# The Marriage Premium on Health: A Structural Analysis using an Equilibrium Search and Matching Model of Marriage and Divorce*

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**Abstract**

Data indicate that married individuals have lower mortality rates and are reported to be healthier than singles. However, drawing the conclusion that marriage inherently improves health can be misleading. A key challenge in estimating the effect of marriage on health lies in disentangling self-selection into marriage from the protective effects of marriage. The complexity arises from the selection of the healthier or unhealthier into marriage or into single through divorce. The objective of this paper is to explain the health gap between married and single individuals using an equilibrium model of marriage search and matching. The model takes into account the endogeneity of marriage choice and different household choices on time, consumption and medical investment that both man/woman and single/married couples are likely to face during their life cycles. The model, which incorporates health-driven selection in the marriage market, is structurally estimated by matching model-generated moments with those observed in the data. Using the estimated model, several counterfactual scenarios are analyzed, such as eliminating the gender wage gap, removing age preferences in the marriage market, and altering Pareto weights to explore the impact of household allocations on the health trajectories of married couples. The findings suggest that married households benefit from economies of scale in home production and achieve higher efficiency in medical investments compared to single households. Furthermore, within married households, the advantages of marriage are not uniform across genders. Through counterfactual analysis, we identify changes in Pareto weights as the most significant factor in affecting the health disparity associated with marital status.

*Keywords: marriage, health, divorce, life-cycle, search and matching, intra household allocation, structural estimation*

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# 1 Introduction

In sociology and medical sciences, the impact of marriage on health—often referred to as the "protective effect of marriage"—is widely regarded as beneficial. Empirical evidence shows that married individuals exhibit lower mortality rates and report better health outcomes compared to their unmarried counterparts (Waite et al., 2002; Wilson and Oswald, 2005). These observed associations raise the question of whether marriage itself directly improves health, or if the correlation is driven by selection effects. Understanding the true relationship between marriage and health is crucial, as modern society is experiencing rapid changes in marriage rates and forms, raising growing interest in how these shifts might impact both individuals and society (Kearney and Levine, 2017).

Nevertheless, the literature in economics provides inconclusive evidence regarding the health benefits of marriage. Some findings suggest that marriage or even cohabitation can provide the protective effect on health (Kohn and Averett, 2014a ;Kohn and Averett, 2014b; Guner et al., 2018; ), but other findings show that the benefits of marriage are small or limited (Kalmijn, 2017). Additionally, it has been suggested that the existing effect of marriage on health not only contains positive selection into marriage as well as negative self-selection into marriage, i.e., less healthy remarry more quickly (Lillard and Panis, 1996).

A significant challenge in estimating the effects of marriage on health is disentangling selection into marriage from the protective effect of marriage on health itself. The complexity arises because selection into marriage is multidimensional. For instance, healthier singles may be more likely to marry, creating positive selection into marriage, which could lead to a downward bias in the estimated effect of marriage on health. Conversely, if less healthy singles actively seek marriage to gain potential health benefits, this negative selection could create an upward bias in the estimated effect. These mixed selection effects may also occur among already married couples. In decisions to divorce, the selection of either healthier or less healthy spouses into single may introduce additional biases in the observed effects of marriage on health.

Moreover, married and single individuals display distinct decision-making behaviors, with married individuals making joint decisions regarding time use and household resource allocation throughout the life cycle, largely due to the interdependent nature of spousal decision-making. These behavioral differences may represent a key characteristic that distinguishes married individuals from singles, potentially contributing to the observed marriage health gap between the two groups.

In this paper, we construct an equilibrium model of marriage search and matching model of household. The structural model aims to address selection issues in the marriage market and capture joint household behavior. It incorporates the endogeneity of marriage and divorce decisions, along with various household choices related to time use and consumption of both private and medical goods, which are relevant for single individuals and married couples. Specifically, we examine the extent to which the selection process in the marriage market contributes to the health gap between married and single individuals. Additionally, we quantify the health benefits of marriage for each spouse—husband or wife—particularly in the context of joint decisions on time allocation and household resource distribution.

We estimate the structural parameters of the model by matching model moments with data moments from the Panel Study of Income Dynamics (PSID) with the American Community Survey (ACS) and the Medical Expenditure Panel Study (MEPS). The estimated parameters suggest that married individuals benefit from higher efficiencies in home production and medical consumption compared to single individuals. The model is then applied to analyze counterfactual scenarios to gain further insights into the marriage health gap. We conduct several counterfactual analyses to examine scenarios such as the elimination of the gender wage gap, the absence of male preference for younger women, and adjustments in Pareto weights between husbands and wives in intra-household allocations. The findings indicate that changes in Pareto weights have the most substantial impact on the marriage health gap for both genders, followed by the removal of male age preference. In contrast, the elimination of the gender wage gap results in minimal change. Overall, our analysis suggests that evolving family dynamics could either exacerbate or reduce the health gap between married and single individuals.

**Literature Review.**

Methodologically, this paper is closely related to the search and matching equilibrium model of marriage (Goussé et al., 2017; Ciscato, 2021; Shephard, 2019; Flabbi et al., 2023). Specifically, the methodology in this study is influenced by the equilibrium search and matching model that operates both within and across age cohorts, as outlined by Shephard (2019)[1].

In the broader context of structural models addressing the marriage market, several other studies have sought to endogenize marriage and divorce decisions within structural models beyond the search and matching framework. These studies focus on different topics to explain marriage gains by gender (Choo and Siow, 2006; Choo, 2015; Bruze et al., 2015), education and labor market dynamics (Chiappori et al., 2018; Eckstein et al., 2019), and women's labor-force participation (Blundell et al., 2016; Greenwood et al., 2017). Our work contributes to this strand of literature by examining the marriage market search problem in the context of health.

This paper also contributes to the literature on studying the marriage premium on health, including psychology and sociology (Wilson and Oswald, 2005; Wood et al., 2009), by explicitly modelling the decision of marriage and divorce, and focusing on the joint household behaviors on time-uses and intra-household allocations. Several economic papers shed light on the relationship between marriage and health, though the conclusions are different and they depend on the estimation model, data and measured health outcome. For example, Lillard and Panis (1996) show the existence of both positive selection and negative selection

[1]While there are other structural papers examining marriage patterns in the U.S., many consider models where men and women match with partners of the same age (Eckstein et al. (2019)). Using a across-cohort matching model allows for a more understanding of how age, marriage, and health are interconnected in reality

into marriage using a system of simultaneous equations with Panel Study of Income Dynamics (PSID). They find married individuals tend to live longer and sicker men tend to get married quickly. Musick and Bumpass (2012), Kohn and Averett (2014b) and Kohn and Averett (2014a) not only study the benefit of marriage but also cohabitation on health using fixed effect panel or dynamic panel model. They find there are mixed evidences depending on types of relationship, whether it is a marriage or a cohabitation, or age groups. Pijoan-Mas and Ríos-Rull (2014) show that married women and men both are expected to live more than singles using Health and Retirement Survey (HRS). Van den Berg and Gupta (2015) use a duration analysis and a timing-of-events method to address the issue of potential selection into marriage, taking into consideration unobservable, consistent differences among individuals with Dutch registry data. Guner et al. (2018) study the health gaps between married and single individuals of working age groups using the PSID. They report that ,depending on age group, both selection (below age 40) and protective effect (age 55-59) exist. Gilleskie et al. (2017) quantify the life-cycle effects of human and health capital, particularly body mass, on women's wage distribution using NLSY79 data. They find significant differences in the direct and dynamic effects of body mass on wages, varying by age, race and marital status. Overall, evidence on the effect of marriage on health is mixed, depending on the choice of health outcome, data, and model used.

Finally, this paper contributes to the area of research on assortative matching based on health, thereby shedding light on the implications of marriage matching patterns by health and providing several counterfactual analyses. There is a body of research that explores the role of health in the matching process and the correlation of health behaviors between spouses. For example, Oreffice and Quintana-Domeque (2010) and Chiappori et al. (2012) highlight the presence of assortative matching by both socioeconomic factors and health-related outcomes, such as BMI. Chiappori et al. (2018b) further explores the role of smoking behavior in the marriage market. Additionally, recent studies have investigated assortative mating to understand inequalities across various dimensions (Eika et al., 2019; Calvo et al., 2021; Fagereng et al., 2022).

In the remainder, the paper is organized as follows. In Section 2, we show the differences of observed health outcomes between single individuals and married couples using the U.S data. Additionally, we review potential empirical factors that generate both marital and gender differences in health through the data. Section 3 proposes a theoretical model incorporating empirical patterns that we witness. In Section 4, we introduce the estimation method. In Section 5, we suggest the estimation results of structural parameters. Finally, Section 7 is conclusion of this paper.

## 2 Empirical evidence

In this section, we start by providing some empirical evidence that the marriage health gap exists and there are several potential mechanisms affecting observed differences in health between married and single individuals. First, we construct a continuous health index to show overall health of an individual, which has more variation over age than the categorical self-assessed health. Secondly, we define the marriage health gap as the difference between health indices for married and single individuals. We present empirical results to check whether this measure shows the marriage health gap across multiple covariates. Finally, we explore both selection and protection mechanisms that can contribute to the observed gaps in health by marital status of an individual.

It is essential to emphasize that some of the empirical findings presented below should not be interpreted as causal relationships. Rather, they serve to highlight key correlations between marriage and health, laying the groundwork for inclusion in the structural model discussed in subsequent sections.

## 2.1 Data

Data used in the empirical analysis come from the PSID (Panel Study of Income Dynamics) and the MEPS (Medical Expenditure Panel Survey). The PSID tracks a nationally representative sample of households. It collects information on consumption, employment, disability status, and receipt of DI (Disability Insurance) annually between 1985 and 1997, and biennially after 1997. It provides various modules of data regarding time use, general health information, and marriage history. Due to its long data span, we can observe an individual's lifetime trajectory in health and marriage. This long-term data advantage is crucial for our analysis, allowing us to sufficiently observe an individual's lifetime changes in marital status, which is important since changes in marital relationships are rare events for most people, and short-span data cannot provide this advantage. To the best of our knowledge, the PSID is the only accessible dataset of sufficient size that includes all these necessary information for our analysis.

We supplement the Panel Study of Income Dynamics (PSID) with data from the Medical Expenditure Panel Survey (MEPS) to gain insights into individual medical investments within households. While both MEPS and PSID offer information on medical expenditures, MEPS uniquely provides detailed data on medical consumption behaviors and expenditures at the individual level, accounting for varying demographic characteristics. In contrast, PSID only reports medical expenditure data at the household level, lacking granularity at the individual level. Additionally, the PSID provides aggregated medical expenditures at the household level over a 2-year period. The data collection method is retrospective, relying on participants' memory to recall expenditures. This approach may lead to the loss of important information regarding household expenditures. To overcome this downside, we utilize its Household Component (HC) of the MEPS, which conducts interviews with individuals every six months, up to five times, allowing for up to 2.5 years of interviews for a single individual.

The sample periods selected for analysis are from 1999 to 2019 for both the PSID and MEPS. Since 1999, the PSID has provided detailed health information for survey participants, extending beyond self-assessed health status to include variables such as the presence of chronic diseases and hospitalization. To accurately identify trends, we utilize a longer data span to thoroughly investigate marital dynamics and the evolution of individual health status. From a modeling perspective, we construct pooled data under the assumption that our pooled data with long time span is at the stationary distribution as in (Choo, 2015). An alternative approach in studies of this nature is to conduct sample cuts and construct cohort data from different periods, assuming that each cohort follows stationary transitions, with its size remaining constant over time.

We restrict the sample to individuals aged between 21 and 81. Additionally, we further restrict the sample to those whose educational decisions have been completed. The rationale for this selection is that our main focus of analysis lies on the connections between marriage and health, not between marriage and educational choices. Moreover, we include individuals who are not self-employed.

In the next section, we will analyze and discuss the health gap across different dimensions, such as gender and education over different ages. We will then review the potential factors contributing to this gap, examine assortative matching patterns based on health, and explore the varying variation of marital formation and dissolution by health status.

## 2.2 Empirical analysis

**Health-measures.** Measurements of one's health are broad, depending on the variable of interest. Commonly used indicators of one's health include mortality, morbidity, BMI, types of diseases, and categorical self-assessed health. To comprehensively compare observed differences in health by marital status, we show the marriage health gap exists within all these variables. Then, we adopt a continuous health index that fully uses an individual's overall information on health, in order to summarize an individual's health status in one dimension. The advantages of this continuous index are twofold : (*i*), unlike categorical variables that classify health as "very good," "good," "medium," "bad," or "very bad," it allows us to more accurately rank individuals' health levels and avoid arbitrary cut-off points. (*ii*), it enables us to combine multiple pieces of information into a single index, providing a clearer diagnosis of an individual's health.

To construct this continuous measure, we employ a multiple correspondence analysis (Kohn, 2012; Kohn and Averett, 2014) to construct a general index of health. We run the multiple correspondence analysis (MCA) using PSID samples and their health-related information. The variables that we used were types of diseases, self-assessed health, hospitalization, disability level, ADL limitation (activity of daily living limitation), BMI, and mental health. Detailed information about these variables are presented in the Appendix A. The index is constructed by multiplying each weight from the MCA by the corresponding health variable for each individual, then summing the results and normalizing them to have a minimum value of 1. This normalization facilitates inference and comparison with the commonly used self-assessed health measure, which has discrete values ranging from 1 to 5.

In the Appendix A, we show correlation between the health index and other health-related information.

In general, the health index has strong correlation with one's probability of dying and is considered to be a good proxy for an individual's general health status. To interpret our health index, note that it ranges from approximately 1 to 6, with higher values indicating better health.

Subsequently, we show the differences of the health indices between married individuals and singles along their ages. In the figure 1, both graphs illustrate the differences of the health indices between single and married men, as well as single and married women. The horizontal axis represents age, grouped into five-year intervals ranging from 20–24 to 76–80. Confidence bands of two standard errors are presented in each point. The observed patterns are as follows: In early adulthood, around the 20s, the disparities are minimal. However, as individuals age, the health gaps between married and single individuals increasingly diverge in both magnitude and slope. The initial minimal differences, followed by later divergence, may suggest a selection effect into marriage based on health. For men, the gap begins to narrow once they reach their 70s, whereas, for women, the health gap remains relatively stable after this age.

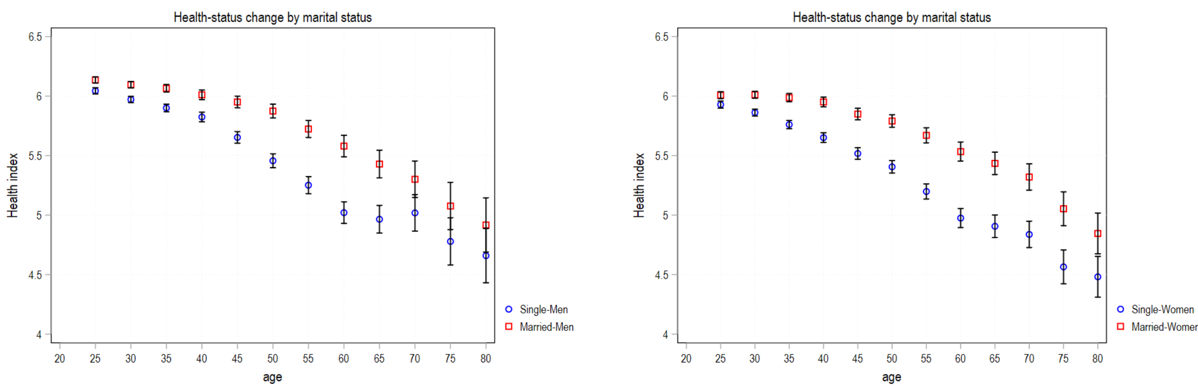



Figure 1: Differences in health index over life-cycles by gender

Similar trends are evident in the figure 20 in the Appendix A, where the marriage health gaps are plotted by gender and education level. 'H' represents high education, while 'L' represents low education group. Although the magnitude of the differences in health gaps appears reduced compared to the figure 1, the disparities remain observable.

In addition to the health index, Table 10 in the Appendix A presents the group differences in other health-related measures between married and single individuals, as derived from the PSID data. The PSID provides data on the severity of diseases, indicating whether a particular illness impacts daily life 'a lot,' 'sometimes,' or otherwise. With all the health outcomes related to diseases, single individuals generally experience higher rates of severe morbidity compared to married individuals. Additionally, in measures such as self-assessed health, limitations in Activities of Daily Living (ADL), disability status, hospitalization, and obesity, single individuals typically exhibit a higher prevalence than their married counterparts.

In conclusion, we examine the disparities in health outcomes across marital statuses, encompassing a range of variables, from overall health indices to disease prevalence rates. These disparities are particularly pronounced during middle age in both genders, irrespective of educational attainment. While the health gap between married and single males narrows over time, the gap between married and single females remains consistently significant.

### 2.2.1 Potential Mechanisms

In this section, we explore potential mechanisms that may contribute to the health disparities observed between married and single individuals as discussed previously. The channels examined in this study include selection into marriage, variations in household resource allocation, access to health insurance, and other psychological and behavioral factors.

**Self-selection into marriage**

Does an individual's health status influence the likelihood of marriage and finding a partner? To address this question, we estimated the following selection equation.

Table 11 in the Appendix A presents the estimated marriage hazards for single individuals using the PSID. Marriage hazards represent the probability of transitioning from single to marriage in the subsequent period, relative to remaining single. We report hazard rates conditioned by key variables, including overall health index, gender, education, and age. The results indicate that an increase of one standard deviation (1.003) in an individual's overall health index is associated with approximately a 14% increase in marriage hazards. The magnitude of these health-specific hazards is comparable to those observed for education-specific hazards.

Table 1 presents the correlation between the attributes of husbands and wives, serving to examine assortative mating patterns. The attributes analyzed include health index, education, BMI, and log-transformed hourly earnings, representing individual health, socio-economic status, anthropometric measures (related to attractiveness), and labor market outcomes, respectively. The correlation matrix indicates that married couples tend to pair with partners who have similar characteristics, particularly in terms of education, labor income, and health.

Table 1: Correlation matrix : (N=5570)

Wife's attributes

Husband's attributes

Correlation Matrix = :

| | Health index | Education | BMI | Log hourly wage |
|---|---|---|---|---|
| Health index | 0.229 | 0.128 | −0.062 | 0.113 |
| Education | 0.181 | 0.487 | −0.016 | 0.245 |
| BMI | −0.048 | 0.001 | 0.167 | −0.018 |
| Log hourly wage | 0.151 | 0.197 | −0.039 | 0.353 |

Table 1 shows the correlation between husband and wife's attributes to check the assortative mating based on them. The attributes contain health index, education, BMI and log-transformed hourly earning, each representing an individual's health, socio-economic status, anthropometric (attraction) measure and labor market measure, respectively. The correlation matrix shows that married couples tend to match together with similar characteristics, especially in terms of education, labor income and health.

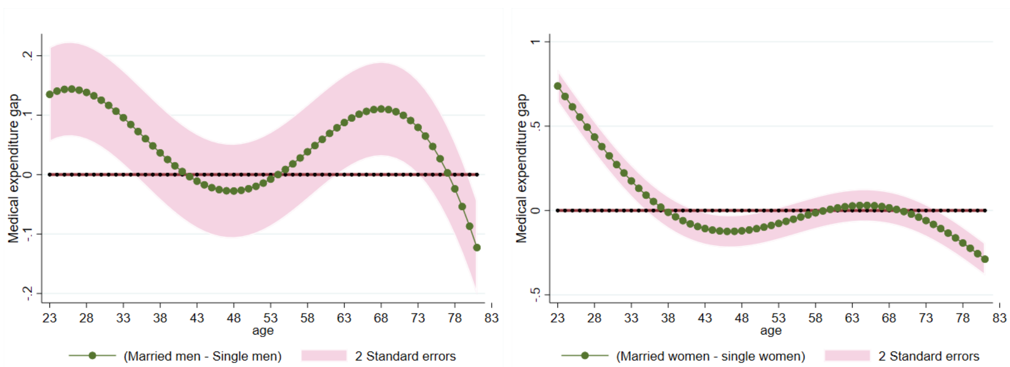
Furthermore, Table 12 in the Appendix A provides the results of assortative mating based on these attributes, using a structural model developed by Dupuy and Galichon (2014). The table also reports the statistical significance of these attributes, helping to determine whether individuals value them when forming matches. Again, we use the PSID to study the matching outcome by attributes. Since the health measure we employed in this study to characterize overall health is a continuous variable, it is not feasible to directly apply traditional methods for estimating matching models, such as those in Choo and Siow (2006). However, Dupuy and Galichon (2014) propose a method to extend matching models to accommodate continuous regressors. Utilizing their approach and our sample of couples who have been married for less than two years, we demonstrate in Table 12 that all relationships, except those involving BMI, education and log hourly wage, are statistically significant, indicating the presence of assortative matching across these four measures. The results reveal a particularly strong matching effect based on education and labor market income. Specifically, an increase in education from high school graduation to a college degree or higher enhances the couple's joint utility by 0.47 units. Also, an unit increase in labor market log income enhances the couple's joint utility by 0.32 units. Furthermore, a one-unit increase in each partner's health index raises their joint utility by 0.11 units. Although the impact of health on matching is less pronounced than that of education, when considering couples who improve their health index from the minimum to the maximum, this change can significantly boost their joint utility, highlighting another form of strong assortative matching.

**Differences in household-resource uses**

In this section, we investigate whether resource utilization within households varies according to marital status, focusing on time allocation and medical investment using the MEPS and the PSID.

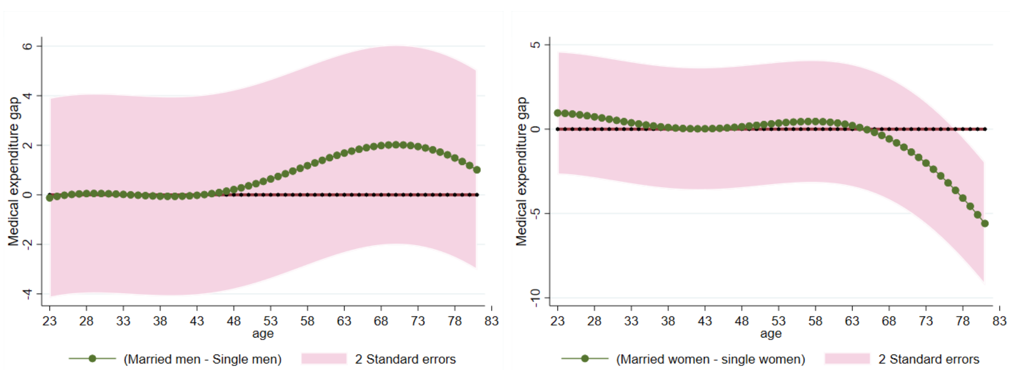
First, we analyze differences in medical investment and preventive care by gender and marital status using data from the Medical Expenditure Panel Survey (MEPS). To accurately measure medical investment, we focus on out-of-pocket medical expenditures , after netting out unexpected emergency and hospitalization costs. Given that expenditure data typically exhibit right-skewness, we apply a log transformation and employ quantile regression to examine the differences in medical expenditures by gender and marital status at the median level. This analysis controls for various factors, including age, non-linear age terms, race, health conditions, education, number of children, and income. The estimating equation is as follows:

$$Y_{it} = f(age_{it}) + \beta(age_t) \cdot M_{it} + \gamma' X_{it} + \epsilon_{it} \tag{2.1}$$



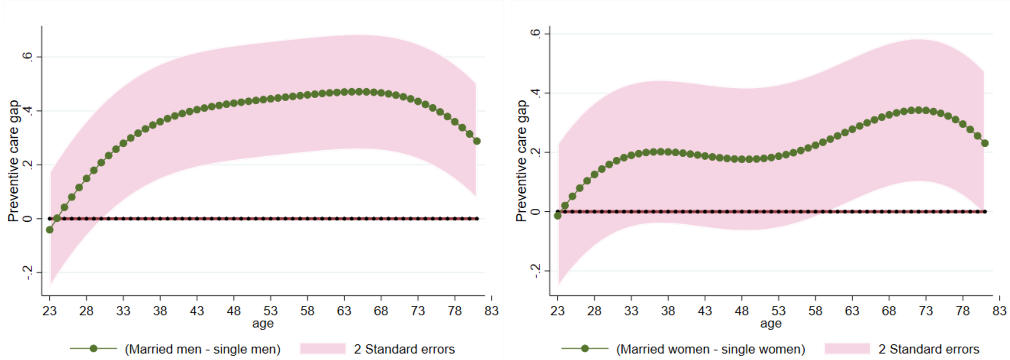

(a) Married men vs. single men (b) Married women vs. single women

Figure 2: Medical expenditure gap : Insured & pooled samples from MEPS




(a) Married men vs. single men (b) Married women vs. single women

Figure 3: Medical expenditure gap : Uninsured & pooled samples from MEPS




(a) Married men vs. single men

(b) Married women vs. single women

Figure 4: Preventive care use : pooled samples from MEPS

where $Y_{it}$ is log-transformed medical expenditure, $M_{it}$ is an individual $i$'s marital status, and $X_{it}$ is a set of control variables that we mentioned above. $\beta(age_t)$ is a non-parametric functional that varies by an individual $i$'s age.

Since health insurance is a critical factor influencing medical expenditures, we estimate equation (2.1) separately for each gender and for individuals with and without health insurance[2].

Figure 2 illustrates the differences in medical expenditures by gender and marital status for individuals with health insurance. Both married men and women tend to spend more on medical care in the early stages of life compared to their single counterparts. Around middle age, married men generally incur higher medical expenditures than single men, while single women tend to spend more than married women. After age 70, single men and women typically outspend their married counterparts in medical expenditures. This reversal in trend may be attributed to previous findings from the PSID, which indicate that single individuals often have poorer health and more serious medical conditions.

Figure 3 displays similar gaps but focuses on individuals without health insurance[3]. Unlike the insured sample, there are no statistically significant differences in medical expenditures between single and married individuals, although uninsured single women tend to spend more than uninsured married women.

From Figures 2 and 3, two key interpretations emerge. First, married couples tend to invest more in medical care during the early stages of life, particularly among the insured individuals and until their 40s[4]. This early-stage investment is also reflected in Figure 4, where married couples utilize more preventive care services than singles, even after controlling for health insurance, age, non-linear age terms, race, health conditions, education, number of children, and income. Married couples are more likely to undergo regular

[2]In the data, an individual is considered insured if they have either private insurance through their employer or public insurance.

[3]In the MEPS data, the uninsured population accounts for 17%, which is higher than the national average of approximately 14% from 2010 to 2021 (source: KFF analysis of 2010-2021 American Community Survey).

[4]One possible reason why married men continue to spend more on medical care in middle age may be that men's health tends to deteriorate more rapidly than women's (Mitnitski et al. (2002)).

dental check-ups, cholesterol tests, flu shots, and other cancer screenings compared to singles. Second, the reason single men and women tend to spend more on medical care later in life is not due to increased concern for their health but rather because they likely experience greater health deterioration due to insufficient early investments. This phenomenon persists even when controlling for the presence of health insurance, suggesting that other factors, beyond the price effects of insurance, may drive these differences.

A subsequent question arises regarding whether the observed differences in resource allocation by marital status are attributable to the increased wealth that married households typically experience compared to single households. One possible explanation is income pooling, where the economically disadvantaged gender may benefit from the resources of the more economically advantaged partner. Given the prevalent gender-based income disparities, which generally favor men, this pooling is likely to benefit wives to a greater extent. Table 12 provides evidence of assortative matching based on income, thereby supporting the existence of income pooling and income effects through marriage.

Another contributing factor could be the enhanced household resources resulting from the joint production and sharing of public goods. This sharing effectively augments household income by freeing up additional resources for private consumption or medical investments.

To examine whether married households benefit from joint household production and the sharing of public goods, we first present descriptive statistics on time use using the PSID, by gender and marital status controlling others like number of children. We focus on time use in home production because, although direct measurement of home production outputs is challenging, time allocation serves as a proxy for these inputs. As depicted in Figure 5 , married women tend to allocate more hours to home production compared to single women, while single men devote more time to home production than their married counterparts. Throughout the life cycle, married women increasingly specialize in home production, whereas the hours married men spend on home production remain relatively stable. Figure 5 suggests a complementarity and specialization in time use between husbands and wives, indicating that married couples may benefit from sharing public goods. As observed, the combined time allocation of two married individuals surpasses that of single males or females. The presence of public goods sharing and income pooling generates an incentive for married couples to allocate more resources to medical goods, influenced by the income effect and the diminishing marginal utility of private consumption.

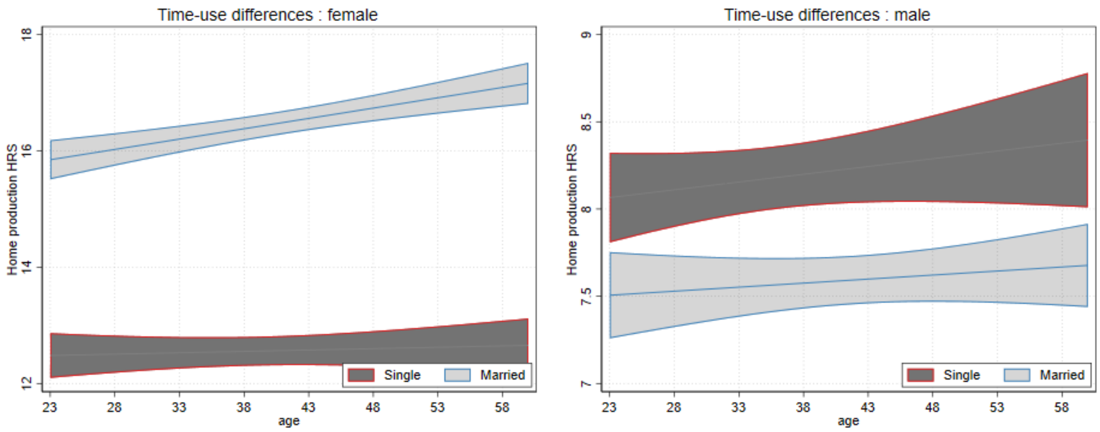



Figure 5: differences in time-use by gender and marital status : home-production hours

**Health insurance**

In this section, we present descriptive statistics to examine whether marriage influences an individual's health insurance status.

Based on summary statistics from the PSID, married men are **12** percentage points more likely to have employer-sponsored health insurance (ESHI) than single men, and married women are **13** percentage points more likely to have ESHI than single women. In contrast, there is **no** observed difference in Medicaid coverage between married and single men, while married women are **6** percentage points less likely to have Medicaid than single women.

Beyond these descriptive statistics, we aim to explore whether there are dynamic behavioral changes before and after marriage. To address this question, we employ an event study that investigates changes in health insurance status before and after marriage, disaggregated by gender. Here, the event is defined as marriage, and the control covariates include racial dummies, age, age-squared term, employment status, education, and region.

It is important to note that the results presented here are not causal. There are previous literature that have sought to establish a causal link between marriage and health insurance (Sohn, 2015; Hampton and Lenhart, 2019; Barkowski and McLaughlin, 2022; Chen, 2023) or between divorce and health insurance (Slusky and Ginther, 2021) by utilizing the ACA expansion or exogenous state-level variations.

Figure 6 displays the predicted margins of health insurance status before and after marriage. The vertical line at time 0 denotes the occurrence of marriage. Each time represents one year. Overall, for both men and women, the predicted probability of having insurance appears to increase following marriage, with statistical significance. However, it is crucial to emphasize that these findings are descriptive. The potential mechanisms underlying these descriptive statistics could include the existence of spousal insurance or the possibility that individuals may be more likely to secure health insurance as they prepare for marriage, possibly through increased labor market participation.

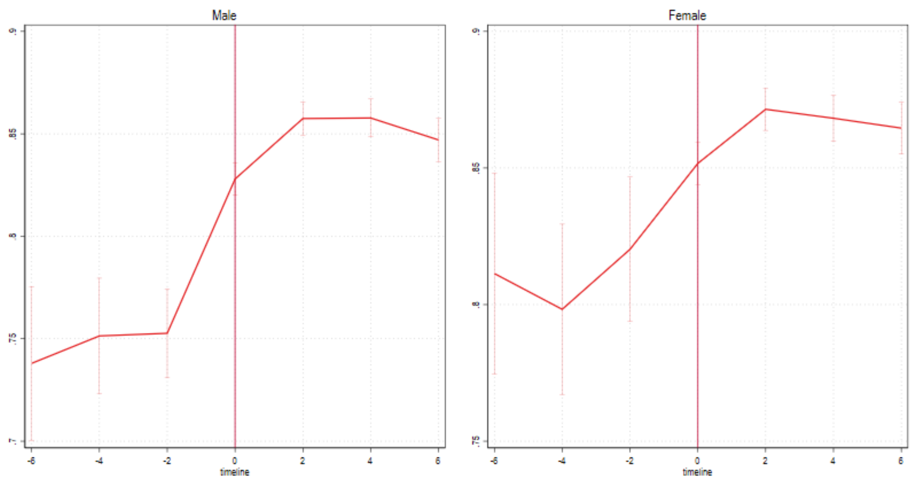



Figure 6: Predicted changes in the health insurance status before/after marriage

Health insurance is a critical factor determining the demand for health care through the price effect in health care service. However, in order to maintain the model tractable we do not endogenize both the health insurance market and marriage market, where individuals simultaneously decide on health insurance and marriage market participation.

Such consideration would be necessary if we are willing to fully explain both the marriage market and health insurance market, and therefore completely explain the marriage lock observed in the data . Here in the estimation stage, we keep the sample of the insured only, and in the data approximately 87% of the population is insured either through public or private insurance. If the model does not account for the health benefits associated with insurance and assumes that all individuals—regardless of marital status—have insurance, then the predicted health disparity between married and single individuals would represent a lower bound, assuming that health insurance has a positive impact on health. Therefore, by restricting our sample to only those individuals who are insured, we aim to minimize potential biases associated with differences in insurance coverage.

**Health-related behaviors**

In this section, we examine whether marriage influences health-related behaviors, including smoking, drinking, and engagement in health-promoting activities such as exercise.

Again, we propose an event study framework to analyze changes in behavior before and after marriage using the PSID. Additionally, we present descriptive statistics comparing married individuals and singles across various health-enhancing activities.

In the following figures, Figure 7 illustrates the changes in the weekly (hours) frequency of light physical activity before and after marriage. Light physical activity, which encompasses activities considered to enhance health status—such as walking, dancing, gardening, golfing, and bowling—was analyzed using the PSID sample. This analysis controls for variables including age, education, employment status, regional factors, and health status. The results indicate a decline in the frequency of light physical activities for both males and females following marriage.

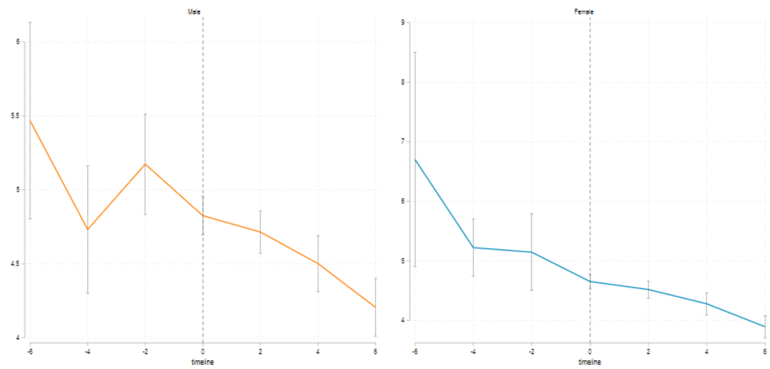



Figure 7: Predicted changes in the light physical activity before/after marriage

Next, Figure 8 presents the changes in the frequency of heavy physical activities before and after marriage, which include vigorous physical activities or sports such as heavy housework, aerobics, running, swimming, and bicycling. Among males, there is a noticeable decline in the frequency of these heavy activities when comparing periods before and after marriage. In contrast, the frequency of heavy physical activities among females remains stable, with no significant changes observed. Overall, these figures provide no descriptive evidence to suggest that men and women increase their engagement in health-enhancing activities following marriage.

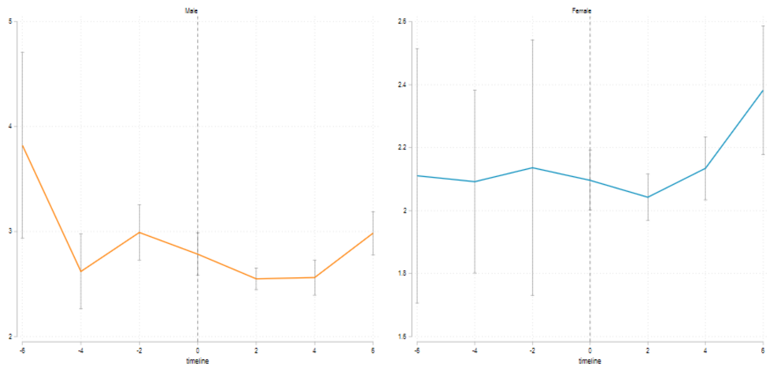



Figure 8: Predicted changes in the heavy physical activity before/after marriage

Subsequently, we investigate the changes in smoking and drinking behaviors before and after marriage. Among married couples, the correlations between smoking and drinking behaviors tend to be negative (e.g., smoking: -0.55, drinking: -0.7), indicating that if the husband smokes, the wife is less likely to smoke. Also, based on basic statistics from the PSID, married men are **3.9** percentage points less likely to smoke compared to their single counterparts, and married women are **4** percentage points less likely to smoke. Regarding drinking behavior, married men are **2.1** percentage points less likely to drink, while married women are **7.5** percentage points less likely to smoke.

To further investigate, we employ an event study approach to assess whether there are significant changes in these behaviors following marriage.

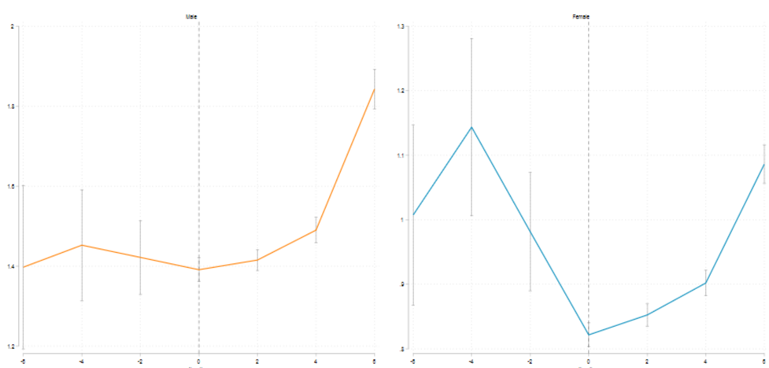



Figure 9: Predicted changes in the number of drinks per day before/after marriage

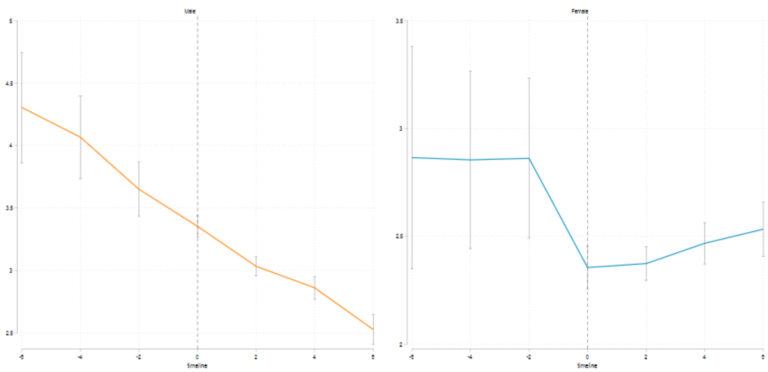



Figure 10: Predicted changes in the number of cigars per day before/after marriage

Figure 9 shows changes in the number of drinks consumed before and after marriage. Before marriage (timeline $< 0$), the number of drinks per day shows a stable trend for men, while for women, the number of drinks per day shows a decreasing trend. After marriage (timeline $> 0$), for both men and women, the number of drinks appears to stabilize initially, followed by a noticeable increase several years after marriage.

Figure 10 depicts the changes in the number of cigarettes smoked before and after marriage. The data indicate a clear decline in the number of cigarettes smoked by men, whereas for women, the trend remains stable before marriage, followed by a decline post-marriage.

These figures suggest that marriage influences both smoking and drinking behaviors. Both men and women tend to increase their drinking behavior as more time passes after marriage. In case of smoking behaviors, men show decreasing smoking leading up to and continuing after marriage, while women show decreasing smoking behaviors after marriage. If reduced smoking is considered indicative of better health outcomes, this descriptive trend may serve as evidence of positive behavioral changes associated with marriage.

Beyond smoking and alcohol consumption, we can examine differences in risky behaviors between married and single individuals using data from the MEPS. Married individuals are more likely to receive preventive care, such as dental checks, blood pressure checks, cholesterol checks, flu vaccinations, routine medical check-ups, PSA tests, Pap smears, breast exams, mammograms, blood stool tests, and colonoscopies. Furthermore, in terms of preferences, married individuals tend to exhibit lower risk tolerance, which can influence health outcomes[5]. Individuals with lower risk tolerance may be more inclined to accumulate human capital to enhance future earnings and to avoid smoking to prevent potential diseases.

**Matching by other dimensions : racial and socio-economic status (SES) differences**

So far, we have examined differences in healthcare utilization, insurance status, and health-related

[5] The variable "risk tolerance" ranges from 1 to 5, with each value representing a different level of risk acceptance. Preventive care checkups are measured by their yearly frequency

Table 2: Behavioral Differences by Marital Status (MEPS)

| | Risk-tolerance | dental checks | blood pressure | cholesterol checks | flu vaccinations | Routine check-ups |
|---|---|---|---|---|---|---|
| Married | 2.11 | 1.31 | 0.90 | 0.74 | 0.78 | 0.46 |
| Single | 2.34 | 1.11 | 0.86 | 0.64 | 0.71 | 0.40 |
| Difference | -0.23** | 0.20** | 0.04** | 0.09** | 0.06** | 0.06** |

| | PSA tests | Pap smears | breast exams | mammograms | blood stool tests | colonoscopies |
|---|---|---|---|---|---|---|
| Married | 0.52 | 0.73 | 0.78 | 0.60 | 0.13 | 0.16 |
| Single | 0.41 | 0.66 | 0.72 | 0.55 | 0.11 | 0.13 |
| Difference | 0.11** | 0.07** | 0.07** | 0.05** | 0.01** | 0.03** |

behavioral changes between married individuals and singles. In this section, we will explore additional dimensions, focusing on potential differences in socioeconomic status (SES) between these groups. In some countries, marriage is perceived as a sign of better socioeconomic status, for instance where the dowry payments exists in the marriage market in South or East asain countries (Botticini and Siow, 2003; *BauandFernández*, 2023; Chiplunkar and Weaver, 2023)

We investigate whether differences in socioeconomic status (SES) exist within the U.S. marriage market by comparing the distributions of SES characteristics between married and single individuals. Analyzing these differences enables us to explore the underlying selection processes based on SES that affect the likelihood of marriage. As noted by Cutler et al. (2008) and Adler and Rehkopf (2008), several factors—such as education, financial resources, ethnicity, and race—impact health outcomes. Therefore, we first examine differences in education and health between married and single individuals.

In both the PSID and MEPS datasets, married individuals tend to have higher levels of education than single individuals, with a difference of approximately **3**% in the MEPS and **4.3**% in the PSID[6]. Although the difference in educational attainment may seem marginal, it is statistically significant. However, the perspective changes when considering educational matching within couples.

Among the possible combinations of educational matching—such as (H, H), (H, L), (L, H), and (L, L), where H represents college education and L represents less than college education—married individuals may benefit from their partner's higher education level, even if their own education level is lower. In Table 13, out of all married couples, nearly **80**% of all married couples have at least one partner with an education level above a college degree. This indicates that education may influence health outcomes both directly and indirectly through a partner's education. Previous research has highlighted the significant impact of education on health outcomes (see Cutler and Lleras-Muney, 2010; Heckman et al., 2018) by influencing occupation, income, behavioral antecedents, and cognitive ability. Since a partner's education can complement the other spouse's health, although we are unsure whether (H,H) couples exhibit greater synergistic effects compared to (H,L) or (L,H) couples, the effects of education on health through marriage matching remain a plausible

[6]In the American Community Survey, which uses a larger cross-sectional sample, the average difference was **4.1**%.

channel.

Although the direction of causality in literature between income and health is somewhat unclear (Ruhm, 2000; Ruhm, 2005; Snyder and Evans, 2006; Smith, 2007), Table 12 shows strong assortative matching by income in marriage, with couples often choosing partners with similar income levels. An increase in household income through joint income pooling after marriage allows a household to allocate more resources to health care, food, and other necessities, potentially leading to a healthier lifestyle. If this mechanism is at work, then changes in the income after marriage could have a potential impact on individuals within a marriage.

Table 3: Marriage by racial groups (PSID)

| | | Women | | | | |
|---|---|---|---|---|---|---|
| | | White | Black | Asian | Others | Total |
| | White | 67599 | 165 | 483 | 841 | 69088 |
| | | 0.8498 | 0.0021 | 0.0061 | 0.0106 | 0.869 |
| | Black | 531 | 4753 | 13 | 60 | 5356 |
| Men | | 0.0067 | 0.0597 | 0.0002 | 0.0008 | 0.067 |
| | Asian | 307 | 10 | 1336 | 31 | 1683 |
| | | 0.0039 | 0.0001 | 0.0168 | 0.0004 | 0.021 |
| | Others | 1012 | 23 | 10 | 2374 | 3419 |
| | | 0.0127 | 0.0003 | 0.0001 | 0.0298 | 0.043 |
| | Total | 69449 | 4950 | 1842 | 3306 | 79547 |
| | | 0.8731 | 0.0622 | 0.0232 | 0.0416 | 1 |

A final review of this section focuses on racial differences. Marriage markets tend to be highly segmented along racial lines. As shown in Table 3, which is derived from the PSID, approximately 84% of couples are both white, around 5% are both black, about 1.6% are both Asian, and roughly 3% belong to other racial groups. Interracial marriages are relatively rare, and the table highlights strong patterns of racial assortative matching.

Assortative matching by race may be a potential factor contributing to the observed differences in health outcomes by marital status. If there are underlying factors contributing to racial health disparities, such as differences in behavior, access to care, social and cultural norms, and discrimination ($WilliamsandMohammed$, 2009), these patterns of assortative matching could amplify the observed health disparities between married individuals and single individuals. In our model estimation, we do not account for racial factors that could drive these disparities. As a result, the estimated health disparities in our model may represent a lower bound. To check the robustness of our findings, we will later use a partial sample limited to whites.

### 2.2.2 Discussion

So far, we have examined the potential factors contributing to the observed health disparities by marital status in the data. These factors include selection effects, household resource utilization, healthcare usage, health behaviors, and socioeconomic status (SES).

Selection effects appear to play a significant role in health disparities between married and single individuals, as healthier individuals are more likely to marry. Additionally, household resource utilization patterns suggest that married couples tend to use more preventive healthcare services, such as dental checks, blood pressure checks, cholesterol screenings, flu vaccinations, routine medical check-ups, PSA tests, Pap smears, breast exams, mammograms, blood stool tests, and colonoscopies. These differences indicate that being married may promote better preventive health practices.

Furthermore, there are differences in health insurance status between married and single individuals, which likely contributes to disparities in healthcare access and usage. In terms of health behaviors, married individuals generally tend to smoke less and drink less on average, although the relationship between alcohol consumption and marriage is less consistent. Regarding exercise, there are no significant differences between married and single individuals; in fact, both light and heavy exercise time tends to decline after marriage.

We also observed differences in education between married and single individuals, although the magnitude of these differences is minimal. However, when considering the potential complementarity of a partner's education, the effect of education on health among married individuals may be stronger than what is suggested by the mere statistical difference in education levels between married and singles.

Moving forward, our theoretical modeling will particularly focus on household resource allocation problems, especially regarding consumption and medical investment. We aim to establish an equilibrium model of marriage search and matching to derive the health disparities observed in our data. Due to the computational complexity and the need for model tractability, we cannot include all these features that we have studied in this empirical analysis section, which may lead to an estimated health disparity that represents a lower bound of the true effect. The primary channel of interest in our model is selection by health, as agents derive utility from both their own health and their partner's health. By focusing on this aspect, we hope to better understand how health selection contributes to the disparities observed between married and single individuals.

# 3 Model

## 3.1 Environment

In this section 3, we introduce a equilibrium search and matching model of marriage and divorce, where individuals , following their marital decisions, allocate their time between labor market participation, leisure, and home production, as well as distribute household resources between private and medical consumption. We consider a overlapping generation version of model where time is discrete and finite. Households in the model have different age structures. Each agent $i_g$ in the model is characterized by age $a$, gender $g \in \{f, m\}$, marital status $m \in \{\text{single}, \text{married}\}$, education $e$, health H, human capital $k$ and household structures related to information on children. For simplicity, we assume $\omega$ vector contains $e$, $k$ and household structures.

An individual $i$ enters the model at age 21 $a_i = 21$ as single with no child and a given education level $e \in \{L, H\}$[7]. Until age 65, an individual is in the working-age period, , after which retirement is assumed to occur automatically[8] receiving her last working-age income. The last period of the model is at age 81, and we assume individuals die at that age and, upon death, will be replaced by newborns. We focus our analysis on stationary equilibria.

If an individual is single, they may meet at most one potential partner of the opposite gender from the population distribution in each period of the model. The process of marital search is assumed to be random in each period. Regarding the search and matching process, we do not allow for on-the-marriage search, meaning that married individuals must first become single before seeking a new match. Once two individuals are matched, they draw the quality of their joint match value $z$ (referred to as a "match-bliss shock") and decide whether to marry. Following this decision, both married and single households face similar allocation problems, including time-use decisions based on time constraints and the division of household income between consumption and medical investment. However, due to the presence of a spouse, married households jointly decide their time-uses and benefit from economies of scale in household production.

To separate and analyze the decision-timing of marriage and household-resource allocation clearly, it is useful to adopt a framework that separates these into two stages: one focusing on decisions within the marriage market, and the other on intra-household resource allocation and time-use decisions. The graphcial summary is presented in the Figure 11

In each age $a$, agent $i_g$ enters in each stage :

1. Learns current human capital, family structures (the number of children and the age of the youngest child) and their age-depreciated health.

[7] $L$ represents high school graduate and below, and $H$ represents college degree and above. The level of education is endowed.

[8] Allowing endogenous retirement is an interesting topic itself, but it might be out of scope of this paper and it could increase more computational complexity on the paper. See studies on relationship between health and retirement, Blau and Gilleskie (2006), Casanova (2010), and Van der Klaauw and Wolpin (2008)

2. A single $i_g$ randomly meets one potential partner with probability $\eta_g$; a married individual, however, will not meet a potential partner.

3. The individual learns the type of their current match and experiences a match-bliss shock $z$. This applies to both single and married individuals.

4. Determines marital status: a single individual decides whether to marry, while a married individual decides whether to divorce.

5. Observes the set of discrete time-uses. Conditional on discrete choice of time-use decisions on labor supplies, purchase private consumption $c$ and medical good consumption $I$ within static budget constraints. On the other hand, a married household decides division of total income into each husband and wife's private goods and medical goods through imperfect utility transfers.

6. Learns transitory labor income shocks and choice-specific errors related to each discrete time-uses

7. Gets flow utility from purchases on $c$ and $I$

8. Finally, an individual transitions to age $a + 1$ experiencing discrete transition in human capital, family structures, and matching types.

We assume that couples within a married household can imperfectly transfer their utilities on private consumption and joint household production with the Pareto weight $\lambda$. For each joint discrete choice of hours on labor supplies, home production and leisure, household decisions on utility transfers are made efficiently, and aggregate household decisions on discrete time-uses choices become independent of this intra-household distribution of resources under transferrable utility framework (Cherchye et al., 2015).

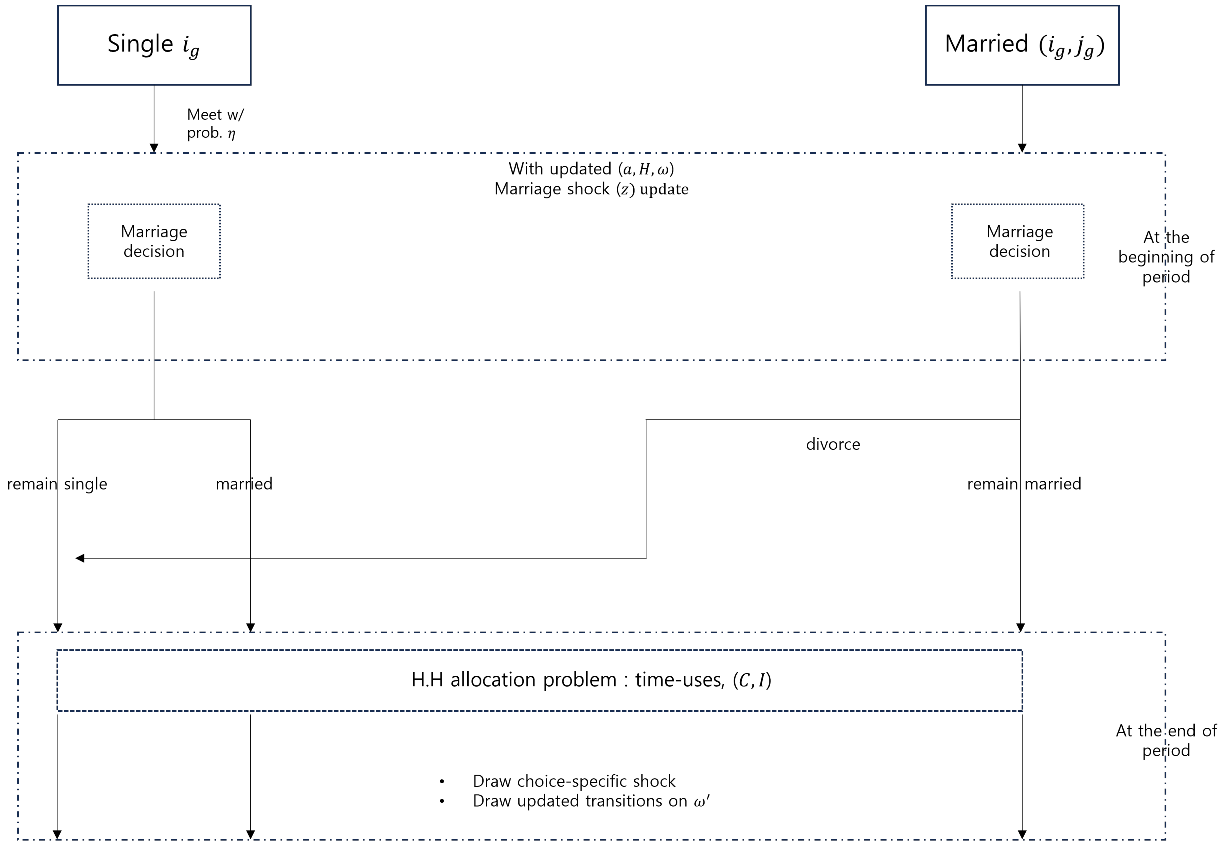



Figure 11: Timing of an agent's decision : In a given period, an individual $i$ has two decision-timings.

## 3.2 Marriage market problem

In this section, we introduce the value functions for single women at the beginning of period where the marriage market decision occurs. The value functions for men are symmetric, albeit differences in gender-dependent structural parameters. At the beginning of period, both single and married couples enter the marriage market after the match quality shocks are realized.

### 3.2.1 Single women

A single woman with her state-vectors $(a_f, \mathrm{H}_f, \omega_f)$ enters the marriage market at the beginning of period. She has a meeting density function $\eta_f(a, \mathrm{H}, \omega)$ of being matched to a man whose age is $a_m$, health $\mathrm{H}_m$, and state-vectors $\omega_m$, which means a function of $a = (a_m, a_f)$, $\mathrm{H} = (\mathrm{H}_m, \mathrm{H}_f)$ and $\omega = (\omega_m, \omega_f)$.

$$\eta_f(a, \mathrm{H}, \omega) = \frac{\gamma(a, e)\tilde{g}^s_m(a_m, \omega_m, \mathrm{H}_m)}{\sum_{a_m}\sum_{\omega_m}\int_{\mathrm{H}_m}\gamma(a, e)\mu_m(a, \omega, \mathrm{H})} = \frac{\text{density of single men with } \mathrm{a}_m, H_m, \omega_m}{\text{total measure of men being matched to } \mathrm{a}_f, H_f, \omega_f} \quad (1)$$

The equation (1) comprises of two components. In the numerator, we have $\tilde{g}_m^s$ that represents a density function of single men with age $a_m$, health $\mathrm{H}_m$, and state-vectors $\omega_m$ at the beginning of period. The reason why we separately denote this beginning of period at the density function is because we have a within-period timing structure, and the decisions that both married individuals and single individuals with types $\omega$ made at the end of past period affect the probability of meeting at the beginning of current period. Eventually, the density function at the beginning of period, $\tilde{g}_m^s(a_m, \omega_m, \mathrm{H}_m)$, will be different from another function, $g_m^s(a_m, \omega_m, \mathrm{H}_m)$, at the end of period. In both numerator and denominator, we have a $\gamma(a, e)$ parameter. This parameter governs the degree of assortative mating by education and age. That being said, if matching patterns in the marriage market equilibrium show positive assortative mating by education and age, $\gamma(a, e)$ will be positive in that marriages with similar ages and education are likely to happen. Finally, in the denominator, we have $\mu_m(a, \omega, \mathrm{H})$ that represents total aggregate measures of single and married men being matched to women with age $a_f$, health $\mathrm{H}_f$, and $\omega_f$.

After matching with a potential partner, a match quality shock $z$ is drawn from a distribution $G$. Match quality $z$ represents an amorphous value of the current matching, or "love". Matched agents decide whether to get married or not if they are single, or to stay in the current marriage or not if they are already married. We impose a structure on the role of the random quality shock in an individual's dynamic optimization as follows (Shephard, 2019; Ciscato, 2021; Galichon and Salanié, 2022) :

**Assumption 1.** *(Separability) Match quality shock $z$ is additively separable in that it enters the value functions for single and married additively*

Note that with the separability on $z$, we have a reservation value, $\underline{z}$ that governs an individual's optimal decision on marriage such that if $z > \underline{z}$, then an individual remain married or vice versa.

Now, consider a single women whose age becomes $a_f$ with discrete state vectors $\omega_f$ and current health status $\mathrm{H}_f$. The expected value functions for single women at the beginning of next period $\tilde{EV}_f^s$ before the marriage market occurs is defined as follows.

$$\tilde{EV}_f^s(a_f, \mathrm{H}_f, \omega_f) = (1 - \sum_{\omega_m'} \int_{\mathrm{H}_m} \eta_f) \cdot \underbrace{\left( \mathrm{E}_{t_f}\left[ V_f^s(t_f; a_f, \mathrm{H}_f', \omega_f') \right] \right)}_{= EV_f^s(a_f, \mathrm{H}_f, \omega_f)}$$
$$+ \sum_{\omega_m'} \int_{\mathrm{H}_m} \eta_f(a, \mathrm{H}, \omega) \left\{ G(\underline{z}) EV_f^s(a_f, \mathrm{H}_f, \omega_f) + \int_{\underline{Z}} (EV_f^M(a, \mathrm{H}, \omega) + z) dG(z) \right\} \quad (2)$$

The expected value function in the equation (2) for single women takes its expectation on a potential match quality shock $z$ and meeting density function $\eta_f$ before the marriage market. It governs an optimal decision rule on the marriage market. It contains two expected value functions, - one is the single's expected value function and the other is the married expected value function from her new matching -, at her end of period.

At her end of period at age $a_f$, the value function for women is given as $V_f^s(t_f; a_f, \mathrm{H}_f, \omega_f)$, which accounts for her household resource allocations and discrete time-uses $t_f$. It takes expectation over each potential discrete choice, and becomes the single's expected value function at the end of period in $a_f$, $EV_f^s(a_f, \mathrm{H}_f, \omega_f)$. The second component is then the expected value functions for the newly married couples. Given a new match with age $a_m$, health $\mathrm{H}_m$ type $\omega_m$ men, if the matching value $z$ is below the reservation value $\underline{z}$, we have the same expected value function for single women, $EV_f^s(a_f, \mathrm{H}_f, \omega_f)$. Otherwise, we have the expected value function for the married women that takes its expectation on the upper support of $\underline{z}$, $(EV_f^M(a, \mathrm{H}, \omega) + z)dG(z)$.

Now, the reservation value $\underline{z}$ that governs the optimal decision rule on marriage is defined if the following two conditions are met

$$\begin{aligned} EV_f^s(a_f, \mathrm{H}_f, \omega_f) &\leq EV_f^M(a, \mathrm{H}, \omega) + z \\ EV_m^s(a_m, \mathrm{H}_m, \omega_m) &\leq EV_m^M(a, \mathrm{H}, \omega) + z \end{aligned} \tag{3}$$

where $\underline{z}$ is the max operator on these two conditions, (3).

### 3.2.2 Married women

Couples update their current match quality $z$ at the beginning of period. After a updated match quality $z$, couples can decide to break up or remain married. We assume for both single and married couples, a match quality shock $z$ is i.i.d from the distribution $G$[9].

The expected value function for married women matching on age $a = (a_m, a_f)$, $\mathrm{H} = (\mathrm{H}_m, \mathrm{H}_f)$, and $\omega = (\omega_m, \omega_f)$ at the beginning of each period is

$$\tilde{EV}_f^M(a, \mathrm{H}, \omega) = G(\underline{z})EV_f^s(a_f, \mathrm{H}_f, \omega_f) + \int_{\underline{z}} (EV_f^M(a, \mathrm{H}, \omega) + z)dG(z) \tag{4}$$

where $EV_f^s(a_f, \mathrm{H}_f, \omega_f)$ is the expected value function for single women at the end of each period, and $EV_f^M(a, \mathrm{H}, \omega)$ is the expected value function for married women at the end of each period. The difference between the equation (2) and the equation (4) is the existence of $\eta_f$, a probability that meets with a new partner. Again, this means that we do not allow on-the-marriage matching.

## 3.3 Household-resource allocation problem

Here in this section, we present the value function for both single and married women who face the household-resource allocation problems at the end of each period. Like the previous marriage market problem,

[9] We rule out serial correlation on $z$, though it is possible to extend it as shown by Shephard (2019). The implication of allowance on positive serial correlation on $z$ is that if both couples draw high match quality $z$ initially at their match, then "love" tends to persistently remain after the match and divorce rate in the model will be less than that without the serial correlation, conditional on everything else. Information on marriage duration can be an important source for identification of this serial correlation on $z$ (Bruze et al. (2015)).

we present women's value functions because men's value functions are symmetric. At the end of each period, an individual who finishes her marriage market decisions solves a household problem allocating labor income between private and medical consumption, conditional on each discrete choice on time-uses. Each time-use contains labor hours, leisure hours and finally home production hours. Each discrete choice is connected to a choice-specific shock, and the shocks become realized after the decision on time-uses. The main advantage of this choice-specific shock structure is that we can conveniently calculate a set of choice-specific probabilities due to the properties of the extreme value distribution assumed on the shock. Conditional choice-specific probability is needed to update future transition probability and calculate the measure of men or women's human capital in the next period's marriage market.

### 3.3.1 Single women

Upon search and matching, and after the marriage decision, single women will consider a finite set of discrete choices on her time-uses, $t_f = \{h_w^f, h_e^f, h_q^f\}$[10]. Each alternative $t_f$ is associated with a choice-specific shock that follows the extreme-value distribution. The choice-specific value function for the single women can be written as

$$V_f^s(t_f; a_f, \mathrm{H}_f^{'}, \omega_f) = u(t_f; a_f, \mathrm{H}_f^{'}, \omega_f) + \epsilon_{t_f} + \beta \sum_{\omega_f^{'}} \pi(\omega_f^{'} | \omega_f, a_f+1, t_f) \int_{\mathrm{H}_f} \tilde{EV}_f^s(a_f+1, \mathrm{H}_f, \omega_f^{'}) \quad (5)$$

where $\tilde{EV}_f^s(a_f+1, \mathrm{H}_f, \omega_f^{'})$ is the expected value function for single women at the beginning of period in $a_f+1$ as in the equation (2), and $\pi(\omega_f^{'}|\omega_f, a_f+1, t_f)$ follows Markov transitions on discrete state-vectors $\omega_f$.

$u(t_f; a_f, \mathrm{H}_f^{'}, \omega_f) = u(c_f(t_f), Q_f(t_f, \mathrm{H}_f(\mathrm{I}_f)), l_f; a_f, \mathrm{H}_f, \omega_f)$ is the flow indirect utility function that solves the following household-resource allocation problems

$$\begin{aligned}
\max_{c,I} \;& u(c_f(h_w^f), Q_f(h_q^f, \mathrm{H}_f(\mathrm{I}_f)), l_f; a_f, \mathrm{H}_f, \omega_f) \\
\text{s.t. } & c_f + p\mathrm{I}_f = w \cdot h_w^f - C(\omega_f, h_w^f) - T(\omega_f, h_w^f) \\
& h_w^f + h_q^f + h_e^f = \mathrm{T} \\
& Q_f = \xi_s(\omega_f) \cdot (\mathrm{H}_f^{'} h_e^f) & (6) \\
& \mathrm{H}_f^{'} = \mathrm{H}_f(I_f) & (7)
\end{aligned}$$

where $c_f$ is private consumption, $\mathrm{I}_f$ is medical consumption, $p$ is relative price of medical consumption. Within a budget constraint, we assume no saving technology. $C(\omega_f, h_w)$ is a cost function of rearing children, and $T$ is a tax function[11]. $Q_f$ is a single household production with an individual $i_f$'s health $\mathrm{H}_f$ augmented.

[10] $h_w$ represents labor-market hours, $h_q$ represents home production hours, and $h_e$ represents leisure hours. Each time use is discretized and summed up to weekly total hours, 115.

[11] For the U.S tax system, I consider federal tax schedule (2009) and its transfer parameters depending on number of children

Within the household production function $Q$, $\xi_s$ represents a single household's home production efficiency.

Conditional on each discrete choice $t_f$, the optimal household-resource allocation problem in the equation (7) is solved and the corresponding solutions, $c^*$ and $\mathrm{I}^*$, yield the per-period indirect utility function $u(t_f; a_f, \mathrm{H}_f^{'}, \omega_f)$. Then, the solution to the discrete choice problem in the equation (5) is given by

$$t_f^* = \arg\max_{t_f}\{V_f^s(t_f; a_f, \mathrm{H}_f^{'}, \omega_f)\} \tag{8}$$

We consider the expected value function for single women before the choice-specific shocks are realized. Following the well-known result of McFadden (1977) when we have the extreme value 1 distribution with conditional independence that current realizations of choice-specific errors $\epsilon_t$ do not influence the realization of future states $\omega_f$, we can write down the following form of the expected value function for single women at the end of each period,

$$EV_f^s(a_f, \mathrm{H}_f^{'}, \omega_f) = \gamma \cdot \sigma_e + \sigma_e \log\bigg(\sum_{t_f} \exp(V_f^s(t_f; a_f, \mathrm{H}_f^{'}, \omega_f)/\sigma_e)\bigg) \tag{9}$$

where $\sigma_e$ is a scale parameter of the type 1 extreme value distribution.

### 3.3.2 Married women

Compared to the single women's problem, the married women's problem are characterized by joint states with her partners, $\omega = (\omega_m, \omega_f)$, $\mathrm{H}^{'} = (\mathrm{H}_m^{'}, \mathrm{H}_m^{'})$, and $a = (a_m, a_f)$ at the end of period. Then, the choice-specific value function for married women can be defined as follows

$$V_f^M(t; a, \mathrm{H}^{'}, \omega) = u_f(t; a, \mathrm{H}^{'}, \omega) + \epsilon_t + z + \beta \sum_{\omega^{'}} \pi(\omega^{'}|\omega, a+1, t) \int_{\mathrm{H}} \tilde{EV}_f^M(a+1, \mathrm{H}, \omega^{'}) \tag{10}$$

where $\tilde{EV}_f^M(a+1, \mathrm{H}^{'}, \omega^{'})\}$ is the expected value function for married women at the beginning of period. We assume a choice-specific shock $\epsilon_t$ jointly affects the household members and is public to both husband and wife. Again, $z$ is the match quality shock, and $u_f(t; a, \mathrm{H}^{'}, \omega)$ is the period indirect utility function that solves the following household-resource allocation problems between her and her partner

$$\begin{aligned}
\max_{c_m, c_f, \mathrm{I}_m, \mathrm{I}_f} \; & \lambda u_f(c_f(h_w^f), Q(h_q, \mathrm{H}(\mathrm{I}_m, \mathrm{I}_f)), l_f; a_f, \mathrm{H}_f, \omega_f) + (1-\lambda) u_m(c_m(h_w^m), Q(h_q, \mathrm{H}(\mathrm{I}_m, \mathrm{I}_f)), l_m; a_m, \mathrm{H}_m, \omega_m) \\
\text{s.t. } & c_m + c_f + p\mathrm{I}_m + p\mathrm{I}_f = w \cdot h_w - C(\omega, h_w) - T(\omega, h_w) \\
& h_w^m + h_q^m + h_e^m + h_w^f + h_q^f + h_e^f = \mathrm{T} \\
& Q = \xi_m(\omega) \cdot (\mathrm{H}_f^{'} h_q^f)^{\alpha} \cdot (\mathrm{H}_m^{'} h_q^m)^{1-\alpha}
\end{aligned} \tag{11}$$

and working members in a household following Eckstein et al. (2019). For married couples, we assume a joint-filing tax system. we consider FS, TANF and EITC for subsidy.

where $\lambda$ is the Pareto weight and household jointly maximizes her utility with the household budget constraints, time constraints, and home production function $Q$. Home production function $Q$ is a health-augmented form with cobb-douglas form and both married women and men enjoy their public good sharing that is produced with their joint home production hours. Joint time-allocation problem is solved by

$$t^* = \arg\max_t \{\lambda V_f^M(t; a, \mathrm{H}', \omega) + (1-\lambda) V_m^M(t; a, \mathrm{H}', \omega)\} \tag{12}$$

Finally, the expected value function for married women at the end of period is defined by

$$EV_f^s(a, \mathrm{H}', \omega) = \gamma \cdot \sigma_e + \sum_t \mathrm{P}(t; a, \mathrm{H}', \omega) \cdot [V_f^M(t; a, \mathrm{H}', \omega) - \sigma_e \log(\mathrm{P}(t; a, \mathrm{H}', \omega))] \tag{13}$$

where $\mathrm{P}(t; a, \mathrm{H}', \omega)$ is the conditional choice probability for the married couple.

## 3.4 Stationary Distribution

The meeting probabilities in the equation (1) depend on the available single individuals at the beginning of each period. The measures of single individuals are the endogenous equilibrium object. Again, as we assume the within-period timing structures, it is convenient to separate the corresponding density and distributions of single and married individuals by the beginning of period and the end of period. We define the measure of marriage matches, and also measure of singles with its age, state-vectors $\omega_g$ and health $\mathrm{H}_g$.

The given initial measures at the beginning of period are given by $\int_{H_m} \tilde{g}_m^s(\underline{\mathrm{A}}, \mathrm{H}_m, \omega_m)$ and $\int_{H_f} \tilde{g}_f^s(\underline{\mathrm{A}}, \mathrm{H}_f, \omega_f))$. With these new-born measures of single individuals at their initial ages $\underline{\mathrm{A}}$, we assume the measures of marriage matches at the beginning of period at $\underline{\mathrm{A}}$ are 0, which means at the time new-cohort enters the model these single individuals are initially unmatched. We first consider the measure of single women at the beginning of each period, where her cohorts have age $a_f$ in between $\underline{\mathrm{A}}$ and $\bar{A}$.

$$\begin{aligned}
\int_{\mathrm{H}_f} \tilde{g}_f^s(a_f, \mathrm{H}_f, \omega_f) = \int_{\mathrm{H}_f} \Bigg\{ & \underbrace{(1-\rho_f(a_f-1, \mathrm{H}_f)) \cdot \sum_{t_f'} \sum_{\omega_f'} g_f^s(a_f-1, \omega_f') \pi_f^s(\omega_f | a_f, \omega_f', t_f') \mathrm{P}_f^s(t_f' | a_f, \mathrm{H}_f, \omega_f')}_{\text{Part A.}} \\
& + \underbrace{\int_{\mathrm{H}_m} \sum_{t'} \sum_{\omega'} g^M([a_f-1, \bar{A}], \mathrm{H}, \omega') \pi_f^s(\omega_f | a_f, \omega_f', t_f') \mathrm{P}^M(t' | [a_f-1, \bar{A}], \mathrm{H}, \omega')}_{\text{Part B.}} \\
& + \underbrace{\sum_{a_m} \sum_{\omega_m'} \int_{\mathrm{H}_m} \rho_m(a_m-1, \mathrm{H}_m) \sum_{t'} \sum_{\omega_f'} g^M([a_f-1, a_m-1], \mathrm{H}, \omega') \pi_f^M(\omega_f | a_f, \omega_f', t_f') \mathrm{P}^M(t' | a-1, \mathrm{H}, \omega')}_{\text{Part C.}} \Bigg\}
\end{aligned} \tag{14}$$

where part A. represents the measure of single individuals who still remains being single at $a_f$, part B. represents the measure of married women who became widows as her husband age reaches to the end of model age, $\bar{A}$, and finally part C. represents the measure of married women who also became widows as her husband died with probability $\rho_m(a_m - 1, \mathrm{H}_m)$. We can define the measure of single men symmetrically.

Similarly, we can define the measure of matches at the beginning of each period.

$$\int_{\mathrm{H}} \tilde{g}^M(a, \mathrm{H}, \omega) = \int_{\mathrm{H}} (1 - \rho_m(\mathrm{H}_m, a_m))(1 - \rho_f(\mathrm{H}_f, a_f)) \sum_{t'} \sum_{\omega'} g^M(a-1, \mathrm{H}, \omega^{'}) \mathrm{P}(t^{'}|a-1, \mathrm{H}, \omega^{'}) \pi(\omega|a, \omega^{'}, t^{'}) \tag{15}$$

Finally, we can define the measures of single women at the end of each period, and the measures of new matches at the end of each period. The measure of single women at the end of period is,

$$\begin{aligned} \int_{\mathrm{H}_f} g_f^s(a_f, \mathrm{H}_f, \omega_f) = \int_{\mathrm{H}_f} \Big\{ & \tilde{g}_f^s(a_f, \mathrm{H}_f, \omega_f) \cdot (1 - \sum_{a_m} \sum_{\omega_m} \int_{\mathrm{H}_m} \eta_f(a, \mathrm{H}, \omega) \bar{G}(\underline{z}(\mathrm{H}, a, \omega))) \\ & + \sum_{a_m} \sum_{\omega_m} \int_{\mathrm{H}_m} \tilde{g}^M(a, \mathrm{H}, \omega) G(\underline{z}(\mathrm{H}, a, \omega)) \Big\} \end{aligned} \tag{16}$$

where $\bar{G}(\underline{z}(\mathrm{H}, a, \omega)))$ is equal to $1 - G(\underline{z}(\mathrm{H}, a, \omega))$.

The measures of matched individuals at the end of period reflect the newly matches, and those who choose to remain married from the beginning of period. That is,

$$\begin{aligned} \int_{\mathrm{H}} g^M(a, \mathrm{H}, \omega) = \int_{\mathrm{H}} \Big\{ & \tilde{g}_f^s(a_f, \mathrm{H}_f, \omega_f) \cdot \eta_f(a, \mathrm{H}, \omega) \bar{G}(\underline{z}(\mathrm{H}, a, \omega))) \\ & + \tilde{g}^M(a, \mathrm{H}, \omega) \bar{G}(\underline{z}(\mathrm{H}, a, \omega)) \Big\} \end{aligned} \tag{17}$$

## 3.5 Equilibrium

The equilibria in this paper are restricted to stationary equilibria. We require equilibrium consistency that all individuals behave optimally at the marriage market and the household-resource allocations, and induce the stationary distributions of singles and matches, given the endogenous marriage market meeting probabilities.

**Definition 3.1.** A stationary equilibrium consists of

*(i).* a set of policy functions for single women $t_f^*$, single men $t_m^*$, and for married couples, $t^*$ with the corresponding optimal allocations for single women $(c_f^*, \mathrm{I}_f^*)^s$, for single men $(c_m^*, \mathrm{I}_m^*)^s$, and for married couples, $(c_f^*, \mathrm{I}_f^*, c_m^*, \mathrm{I}_m^*)^M$,

*(ii).* a set of value functions for singles at the beginning of period and the end of period $\{\tilde{V}^s, V^s\}_{(f,m)}$, value functions for married couples at the beginning of period and the end of period, $\{\tilde{V}^M, V^M\}$ for every age $a$ and $\omega$ cohorts

*(iii).* the reservation values for marriage and divorce, $\underline{\mathrm{z}}(a, \mathrm{H}, \omega)$

*(iv).* meeting probabilities $(\eta_f, \eta_m)$ such that

1. Given the distribution of singles at the beginning of period, which defines the meeting probabilities in the equation (1), the households decide their marriage and divorce decisions through (3).

2. Given the policy functions, in the (8) and (12), singles and married couples solve the optimal allocation problems through (7), symmetrically for single men, and (23).

3. Value functions for single women, symmetrically for men, are defined by the equations (2) and (5), and value functions for married couples are defined by the equations (4) and (10).

4. Meeting probabilities are consistent with the equilibrium measures of single men and women, and matched couples by the equations (14), (15), (16), and (17).

Under suitable regularity conditions on the value functions, and compactness of their functional spaces, the existence of an equilibrium is guaranteed by Brouwer fixed-point theorem. Shephard (2019) proves the existence of this type of model with respect to an update mapping operator. We cannot guarantee the uniqueness of the equilibrium, so the model is open to the multiple equilibria.

# 4 Structural Estimation

## 4.1 Data

To estimate structural parameters in the model, we further utilize data from the American Community Survey (ACS) in addition to the PSID and MEPS. Specifically, we pool together ACS data from 2001 to 2019 to match with the PSID and MEPS. The ACS offers data on education, marital patterns, marriage events, demographics, income, and labor supply. Compared to the PSID, the ACS has the large sample size, which makes it especially suitable for analyzing the age distribution of marriages in cross-sectional dimension. The sample periods selected to construct the pooled-moments are from 1999 to 2019 for both the PSID and

MEPS, and from 2001 to 2019. Again, we employ pooled data to comprehensively examine marital dynamics and the progression of individual health status. Also, we construct pooled data under the assumption that our pooled data with long time span is at the stationary distribution as in (Choo, 2015; Shephard, 2019).

We limit the sample to individuals aged 21 to 81 and further narrow it to those who have completed their educational decisions. Only individuals with health insurance and who are not self-employed are included. These restrictions are imposed to avoid confounding effects arising from the interaction between health insurance and marriage decisions, as we studied in the Section 2.

We have total 5 sections of parameter sets : preference parameters, labor-market related parameters, health related parameters, home production parameters, and marriage matching parameters. To target these parameter sets, we first utilize the information from the ACS that provides us with cross-sectional marriage matching information, and cross-sectional labor market information. We also utilize the information from the PSID that provides us with panel marriage matching information, panel labor market information, intra-household time-uses, and changes in health-related information. Finally, through the MEPS, we utilize the information on an individual's out-of-pocket medical expenditures (OOP) in a household. out-of-pocket medical expenditures used in the estimation are defined by total out-of-pocket medical expenditures minus out-of-pocket emergency and hospitalization expenditures. We construct an out-of-pocket measure to effectively utilize information related to medical investment characteristics, rather than focusing on unexpected costs resulting from health shocks.

In the model, we have the following state variables (types of agents, $\omega$) : gender, age, education, marriage matching type, human capital, family structures, and health. In order to target for the structural parameters, we need to construct relevant moments from the datasets by conditioning the state variables. Total number of the constructed moments is 523 from the ACS, 391 from the PSID, and 32 from the MEPS. The detailed information on the constructed moments is given in the Appendix *C*

In addition, we provide the summary statistics for each dataset in the Appndix *C*. We compare the three datasets, to keep individuals that is homogeneous in terms of the state variables.

## 4.2 Econometric specification

### 4.2.1 Preferences, constraints, and home production

We adopt the following parametrization of utility function for each gender $g \in \{f, m\}$

$$u^S(c_f(h_w^f), Q_f(h_q^f, \mathrm{H}_f(\mathrm{I}_f)), l_f; a_f, \mathrm{H}_f, \omega_f) = \frac{c_f \cdot \exp\left[(1-\sigma_c)(l_f(h_f) + \beta_Q \frac{Q^{1-\sigma_Q}}{1-\sigma_Q} + \mu(\mathrm{H}_f, h_w)\right]}{(1-\sigma_c)} \tag{18}$$

where a single woman chooses her consumption of normal good and home production by allocating her time between leisure $h_f$, home hours $h_q$, and labor market hours $h_w$. The utility function shows a non-separable form in terms of health, home production and normal good consumption as in (Low and Pistaferri, 2015; Low and Pistaferri, 2020; Shephard, 2019). $\mu(\mathrm{H})$ is added utility cost if an individual is working with bad health status H. The utility function for a male agent is defined symmetrically.

A single individual faces the budget constraint and time constraint defined by

$$c_f + p\mathrm{I}_f = w \cdot h_w^f - C(\omega_f, h_w^f) - T(\omega_f, h_w^f)$$
$$h_w^f + h_q^f + h_e^f = \mathrm{T}$$

where the budget constraint incorporates the institutional tax scheme $T$, which depends on the marital status and number of children by the federal tax schedule (2009), and $C(\omega_f, h_w)$ is a cost function that incorporates a household's childcare costs. The childcare cost function $C$ is a function of gender, labor market hours, age of the youngest child, education, and marital status. It is separately estimated by using the PSID that uses the following regression equation

$$\frac{childcare_{it}}{inc_{it}} = \beta_1 y_{it}^{ac} + \beta_2 edu_{it} + \beta_3 \mathrm{H}_{it} + \beta_4 f(age_{it}) + \sum_{k \in \{20,40,60\}} \beta_{5,k} 1(h_w = k) + \beta_6 m_{it} + \epsilon_{it} \tag{19}$$

where the equation provides us with the information that an individual's proportional childcare cost relative to her labor market hours $h_w$ and age of the youngest child $y^{ac}$ after controlling her age, education, health status, and marital status.

Home production function $Q_f$ is specified by $\xi_s(\omega_f) \cdot (\mathrm{H}_f h_e^f)$. It is a health-augmented form, where an individual time-use on home hours is affected by one's health status. Simultaneously, a choice of labor market hours is too affected by $\mu(\mathrm{H}_f, h_w)$. Lastly, $\xi(\omega_f)$ represents the efficiency of home production that depends on age of the youngest child, number of children, and marital status. Its functional form is

$$\xi_s = \log(exp(1) + \xi_{s,y_{ac}} \cdot 1(y_{ac}) + \xi_{s,n_c} \cdot 1(n_c)) \tag{20}$$
$$\xi_m = \log(exp(1) + \xi_{m,y_{ac}} \cdot 1(y_{ac}) + \xi_{m,n_c} \cdot 1(n_c) + \xi_{m,0}) \tag{21}$$
$$Q_f = \xi_s(\omega_f) \cdot (\mathrm{H}_f h_e^f) \tag{22}$$

Given the discrete choice of time-use decisions, a static budget constraint is determined. Then, an individual maximizes her utility with medical investment I and consumption.

We adopt age preference of spouse $A_g(a_m, a_f)$ that is interacted with the above utility function, $u_g^M = u^s(c_f(h_w^f), Q_f(h_q^f, \mathrm{H}_f(\mathrm{I}_f)), l_f; a_f)_g \times A_g(a_m, a_f)$ from Shephard (2019), which defines the married individual's utility function. The age preference terms include five parameters that reflect an individual's preferences regarding the marital age of their spouse. It allows us to account for marital preferences related to spousal age, a crucial consideration given the close relationship between age and health. Therefore, it can account for preferences where individuals favor partners who are either close in age or somewhat younger or older than themselves.

The problem for married households is defined similarly,

$$\max_{c_m,c_f,\mathrm{I}_m,\mathrm{I}_f} \lambda u_f^M(c_f(h_w^f), Q(h_q,\mathrm{H}(\mathrm{I}_m,\mathrm{I}_f)), l_f; a_f, \mathrm{H}_f, \omega_f) + (1-\lambda)u_m^M(c_m(h_w^m), Q(h_q, \mathrm{H}(\mathrm{I}_m, \mathrm{I}_f)), l_m; a_m, \mathrm{H}_m, \omega_m)$$

where they have the joint utility maximization problem with the Pareto weight $\lambda$. The Pareto weight $\lambda$ is fixed to 0.5 in the estimation.

They face the following joint constraints

$$c_m + c_f + p\mathrm{I}_m + p\mathrm{I}_f = w \cdot h_w - C(\omega, h_w) - T(\omega, h_w)$$
$$h_w^m + h_q^m + h_e^m + h_w^f + h_q^f + h_e^f = \mathrm{T}$$
$$Q = \xi_m(\omega) \cdot (\mathrm{H}_f h_q^f)^\alpha \cdot (\mathrm{H}_m h_q^m)^{1-\alpha}$$

Given the joint time-use decision of a household, married couples maximize the joint utility by allocating the time-uses $h_w^m, h_q^m, h_e^m, h_w^f, h_q^f,$ and $h_e^f$.

#### 4.2.2 Health dynamics

The evolution of health follows the following dynamics

$$\mathrm{H}^{'}_{i_g,a+1} = (1 - \rho_g^0(a_i))\mathrm{H}^g_{i,a} + \rho^1_{m,g,e}(I^h_{i,g,a+1})^{\gamma_h} \tag{23}$$

where $\rho_g^0(a_i)$ is deterministic depreciation of health $\mathrm{H}_i$ with one's age. $\rho^1_{m,g,e}$ is an efficiency parameter of health investment I, which depends upon an individual's marital status, education and gender. The specification of its marital dependency exhibits the potential characteristics of martial protection over one's health.

When updating both married and single individuals' measure at the beginning of period in the 15 and 15 with the policy functions $I^*$, we assume the aggregate measures of health follows $N(0, \sigma^2_{e,g})$.

#### 4.2.3 Labor market and wage equation

The labor market is perfectly competitive exhibits no search friction. It allows individuals to have voluntary unemployment through $h_w = 0$ and they do not face involuntary unemployment. Individuals gain their skills through the amount of their labor market experiences. They accumulate their human capital $k$

and it affects the log hourly wage by the following equation

$$lnw_{i,a} = \gamma_{g,e} + \alpha_{g,e} ln(1 + k_{i,a}) + \epsilon_{i_g,e} \tag{24}$$

where the log wage $lnw_{i,a}$ at age $a$ has its parameters being specific to both education and gender, including shock distributions that follows normal distribution. Human capital, $k_{ia}$, has three grid points : $[0 = k_1, \cdots, k_3]$. The total number of grids $K$ is set to be 3. And, workers in the model start their life-cycles with $k$ equal to 0.

The evolution of human capital follows the Markov process, with its transition probability $\pi_k$. The transition probability $\pi_k = \Pr(k'_{a+1}|k_a, h_w)$ is a function of labor market hours $h_w$. Choosing zero labor market hour will reduce the probability of accumulating better human capital $k'$ in future. Given that the total number of grid points is set to 3, at least three parameters are required to model the transition probabilities. For this purpose, for any working hours between 0 and $\bar{h}^w = 60$, the transition probability $\pi_k$ can be calculated by weighted sum of above two transitions, $\pi(k', k, 0)$ and $\pi(k', k, \bar{h}^w)$,

$$[\pi(k', k, 0) : \begin{array}{c} \\ k_{1,a} \\ k_{2,a} \\ k_{3,a} \end{array} \begin{array}{c} \begin{array}{ccc} k_{1,a+1} & k_{2,a+1} & k_{3,a+1} \end{array} \\ \begin{pmatrix} 1 & 0 & 0 \\ \delta_0 & 1-\delta_0 & 0 \\ 0 & \delta_0 & 1-\delta_0 \end{pmatrix} \end{array} \quad ] \tag{25}$$

$$[\pi(k', k, \bar{h}^w) : \begin{array}{c} \\ k_{1,a} \\ k_{2,a} \\ k_{3,a} \end{array} \begin{array}{c} \begin{array}{ccc} k_{1,a+1} & k_{2,a+1} & k_{3,a+1} \end{array} \\ \begin{pmatrix} 1-\delta_1 & \delta_1 & 0 \\ 0 & 1-\delta_2 & \delta_2 \\ 0 & 0 & 1 \end{pmatrix} \end{array} \quad ]$$

#### 4.2.4 Family structures

To account for changes in family structure within the model, we track age ($y_{ac}$) and the number of children ($n_c$) as state variables. Children influence the model in several ways, affecting the budget constraint through childcare costs and the tax system, as well as the efficiency of home production.

The birth of a new child occurs within a household according to a stochastic process, with probabilities that depend on the woman's age, marital status, current number of children, and education level. Since fertility decisions are not modeled within the model, the probability of a new child's arrival is estimated externally using the following equation

$$P(y_i^{ac} = 0 | e_i, a_f - 1, n_{i,a_f-1}^c, m_{a_f-1}, \mathrm{H}_{a_f}) \tag{26}$$

To avoid the curse of dimensionality (Eckstein et al., 2019), we restrict birth probability to 0 after women's age becomes 45.

#### 4.2.5 Marriage matching

Meeting probabilities are endogenous, depending on the availability of single individuals and a meeting efficiency parameter Meeting probabilities are endogenous and depend on the availability of single individuals and an meeting efficiency parameter, $\gamma(a, e)$. This parameter governs educational homophily and age hypergamy. The meeting efficiency parameter is modeled by

$$\gamma(a, e) = (\gamma_e \cdot 1(e_f == e_m) + (1 - \gamma_e) \cdot 1(e_f \neq e_m)) \cdot (1. - (\frac{(a_m - a_f)}{(2\bar{\Delta} + 1.)})^2)^{\gamma_a} \tag{27}$$

The total number of solutions would be vast if we were to estimate the age-matching matrix from ages 21 to 81. To reduce the complexity to a manageable level, it is necessary to impose a restriction on the age gap, $\bar{\Delta}$. In our estimation, we limit this gap to 12 years.

Following the matching process, we assume that the match quality shock $z$ is drawn from a logistic distribution $G$. Match quality can be classified into two types: high or low. The match quality shock $z$ is characterized by a different mean for each type, with high-type matches having a higher mean than low-type matches. This specification allows the model to accurately reflect the observed data, where certain matches tend to persist over time while others dissolve quickly. Consequently, this approach effectively explains match duration in the data.

### 4.3 Estimation Procedures

To solve the model, we require initial estimates of the singles' expected value function and the distribution of singles at the beginning of the period. While we have the solution for intra-household allocations at the end of the model periods, the solution for marriage market decisions at the beginning of the final period remains unknown. This uncertainty arises because the precise distribution of singles and the corresponding meeting probabilities, as well as the decision-making process of singles, are not yet determined. Therefore, to obtain the complete model solution, we first make initial guesses for the singles' expected value function and the distribution of singles at the beginning of the period. The model solution then proceeds iteratively to ensure accurate convergence. The detailed solution procedures are outlined in the above table.

**Algorithm 1** Model solution

**Input:** Guess for the expected value functions and measures of singles at the beginning of period, $\tilde{E}V_g$ and $\tilde{g}^s$

**Output:** Full solutions $(EV^s, \tilde{E}V^s_{(f,m)})$, $(EV^M, \tilde{E}V^M_{(f,m)})$, and measures (14), (15), (16), and (17)

1: Given a known terminal value, for age $a = \bar{A}$, we can calculate value functions for single and couples. And, age 1 start-of-period measures of singles can be known.

2: Provide initial guesses for the start-of-period measures of singles $\tilde{g}_i, \tilde{g}_j$, and expected the start-of-period value functions for singles, $\tilde{EV}^s_f, \tilde{EV}^s_m$.

3: Calculate the end-of-period single's expected value functions using the current guess for start-of-period value functions, and the state transition functions.

4: Calculate the end-of-period couples' value function along the main diagonal where $a_f = a_m = a$ by Backward induction.

5: Calculate the end-of-period couples value function along the off-diagonal for the age difference, exploiting that someone who gets married to a spouse aged $A$ today will be single next period.

6: Calculate the end-of-period and start-of-period measures of marriage using reservation, transition and ccp. From these, we can update the current guess of single measure.

7: Update the single's expected value functions because we can now know the meeting probabilities, $\eta_f, \eta_m$.

8: (Outer loop) : The distance between the updated and previous expected value functions and single measures is evaluated by $\delta_{\text{tol}}$.

Since we characterize the every equilibrium distribution, value functions, and policy functions, we can generate any necessary moment from the model. For example, since we have the relevant distributions of men/women from the model's equilibrium outcome, we can construct the marriage health gap by

$$E^{\text{Married}}_{H_m} - E^{\text{single}}_{H_m} = \sum H^{\text{Married}}_m \times g(H^{\text{Married}}_m|\omega^{\text{Married}}) - \sum H^{\text{Single}}_m \times g(H^{\text{Single}}_m|\omega^{\text{Single}})$$

The constructed model moments can be matched with the data moments, and if they fit and explain the data moments well, we can attain the convergence of the structural parameters in the model. There are 68 parameters to be estimated, and we construct empirical moments from the dataset to estimate the parameters. The set of the empirical moments is large enough to account for the variation by the state vector $\omega$, hoping to avoid making arbitrary selections of empirical moments to fit.

We use the generalized method of moments (GMM) to estimate the model parameters

$$\hat{\theta}_{GMM} = \arg\min_{\theta}(Q(\theta) - Q_d)' W^{-1}(Q(\theta) - Q_d) \tag{28}$$

with weight matrix $W$. The weight matrix $W$ is constructed from the inverse of the variances of the empirical moments.

# 5 Structural estimation results

In this section, we present the estimation results and model fits. We begin by estimating parameters related to childcare costs (19), fertility shocks (26), and health-specific mortality rates independently of the model. In order to estimate the first-step parameters, we use the PSID dataset, which provides the requisite data on the dynamics of fertility, health, and childcare expenses. The remaining parameters are estimated using a generalized method of moments, wherein we solve the model based on structural parameters and generate model moments to minimize the discrepancies between the model-generated moments and those observed in the data. Data moments are constructed from the PSID supplemented with MEPS and ACS.

We have total 5 sets of parameters : preference parameters, labor-market related parameters, health related parameters, home technology parameters, and marriage matching parameters.

The preference parameters can be identified using data on joint time use. The utility function is non-linear and non-separable with respect to health and home production. For instance, through the functional form of the utility, which includes the consumption curvature parameter ($\sigma_c$), a correlation exists between the spouses' joint decisions regarding time use. However, if $\sigma_c$ is absent, the model simplifies to a linear form, unable to account for joint decisions that distinguish single households from married households (Flabbi and Mabli (2018)). Since we have the joint decision on labor market and home production generated from married household in the model, the information on the joint time-uses decision can help us to identify the consumption curvature parameter $\sigma_c$. Additionally, the parameters related to the value of leisure and home production can be identified using data on both married and single individuals' home production and leisure decisions. The parameters related to meeting probabilities and age preferences can be identified by analyzing marriage matching outcomes by education and age. Home production parameters, which depend on health and family structure, can be identified through data on home production hours across different family structures, health statuses, and marital statuses.

Labor market parameters involve two components: the wage offer function, which depends on gender, education, and human capital, and the transition probabilities of human capital. The conditional mean of log-wages by gender and education helps identify the wage offer function, while age-dependent earnings profiles and transition probabilities from employment to unemployment help identify human capital dynamics.

Finally, health-related parameters can be identified through the conditional mean of health indices by age, gender, and education. Marriage-related parameters can be derived from divorce rates by education, gender, age, health, and marriage duration. Furthermore, marriage hazards by gender, education, family structure, and health, along with data on the proportions of never-married individuals and health-based matching patterns, help to identify this set of parameters.

Table 4: Parameter Estimates Table

| | | Estimate | Std.Error | | | Estimate | Std.Error | | | Estimate | Std.Error |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Preference parameters | | | | Home-prduction parameters | | | | Health-related parameters | | | |
| | $\sigma_c$ | 1.0537 | 0.002 | | $\xi_0$ | -1.0794 | 0.011 | | $\rho^1$(L,men,single) | 0.0350 | 0.001 |
| | $\sigma_t$ | 4.0360 | 0.019 | | $\xi_{y_{ac}=1}$ | 3.0360 | 0.012 | | $\rho^1$(H,men,single) | 0.1183 | 0.004 |
| | $\sigma_Q$ | 0.9014 | 0.044 | | $\xi_{y_{ac}=2}$ | 3.4470 | 0.011 | | $\rho^1$(L,women,single) | 0.0453 | 0.002 |
| | $\beta_Q$ | 0.8907 | 0.14 | | $\xi_{n_c=1}$ | 4.2100 | 0.018 | | $\rho^1$(H,women,single) | 0.1256 | 0.003 |
| | $\gamma_h$ | 0.1970 | 0.071 | | $\xi_{n_c=2}$ | 2.6100 | 0.015 | | $\rho^1$(L,men,married) | 0.4075 | 0.096 |
| | $\mu_H$ | -2.5720 | 0.008 | | $\alpha$ | 0.4503 | 0.009 | | $\rho^1$(H,men,married) | 0.4080 | 0.003 |
| | | | | | | | | | $\rho^1$(L,women,married) | 0.3414 | 0.011 |
| | | | | | | | | | $\rho^1$(H,women,married) | 0.3495 | 0.02 |
| Health-related parameters | | | | Labor-market parameters | | | | Labor-market parameters | | | |
| | $\sigma_h(1,1)$ | 1.577 | 0.093 | | $\gamma^0_{0,m}$ | 2.034 | 0.078 | | $\sigma_w$ | 0.0577 | 0.003 |
| | $\sigma_h(1,2)$ | 1.672 | 0.061 | | $\gamma^0_{1,m}$ | 2.07 | 0.021 | | $\sigma_w$ | 0.0305 | 0.002 |
| | $\sigma_h(2,1)$ | 1.570 | 0.054 | | $\gamma^0_{0,f}$ | 1.875 | 0.044 | | $\sigma_w$ | 0.0803 | 0.019 |
| | $\sigma_h(2,2)$ | 1.349 | 0.04 | | $\gamma^0_{1,f}$ | 1.932 | 0.038 | | $\sigma_w$ | 0.0765 | 0.011 |
| | | | | | $\alpha_{0,m}$ | 0.5535 | 0.005 | | $\delta(1)$ | 0.4269 | 0.017 |
| | | | | | $\alpha_{1,m}$ | 1.1756 | 0.003 | | $\delta(2)$ | 0.5202 | 0.013 |
| | | | | | $\alpha_{0,f}$ | 0.6155 | 0.011 | | $\delta(3)$ | 0.3160 | 0.012 |
| | | | | | $\alpha_{1,f}$ | 1.2415 | 0.008 | | | | |
| Marriage maching parameters | | | | Marriage maching parameters | | | | | | | |
| | $_\eta(1)$ | 9.4770 | 3.159 | | $\mu_z(L)$ | -4.8875 | 1.324 | | | | |
| | $_\eta(2)$ | 1.1722 | 0.313 | | $\mu_z(H)$ | 10.3548 | 1.945 | | | | |
| | $\gamma_\eta(1)$ | 0.9960 | 0.404 | | $\Pr(H\|L)$ | 0.3673 | 0.019 | | | | |
| | $\gamma_\eta(2)$ | 0.9022 | 0.046 | | $\Pr(L\|H)$ | 0.0291 | 0.002 | | | | |
| | $\alpha_\eta(1)$ | 2.1101 | 0.508 | | $\Pr(L)$ | 0.6284 | 0.03 | | | | |
| | $\alpha_\eta(2)$ | -1.0740 | 0.095 | | $\sigma_z$ | 2.1395 | 0.188 | | | | |
| | $\beta_\eta(1)$ | 35.9019 | 4.355 | | $\gamma$ | 0.0500 | 0.001 | | | | |
| | $\beta_\eta(2)$ | 35.0240 | 2.445 | | $\gamma(a)$ | 0.4841 | 0.069 | | | | |
| | $\sigma_\eta(1)$ | 15.8469 | 1.284 | | divorce cost | 5.9340 | 0.547 | | | | |
| | $\sigma_\eta(2)$ | 5.6848 | 0.854 | | | | | | | | |

The results of the structural estimation are presented in Table 4. Among the estimated parameters, the negative coefficient on $\xi_0$ indicates that singles have lower efficiency in home production compared to married individuals, suggesting that married individuals gain an advantage from joint efficiency in home production. Additionally, the estimated coefficients for the health-related parameters in Table 4 capture the efficiency of medical consumption relative to education, gender, and marital status, $\rho^1(e, g, m)$. The magnitude of these parameters is greater for married individuals than for singles, indicating that married individuals exhibit higher efficiency in medical consumption compared to their single.

To assess the validity of the model, we evaluate its fit by comparing key moments generated by the model with those observed in the data. We first consider the labor market-related moments. To target the relevant structural parameters, we examine labor market wages, employment, and labor market hours conditioned by several state variables present in the data.

To match these cross-sectional moments, we primarily use the ACS due to its large sample size, while we use the PSID to match panel moments in the labor market like the transition probability from unemployment to employment. We calculate the mean of log income, employment, and hours worked, categorized by gender, education, age, household structure, and health status.


Figure 12: Results of log-income moment fits by gender

Figure 12 presents the alignment between the model outcomes and data from the ACS. The Figure 12 focuses on targeting the mean of the log-income equation 24 by gender. While there is a slight mismatch for men, the absolute difference is relatively small, and there is a decent match for women. The Figure well generates the observed wage disparity between men and women, favoring toward men.

The above table 5 illustrates the lifetime evolution of log income by gender among the educated group. Generally, as individuals age, log income increases for both genders. Although the model does not perfectly align with the data, it does capture the general trend of increasing log income with tenure. One potential reason for the mismatch near at the retirement age is the model's lack of a retirement decision and the

Table 5: Log wage over ages

| College(+) | | 20s | 30s | 40s | 50s |
|---|---|---|---|---|---|
| Male | Data | 1.9830 | 2.3463 | 2.4604 | 2.4200 |
| | Model | 2.1270 | 2.3180 | 2.3255 | 2.4570 |
| Female | Data | 1.8984 | 2.1487 | 2.1892 | 2.1895 |
| | Model | 1.9108 | 2.0479 | 2.0890 | 2.2917 |
| **High school** | | **20s** | **30s** | **40s** | **50s** |
| Male | Data | 1.6567 | 1.8374 | 1.9156 | 1.9431 |
| | Model | 1.6929 | 1.8298 | 1.8253 | 1.8172 |
| Female | Data | 1.5147 | 1.6510 | 1.7332 | 1.7834 |
| | Model | 1.6031 | 1.6259 | 1.6539 | 1.6695 |

absence of involuntary unemployment.

Next, Figure 13 compares the employment moments from the ACS with those generated by the model. The constructed moments depict employment based on the age of the youngest child in a family, separated by gender, to capture labor market decisions influenced by family structure and the presence of children. The results indicate that the employment rate is lowest when the youngest child is of pre-school age for both genders. Conversely, the employment rate is highest when there are no children or when the youngest child is over the age of 10.

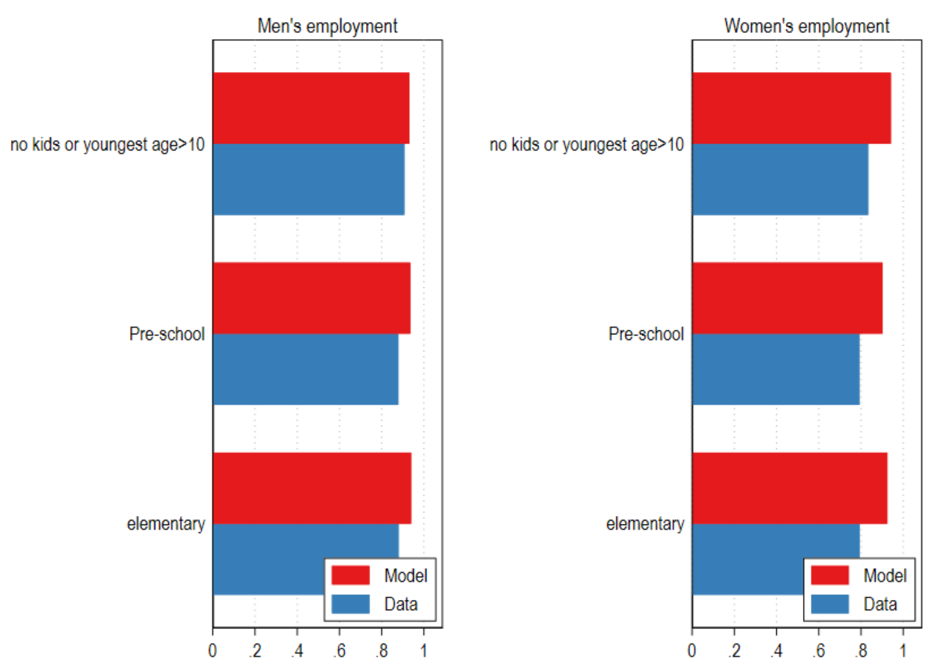



Figure 13: Results of employment moment fits by gender and family structure

Additionally, Figure 14 presents the comparison of hours of work between the data and the model, disaggregated by gender and family structure. While there are slight discrepancies between the two, the patterns observed are similar to those in Figure 13. Specifically, the model shows lower hours of work among families with children in pre-school or elementary school, and higher hours of work among families with children over the age of 10 or with no children, assuring the labor market decisions are influenced by the presence of children and their ages.

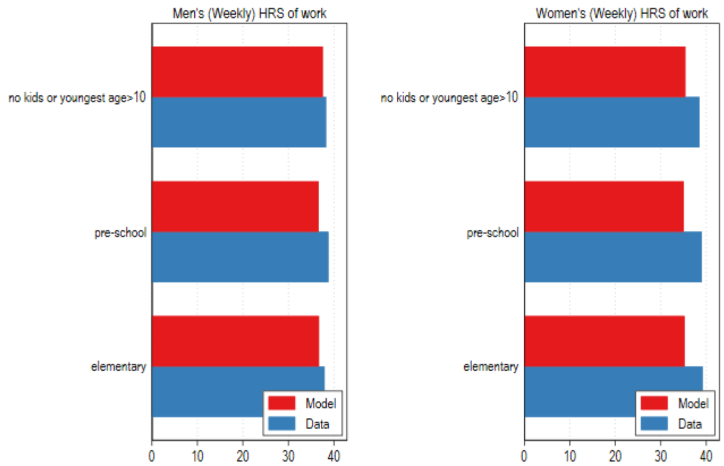



Figure 14: Results of labor-market hours moment fits by gender and family structure

Subsequently, we evaluate the assortative matching outcomes of marriage by each state variable : education, age and health. The governing parameters related to these moments not only include the structural parameters governing meeting probability, and age-preference parameters, but also other parameters affecting the total value of marriage compared to single.

Table 6 shows the distribution of assortative matching by education levels, separated into four categories: (L, L), (L, H), (H, L), and (H, H), where "L" and "H" denote low and high levels of education, respectively. The plot shows both the observed data (labeled as "Data") and the model's predictions (labeled as "Model") for each education combination.

Table 6: Matching by education

| | Data | Model |
|---|---|---|
| (H,H) | 0.443 | 0.459 |
| (H,L) | 0.131 | 0.052 |
| (L,H) | 0.139 | 0.206 |
| (L,L) | 0.287 | 0.283 |

For (L, L) type of matching, the model closely matches the observed data for low-education couples, indicating the model's performance in capturing this category. Similarly, for the (H, H) type of matching, the model accurately reflects the observed data for high-education couples, indicating its robust performance in this category.

However, for (L, H) and (H, L) matching, there are slight discrepancies between the model and data. The potential reason behind these discrepancies may be due to the fact that the equation 1 relies on a single parameter to govern the meeting probability, specifically the likelihood of meeting a partner with the same level of education. The model does not account for any dis-utility or positive utility associated with meeting a partner who has different educational attributes but possesses other desirable qualities. This limitation restricts the model's ability to replicate phenomena such as "trophy wife" or "trophy husband".

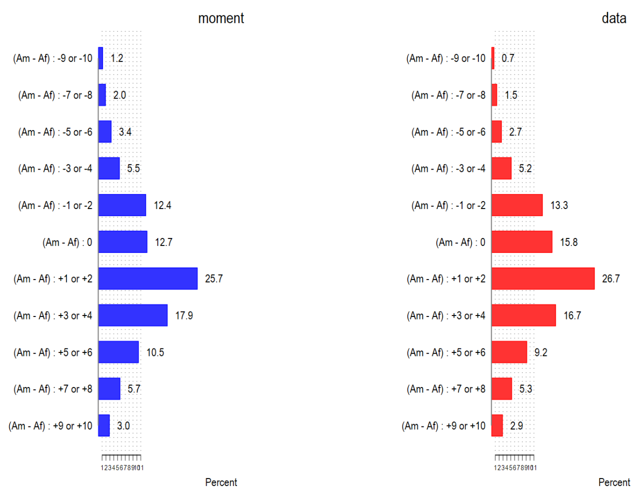



Figure 15: Age matching outcome of marriage

Next, we examine the outcomes of assortative matching by age. The relevant factors influencing these outcomes include age preferences and health considerations, as these continuously impact the value of marriage due to the age of individuals. The data indicates that, on average, men tend to marry women who are 3.8 years younger, reflecting a preference for younger spouses. Additionally, since age affects factors like mortality and fertility—though these are estimated outside the model—the age of an individual also influences the value of marriage. Therefore, we aim to assess whether the model can adequately explain these matching behaviors. Figure 15 shows a reasonable fit for these matches.

Also, we investigate the outcomes of assortative matching based on health. The contour plot in Figure 16 illustrates the health status of married husbands and wives, indicating that couples are more likely to be matched when both partners are healthy. This pattern is evident in the proportion of matches in both the model's moments and the data moments shown in Figure 16. While the highest proportion of matches occurs when both partners are healthy, there are very few matches when both partners are unhealthy. From the model's perspective, this suggests the participation of marriage is violated under poor health conditions of one partner, as the bad health status of one partner affects the joint value of marriage. This highlights potential selection mechanisms that the model can generate. Overall, when comparing the fit between the data and the model, it appears that the model effectively replicates assortative matching based on health.

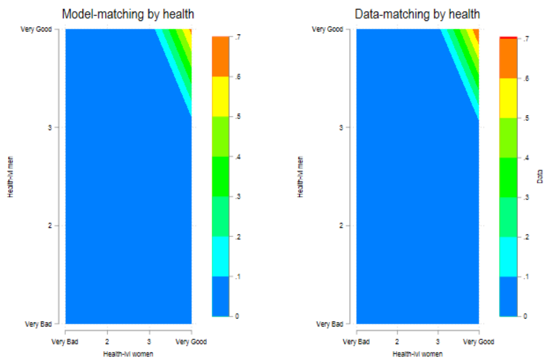



Figure 16: Health matching outcome of marriage

To investigate more selection into both marriage and divorce, Table 7 shows the relationship between health status and divorce probability for men and women, comparing the data moments with the model moments. The model generally captures the trend that worse health is associated with a higher probability of divorce, which could be indicative of a "selection into being single" effects.

Table 7: Divorce probability

| Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|
| Model | Data | educ | Health index | Model | Data | educ | Health index |
| 0.09 | 0.05 | L | 1st quantile | 0.08 | 0.12 | L | 1st quantile |
| 0.06 | 0.07 | L | 2nd quantile | 0.10 | 0.07 | L | 2nd quantile |
| 0.05 | 0.05 | L | 3rd quantile | 0.07 | 0.07 | L | 3rd quantile |
| 0.05 | 0.08 | L | 4th quantile | 0.06 | 0.07 | L | 4th quantile |
| 0.08 | 0.07 | H | 1st quantile | 0.09 | 0.11 | H | 1st quantile |
| 0.05 | 0.05 | H | 2nd quantile | 0.10 | 0.10 | H | 2nd quantile |
| 0.03 | 0.04 | H | 3rd quantile | 0.08 | 0.06 | H | 3rd quantile |
| 0.03 | 0.06 | H | 4th quantile | 0.04 | 0.07 | H | 4th quantile |

Lastly, the graphs 17 illustrate the percentage health gap between married and single individuals across different age groups for men and women, comparing the model's moment fits with the data. The estimated gap was generated from the figures 21 and 22. The actual data indicates that the health gap between married and single individuals widens with age, peaking in the 60s for both men and women, before slightly narrowing in the 70s. The model generally captures this trend but tends to underestimate the magnitude of the health gap, particularly for men and women in their 50s to 60s. The model's underestimation suggests it may not fully capture factors that influence the health advantage of married individuals as they age, such as social support or health insurance that could contribute to better health outcomes.

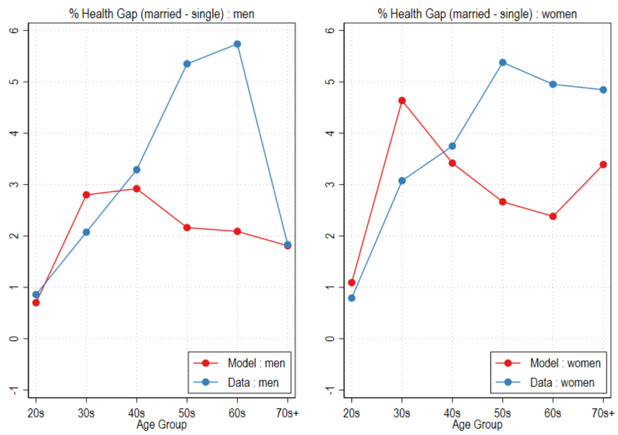



Figure 17: Marital Health gaps ($\mathrm{H}_M - \mathrm{H}_s$) for men and women by age

# 6 Counterfactual analysis

In this section, we use the estimated model to conduct a counterfactual analysis that decomposes the health gap associated with marital status. We examine three scenarios: the absence of income effects (no gender differences in the labor market), the removal of age preference (no age hypergamy), and unequal Pareto weights in household allocations.

The first scenario eliminates the gender wage gap in the labor market. In the absence of this scenario, individuals disadvantaged in the labor market could experience an increase in joint household income by marrying spouses with higher earnings. This increase in household income could lead to enhanced access to medical services, potentially improving health outcomes over time. By assuming equal labor market compensation, we aim to isolate the impact of joint income pooling as a potential driver of health disparities between married and single individuals.

In the second scenario, we seek to isolate the effect of a preference for younger spouses from the general impact of age on health outcomes. Since age and health are closely linked, a preference for younger partners may significantly contribute to the observed health disparity in the data.

Finally, regarding the household allocation problem, we assume equal Pareto weight parameters during the estimation stage. The Pareto weight $\lambda$ influences the distribution between private consumption and medical investment, especially within the context of joint utility maximization. By adjusting the values of $\lambda$, we aim to examine its impact on the observed health disparity, thereby providing deeper insights into the marital health disparity across genders.

We present the marital health gap across ages in Table 8. The first column ("Data%") suggests the marriage health gap that we observe in the PSID data. The second column ("Model%") represents the marital health gap, which serves as a baseline result derived from the estimated coefficients that show gender differentials in the labor market, men's age preference for younger partners, and equal Pareto weights between husband and wife. Columns four through six represent each of the counterfactual scenarios discussed.

Table 8: The evolution of the marital health gap (%) : $\frac{\mathrm{H(single)}-\mathrm{H(married)}}{\mathrm{H}^{\max}}$

| | | Data% | Model% | CF - 1 % | CF - 2 % | CF - 3 % : $\lambda = 0.7$ | CF - 4 % : $\lambda = 0.4$ |
|---|---|---|---|---|---|---|---|
| Male | 20s | -0.9% | -0.7% | -2.0% | -0.8% | -8.9% | -2.2% |
| | 30s | -2.1% | -2.8% | -2.7% | -2.9% | -9.7% | -3.9% |
| | 40s | -3.3% | -2.9% | -2.9% | -2.9% | -12.1% | -6.0% |
| | 50s | -5.4% | -2.2% | -2.1% | 0.5% | -12.9% | -1.1% |
| | 60s | -5.7% | -2.1% | -1.9% | 0.8% | -11.3% | 0.3% |
| | 70s+ | -1.8% | -1.8% | -1.6% | 3.2% | 4.9% | 3.5% |
| Female | 20s | -0.8% | -1.1% | -3.1% | -1.2% | -3.1% | -3.4% |
| | 30s | -3.1% | -4.6% | -4.0% | -6.8% | -3.8% | -5.4% |
| | 40s | -3.8% | -3.4% | -3.1% | -2.3% | -3.0% | -2.2% |
| | 50s | -5.4% | -2.7% | -2.6% | -2.1% | -2.6% | -3.6% |
| | 60s | -5.0% | -2.4% | -2.4% | -4.1% | -2.2% | -5.4% |
| | 70s+ | -4.8% | -3.4% | -2.9% | -4.9% | -3.1% | -4.3% |

In the second column, when comparing data from the early stage of life-cycles, the health disparity is overestimated at younger ages, while the model underestimates the lower bound of health differences observed in the data from age 40 onward. The factors that can generate a health gap in the current model include selection-based matching and differences in intra-household health investments between married and unmarried individuals. The reason for the larger gap at younger ages in the model, compared to the data, is that selection is a key factor in the data for younger ages (as noted by Guner et al. (2018)), but the model incorporates both selection and intra-household effects, potentially leading to an overestimation. As individuals age into their 40s, the lower bound observed in the model suggests that non-economic factors, such as emotional support or intangible elements, which are reflected in the data and are not captured in the model, resulting in an underestimation.

When the gender wage gap is eliminated, the model-generated health gap in the third column (CF - 1) of Table 8 shows a reduced gap for both men and women compared to the existing model from the 30s onward, except for a slight increase in the gap during the 20s. This reduction is likely due to the narrowing of the relative wage differential, which increases the reservation value of marriage for single women, leading to a higher proportion of healthier women remaining single.

In the fourth column (CF - 2) of Table 8, if men's preference for younger women is eliminated and they become indifferent to age, the health gap between married and unmarried men significantly decreases after the age of 40. In fact, healthier individuals are more likely to be observed as single after the age of 40. This can be explained by the fact that in their 20s and 30s, both men and women generally have a higher proportion of healthy individuals, and those with poorer health find it challenging to get married. As a result, couples who marry in their 20s and 30s tend to be healthier compared to their single counterparts. However, after the age of 40, the health gap between married and single individuals narrows when we eliminate the age preference of men. This is because, in the original model where there was a preference for younger women, men over 40 had to remain relatively healthy, similar to younger men, in order to continue participating in the marriage market and fulfill the marriage participation constraint. In contrast, without age preference, there is less an incentive for relatively healthy men to seek out younger women in their 20s and 30s for marriage. Consequently, over the age of 40s, the health gap between married and single men diminishes, and healthier men are more likely to remain single.

In the fifth column (CF - 3) and the sixth column (CF - 4) of Table 8, we modify the Pareto weight, denoted as $\lambda$, from 0.4 to 0.7. The Pareto weight $\lambda$ is set to 0.5 when equal weights are assigned to the division of household surplus. For the purpose of estimation, we fix this weight at 0.5.

In the fifth column (CF - 3) of Table 8, we generate the marital health gap from the model with Pareto weight $\lambda$ equal to 0.7. This increased value signifies a greater emphasis on men's private consumption and medical investment within intra-household allocations. The estimated fitting shows that the health gap between married and single men widens up to the age of 60. The subsequent reversal in the trend, observed after the age of 70, is likely due to the impact of automatic retirement occurring around the mid-60s. Under this extreme Pareto weight $\lambda$, households after the retirement and receiving less labor income are not likely to sustain marriage unless the quality of the marital match is high or the joint value of marriage is sufficiently enhanced by favorable joint health status between spouses. For women's case, the health gap seems to be relatively similar to the baseline outcome in the second column of Table 8.

In the sixth column (CF - 4) of Table 8, the marital health gap is estimated using a model where the

Pareto weight $\lambda$ is set to 0.4. This lower weight places less emphasis on men's private consumption and medical investment within intra-household allocations. Under this scenario, the health gap between married and single women also increases; however, its magnitude is not as pronounced as that observed for men. Compared to women, the health gap between married and single men decreases after the age of 50s.

# 7 Conclusions

The relationship between marriage market and health is essential for understanding the observed health disparity associated with marital status. In this paper, we establish and quantify the role of marriage markets and health-driven selection processes. We begin by presenting evidence that health significantly influences individuals' marriage decisions, and that married and single individuals differ across various dimensions, such as intra-household specialization and socioeconomic status.

We then provide a theoretical framework to explain these correlations using a stationary equilibrium model with heterogeneous agents, incorporating endogenous decisions regarding marriage, divorce, and health investments. In this model, agents are differentiated by characteristics such as gender, education, age, family structure, and marriage type. Within a marriage, resources are allocated to maximize joint utility, considering Pareto weights assigned to each spouse, while individuals can choose to divorce as the outside alternative for both partners. The value of marriage for couples is contingent upon the health status of each partner; when one spouse is paired with a partner in poor health, the stability of the marriage and the participation constraint of marriage are likely to be compromised. Additionally, all else being equal, marital surplus tends to be greater when both individuals have similar levels of health.

The model that incorporates this kind of selection by health in marriage market is estimated by matching the moment constructed from the model with the real data moment. The estimated model is used to study several counterfactual scenarios, such as elimination of gender wage gap, elimination of age preference of men, and change in Pareto weight to study the effect of household allocation on married couple's health evolution.

The model generally indicates that married households gain significantly from economies of scale in home production, enabling them to allocate resources more toward medical investment. Moreover, these ,married households tend to exhibit greater efficiency in medical investments, which leads to better health outcomes relative to single households. Furthermore, the benefits of marriage are not evenly distributed across genders.

In the counterfactual analysis, changes in Pareto weights emerged as the most significant factor in reducing the observed health gap associated with marriage. Although less influential, age preferences also played a role in narrowing this disparity.

The analysis presented in this paper raises several important questions. First, it underscores the need for further research to investigate how additional factors, such as health insurance coverage or joint time investments in health-related activities—requiring more detailed individual-level data—might influence health disparities associated with marital status. Second, it emphasizes the role of selection in driving these differences and suggests that, even after accounting for health-based selection, the impact of policy interventions, such as reducing the gender wage gap or altering family dynamics related to gender roles, could significantly affect the health outcomes of individuals within households, particularly when these interventions interact with the complexities of the marriage market.

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# 8 Appendix

# A Empirical Analysis

The variables

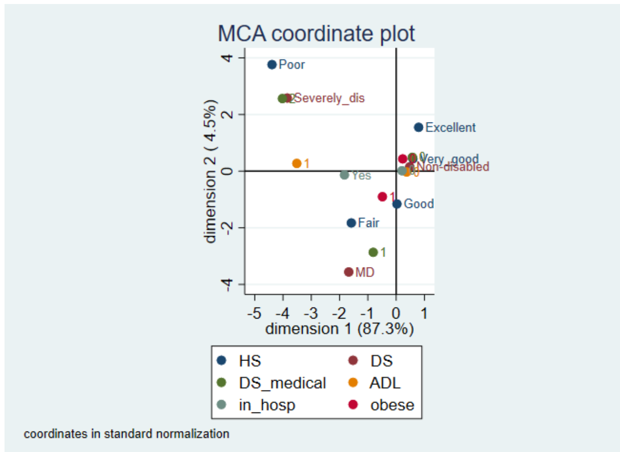
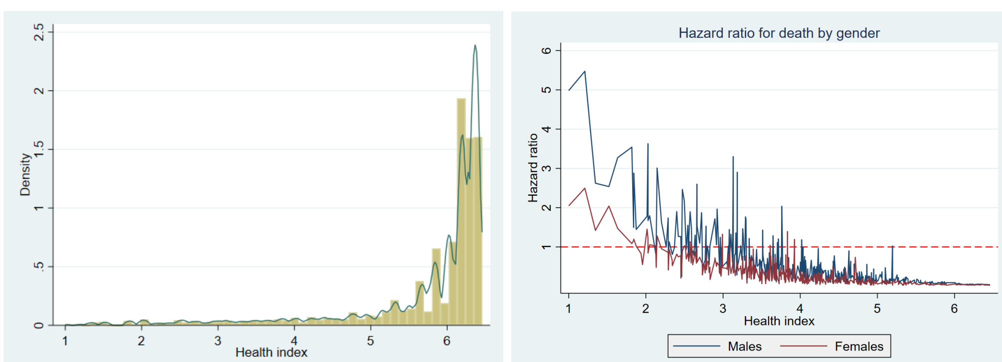



Figure 18: MCA coordinate plot

Figure 19a shows a histogram of the constructed health index. Distribution has the skewness of health toward right, meaning that samples possess generally good health. Figure 19b shows a estimated hazard ratio for death by health index from Cox regression. If the hazard ratio is less than 1 (see the red dotted line), it means that the hazard of being died in next period is being less as the health index increases. Controlling after age, the health index is closely related to mortality risk of both gender, though men generally tend to have higher risk than women.




(a) Distribution of health index

(b) Hazard ratio for death by health index

Figure 19: Pooled samples ($N = 99,876$)

Table 9: Health-index summary statistics

| | Full Sample N= 99,876 | |
|---|---|---|
| Variable | Mean | Std.Dev |
| **Disability status** | | 0.55 |
| Non disability | 0.84 | |
| Moderate disability | 0.08 | |
| Severe disability | 0.06 | |
| | | |
| **Disease types**[12] | | |
| Stroke before | 0.027 | 0.68 |
| Blood pressure before | 0.084 | 2 |
| Diabete before | 0.095 | 1.18 |
| Cancer before | 0.051 | 0.91 |
| Lung disease before | 0.045 | 0.85 |
| Heart attack before | 0.031 | 0.72 |
| Heart disease before | 0.045 | 0.85 |
| Emotional problem before | 0.084 | 1.13 |
| Arthritis before | 0.156 | 1.47 |
| Asthma before | 0.106 | 1.24 |
| Mental loss before | 0.015 | 0.54 |
| Learning disorder before | 0.026 | 0.66 |
| | | |
| **Self-assessed health** | | 1.04 |
| Excellent | 0.184 | |
| Very good | 0.346 | |
| Good | 0.308 | |
| Fair | 0.121 | |
| Poor | 0.038 | |
| | | |
| **Obesity** | | 0.46 |
| BMI>30 | 0.323 | |
| | | |
| **Hospitalization** | | 0.3 |
| Yes | 0.102 | |
| | | |
| **ADL limitation** | | 0.28 |
| Yes | 0.095 | |

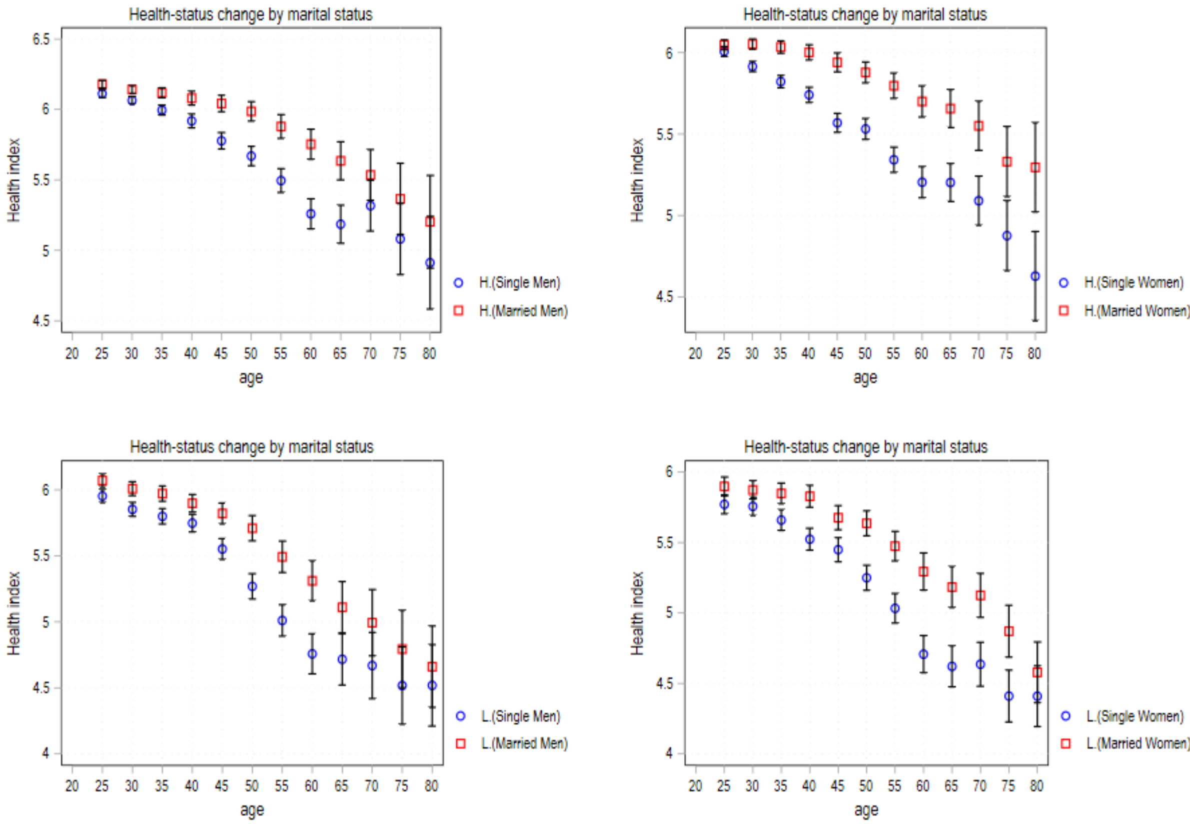



Figure 20: Differences in health index over life-cycles by gender and education : H (more than college), L (High school)

Table 10: The differences in other health measures between single and married individuals

| | Single | Married | Difference | t-statistics |
|---|---|---|---|---|
| (Serious) Stroke before | 0.0406 | 0.0289 | 0.0111*** | 10.5490 |
| (Serious) Blood pressure before | 0.3036 | 0.2819 | 0.0294*** | 10.9679 |
| (Serious) Diabete before | 0.1151 | 0.1083 | 0.0104*** | 5.6684 |
| (Serious) Cancer before | 4.7258 | 4.6958 | 0.0231*** | 3.6912 |
| (Serious) Lung disease before | 0.0738 | 0.0432 | 0.0311*** | 23.5150 |
| (Serious) Heart attack before - | 0.0436 | 0.0441 | 0.0032** | 2.7016 |
| (Serious) Heart disease before | 0.0638 | 0.0598 | 0.0088*** | 6.2014 |
| (Serious) Emotional problem before | 0.1443 | 0.0663 | 0.0723*** | 42.6196 |
| (Serious) Arthritis before | 0.2410 | 0.1813 | 0.0590*** | 24.6876 |
| (Serious) Asthma before | 0.1370 | 0.0865 | 0.0454*** | 25.3808 |
| (Serious) Mental loss before | 0.0269 | 0.0138 | 0.0136*** | 17.1522 |
| (Serious) Learning disorder before | 0.0450 | 0.0184 | 0.0254*** | 27.1098 |
| Disability status | 0.3401 | 0.2112 | 0.1268*** | 36.6713 |
| Any serious medical condition | 0.4803 | 0.3122 | 0.1595*** | 43.6965 |
| Self-assessed Health | 2.4212 | 2.6703 | -0.2359*** | -37.5784 |
| Obesity | 0.3292 | 0.2768 | 0.0538*** | 20.0375 |
| Any hospitalization | 0.1157 | 0.0961 | 0.0194*** | 9.7084 |
| ADL limitation | 0.1620 | 0.0893 | 0.0690*** | 37.8562 |
| N | 99464 | | | |

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: Marriage-hazards for single individuals

| Variable | | Hazard ratio | Std. Err. | z |
|---|---|---|---|---|
| (standardized) Health index | | **1.141** | 0.005 | 32.650 |
| Sex | | | | |
| Men | (Base) | 1 | | |
| Women | | 0.934 | 0.006 | -9.968 |
| Educ. | | | | |
| High school | (Base) | 1 | | |
| college | | 1.02 | 0.007 | 2.707 |
| age | | 1.068 | 0.002 | 41.292 |
| Non-linear age terms | | 0.999 | 0.001 | -38.260 |

Table 12: Estimates of the Affinity matrix : (N=5570)

Wife's attributes

Husband's attributes

$$\text{Affinity Matrix} = \; : \begin{array}{l} \\ \text{Health} \\ \text{Education} \\ \text{BMI} \\ \text{Log hourly wage} \end{array} \begin{array}{cccc} \text{Health} & \text{Education} & \text{BMI} & \text{Log hourly wage} \end{array} \hspace{-20em} \begin{pmatrix} 0.111^{*} & 0.049^{*} & -0.017^{*} & 0.0349^{*} \\ 0.099^{*} & 0.470^{*} & -0.003 & 0.0814^{*} \\ -0.034^{*} & -0.002 & 0.054^{*} & -0.0096 \\ 0.0700^{*} & 0.0251 & -0.0334^{*} & 0.3256^{*} \end{pmatrix} \tag{29}$$

## B Tax system

Household income is influenced by key components of the tax and transfer system, including the Earned Income Tax Credit (EITC), federal income taxes, and food stamps. The parameters of these systems are set according to their 2009 values, with relevant information sourced from the following: EITC parameters (https://www.taxpolicycenter.org/statistics/eitc-parameters), federal tax information (https://taxfoundation.org/federal-tax/individual-income-payroll-taxes), and food stamp program characteristics (https://www.fns.usda.gov/snap/characteristics-households-fy-2009).

Federal taxes on pre-tax income follow the actual 2009 tax schedules. We assume that married households file taxes jointly. For single households, the marginal tax rates are 10%, 15%, 25%, 28%, 33%, and 35%, applying to income brackets starting at \$0, \$8,350, \$33,950, \$82,250, \$171,550, and \$372,950, respectively. For married households, the same marginal tax rates apply to income brackets starting at \$0, \$16,700, \$67,900, \$137,050, \$208,850, and \$372,950, respectively. Federal tax deductions and exemptions vary based on marital status and the number of children.

Transfers through the EITC are determined by household earned income, the maximum credit amount, and the phase-in and phase-out rates, all of which depend on the number of children and marital status. The income level at which the EITC phase-out begins is also contingent on marital status and the number of children in the household.

Food stamps (SNAP) are included in the model as the primary general social safety net program, with eligibility and cash benefits determined according to actual program rules. Eligibility requires that gross household income falls below \$14,000, \$17,600, and \$21,200 annually, depending on the number of children (0, 1, or 2, respectively). Deductions include a standard deduction, a 20% deduction for earned income, and a \$144 monthly deduction per dependent child. Food stamp benefits increase with household size and are reduced by 30% of household income after deductions.

# C Data moments

Table 13: Summary Statistics : Comparison between PSID and ACS

| Variable | | ALL | | | | MALE | | | | FEMALE | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PSID | | ACS | | PSID | | ACS | | PSID | | ACS | |
| | | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Age | | | | | | | | | | | | | |
| | 20s | 0.1589 | 0.3656 | 0.1818 | 0.3857 | 0.1641 | 0.3704 | 0.1876 | 0.3904 | 0.1533 | 0.3603 | 0.1751 | 0.3800 |
| | 30s | 0.2501 | 0.4331 | 0.2395 | 0.4268 | 0.2591 | 0.4382 | 0.2451 | 0.4301 | 0.2404 | 0.4273 | 0.2330 | 0.4228 |
| | 40s | 0.2640 | 0.4408 | 0.2524 | 0.4344 | 0.2595 | 0.4383 | 0.2497 | 0.4329 | 0.2689 | 0.4434 | 0.2554 | 0.4361 |
| | 50s | 0.2298 | 0.4207 | 0.2166 | 0.4119 | 0.2198 | 0.4141 | 0.2094 | 0.4069 | 0.2405 | 0.4274 | 0.2249 | 0.4175 |
| | 60s | 0.0822 | 0.2747 | 0.0914 | 0.2882 | 0.0825 | 0.2751 | 0.0891 | 0.2849 | 0.0819 | 0.2742 | 0.0940 | 0.2919 |
| | Over 70s | 0.0150 | 0.1215 | 0.0184 | 0.1344 | 0.0150 | 0.1216 | 0.0191 | 0.1368 | 0.0149 | 0.1213 | 0.0176 | 0.1316 |
| Age matching ("Married couple") | | | | | | | | | | | | | |
| | (Am - Af) | 3.8257 | 1.0026 | 3.8393 | 1.0059 | | | | | | | | |
| Employment | | 0.9456 | 0.2268 | 0.9370 | 0.2429 | 0.9444 | 0.2291 | 0.9357 | 0.2452 | 0.9468 | 0.2244 | 0.9385 | 0.2402 |
| Marriage | | 0.6555 | 0.4752 | 0.5884 | 0.4921 | 0.6835 | 0.4651 | 0.6170 | 0.4861 | 0.6265 | 0.4837 | 0.5564 | 0.4968 |
| Number of children | | 0.7609 | 1.0989 | 0.8862 | 1.1395 | 0.7789 | 1.1217 | 0.8615 | 1.1576 | 0.7422 | 1.0744 | 0.9137 | 1.1183 |
| Proportion of + college education | | 0.6816 | 0.4659 | 0.5477 | 0.4977 | 0.6487 | 0.4774 | 0.5173 | 0.4997 | 0.7170 | 0.4505 | 0.5824 | 0.4932 |
| Educ. matching ("Married couple") | | | | | | | | | | | | | |
| | (H,H) | 0.5636 | 0.4952 | 0.4781 | 0.4995 | | | 0.4737 | 0.4992 | | | 0.4835 | 0.4997 |
| | (H,L) | 0.1017 | 0.3020 | 0.1162 | 0.3203 | | | 0.1195 | 0.3241 | | | 0.1121 | 0.3155 |
| | (L,H) | 0.1498 | 0.3611 | 0.1509 | 0.3581 | | | 0.1455 | 0.3528 | | | 0.1576 | 0.3644 |
| | (L,L) | 0.1849 | 0.3803 | 0.2548 | 0.4362 | | | 0.2613 | 0.4402 | | | 0.2468 | 0.4310 |
| Hours of work | | 37.8738 | 13.8671 | 39.3012 | 12.8369 | 41.0695 | 13.8228 | 41.6533 | 12.6901 | 34.3812 | 13.0491 | 36.6122 | 12.4704 |
| Home hours | | 14.6594 | 8.7306 | | | 8.1362 | 6.9656 | | | 13.1184 | 9.4082 | | |
| Log wage | | 2.6702 | 0.6865 | 2.0146 | 0.8358 | 2.7885 | 0.7014 | 2.0810 | 0.8841 | 2.5417 | 0.6458 | 1.9388 | 0.7702 |
| Marriage Duration | | 15.7183 | 12.1458 | | | 15.3900 | 12.0549 | | | 16.0923 | 12.2380 | | |

Table 14: Summary Statistics : MEPS

| | | ALL | | Male | | Female | |
|---|---|---|---|---|---|---|---|
| | | MEPS | | MEPS | | MEPS | |
| Variable | | Mean | SD | Mean | SD | Mean | SD |
| Health | | | | | | | |
| | Very Bad | 0.12 | 0.32 | 0.11 | 0.31 | 0.13 | 0.33 |
| | Bad | 0.29 | 0.45 | 0.28 | 0.45 | 0.29 | 0.45 |
| | Fair | 0.37 | 0.48 | 0.37 | 0.48 | 0.37 | 0.48 |
| | Good | 0.23 | 0.42 | 0.24 | 0.43 | 0.21 | 0.41 |
| Fraction of the insured | | 0.87 | 0.34 | 0.84 | 0.36 | 0.89 | 0.32 |
| Average annual medical expenditure | | | | | | | |
| Educ. : | H (+College) | 580.73 | 1339.94 | 467.07 | 1257.56 | 690.30 | 1406.16 |
| | L | 710.35 | 1567.76 | 597.48 | 1348.79 | 814.37 | 1738.95 |
| Average annual medical expenditure | | | | | | | |
| Health : | Very Bad | 1181.02 | 2301.23 | 1084.20 | 2259.45 | 1259.78 | 2331.74 |
| | Bad | 742.81 | 1574.80 | 640.51 | 1380.62 | 834.29 | 1724.97 |
| | Fair | 570.88 | 1252.46 | 460.06 | 1049.62 | 673.90 | 1407.39 |
| | Good | 441.73 | 1064.25 | 337.74 | 884.49 | 554.28 | 1219.60 |

# D Additional Tables

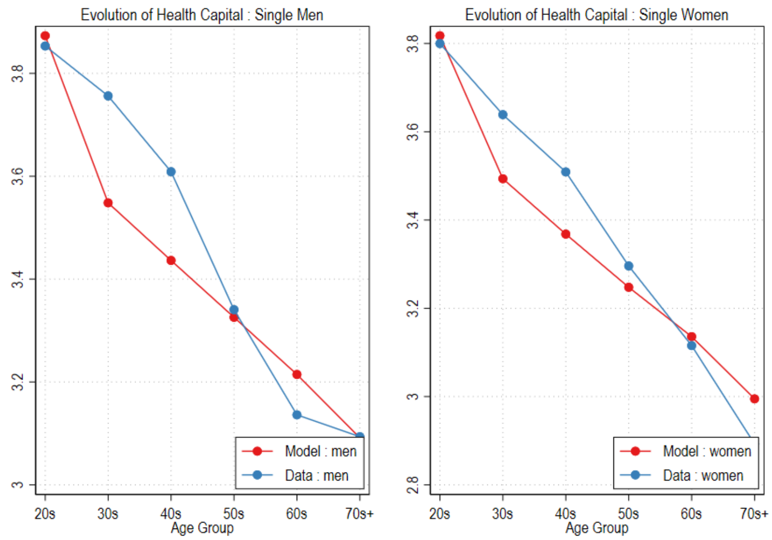



Figure 21: Evolution of Men's Health index over life cycles

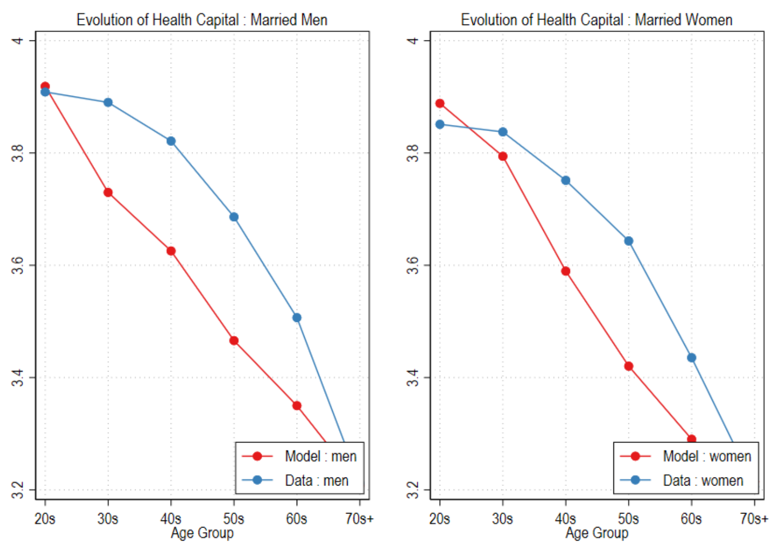



Figure 22: Evolution of Women's Health index over life cycles