Labor and Family Dynamics in a Joint-Search Framework*

Marta Morazzoni† Danila Smirnov‡

July 24, 2026

Abstract

This paper develops a quantitative model of search in the labor and marriage markets. Heterogeneous agents accumulate and deplete productivity, search and lose jobs, and undergo a two-sided matching process to form couples. Sorting and selection into couples determine productivity differences across married and singles, while income-sharing insures agents in couples from productivity shocks and unemployment risk. Calibrated to U.S. evidence, the model explains 85% of the wage marital premium and 50% of the unemployment marital gap. We find that ignoring endogenous marital choices mismeasures welfare gains and fiscal costs of more generous unemployment benefits and tax credits by 20–25%.

Keywords: Job Search, Endogenous Household Formation, Unemployment Insurance.
JEL Classification: H21, J12, J64, J65.

---

*We thank Árpád Ábrahám, Isaac Baley, Davide Debortoli, Matthias Doepke, Luisa Fuster, Nezih Guner, Fatih Guvenen, Stefania Marcassa, Lukas Nord, Edouard Schaal, Bastian Schulz, Arnau Valladares-Esteban and Jaume Ventura for invaluable discussions, as well as participants in the CREI Macro Lunch, the CERGY Webinar in Gender and Family Economics, the 4th Dale T. Mortensen Conference, the European Economic Association, the Spanish Macroeconomic Network, the Royal Economic Society and the Barcelona Summer Forum for helpful comments. The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management.

†University College London, CEPR and Institute for Fiscal Studies. Email: m.morazzoni@ucl.ac.uk.

‡International Monetary Fund. Email: dsmirnov@imf.org.

1 Introduction

Half of US labor force participants are married, labor statistics point to stark heterogeneities in employment outcomes by marital status, and several instruments of fiscal redistribution are tailored to family-specific household characteristics. Despite the seemingly rich interaction between employment and marital dynamics, quantitative models of search in the labor and marriage markets are scarce. In standard joint-search theories, income-pooling allows married households to search longer for better jobs, but marital status is taken as exogenous (Guler et al. (2012)), and a few model predictions remain counterfactual to the empirical evidence. For instance, within-couple insurance can rationalize why married agents have higher average wages than singles, but not why their unemployment rates are lower in the data (Choi and Valladares-Esteban (2018)).[1] What is more, since this class of models does not endogenize marital decisions, any inference on the aggregate implications of changes to family-based policies can potentially miss key compositional channels.

This paper shows that, to deliver empirically consistent labor market differences across married and singles, a job-search framework has to account for the patterns of agents' selection into joint-households. Our focus on individuals' search in the marriage market is grounded in a rich body of literature documenting selection and sorting within couples along several socio-economic traits (e.g.: Calvo et al. (2021)). By endogenizing marital decisions, we are not limited to analyzing the job search strategies of households whose marital status is taken as given, and can investigate the interplay between labor market and marital choices. Most importantly, modeling search in both markets alongside the traditional channel of within-couple insurance allows us to study how the provision of public resources affects, and is affected, by agents' endogenous marital decisions.

Concretely, the paper develops a heterogeneous agents search model where individuals differ in productivity, gender, fertility and marital status. Productivity is accumulated on the job and depleted off the job, it determines wages in efficiency units and is subject to uninsurable idiosyncratic shocks. With respect to labor market outcomes, agents can be either employed, unemployed, or out of the labor force. As in McCall (1970), job search is random and unemployed individuals receive wage offers at an exogenous rate, while enjoying unemployment benefits. When working, agents consume their wage net of taxes and face the risk of losing their job. Whether employed or unemployed, they can decide to leave the labor force and enjoy home production, and when out of the labor force they can also search for jobs. In addition, households face an exogenous probability of realized fertility, which is higher for couples, and have a working life of 40 years on average, before they retire and exit the economy. Realized fertility entails child costs, which vary with agents' income. Income taxes are progressive and get filed jointly, and we include child-based tax credits.

[1] See Flabbi and Mabli (2018) on the quantitative fit of joint-search models with respect to labor market differences by marital status, Flabbi and Finn (2015) on the interplay between education, household's and labor market decisions, and Gemici (2011) on the connection between migration, within-household bargaining and labor market outcomes.

Allowing for gender differences in job finding and loosing rates, home-production and wage offers, as well as for the accumulation and depletion of productivity, already sets our model apart from existing joint-search theories. Yet, our main contribution is to allow the choice of marrying to be endogenous and bilateral. Specifically, every agent in the economy is born single and faces an exogenous probability of meeting individuals with heterogeneous productivities and employment outcomes. When two potential partners meet on the marriage market, they each assess the return of matching compared to staying single and continuing to search. From the moment a match is bilaterally agreed on, married agents start to equally share the sum of their wages, unemployment benefits or home-production goods, and behave as a joint-searcher on the labor market as well.

Two main mechanisms are at work in the model. On the one hand, agents have strong incentives to marry and benefit from the informal insurance provided within couples against idiosyncratic productivity shocks and unemployment risk. Income-pooling shields individuals from large drops in consumption, and allows them to have higher reservation-wage strategies. On the other hand, being in a couple is costly if a spouse looses their job or is hit by a negative productivity shock, and because joint-households more often face child costs. This fosters selection into couples along productivity and labor market outcomes, and, as marriage requires bilateral agreement, generates positive sorting. Moreover, productive individuals have the incentive to quit unemployment faster and avoid depleting their productivity. Ex-post, selection and sorting are consistent with married agents having higher average wages and lower unemployment rates than singles.

Qualitatively, our framework accounts for several labor market differences by gender and marital status observed in US data. In particular, using the Current Population Survey and the 1979 National Longitudinal Survey of Youth, we show that both married men and women have on average 20% higher wages and 2.5 percentage points lower unemployment rates compared to their single counterparts, consistent with evidence by Choi and Valladares-Esteban (2018). Second, we show that part of these differences between married and singles may be unconditional on being married. In fact, the married sample is composed by a larger fraction of highly educated agents, who tend to have better labor market outcomes and to partner with individuals of similar education and labor income. This suggests that sorting and selection into marriage may partly underpin the wage marital premia (WMP) and unemployment marital gaps (UMG) documented in the data.

We then quantitatively bring the model to the data: our novel continuous-time computational method allows us to solve for twelve endogenous distributions of households over productivity, labor market outcomes, gender, fertility and marital status. The calibrated framework replicates – as untargeted moments – 85% and 50% of the differences in wages and unemployment rates across married and single households. In fact, we estimate that abstracting from sorting and selection into marriage leads to explaining half of the empirically observed WMP, due to the higher reservation-wage strategies of joint-searchers, but predicts counterfactually higher unemployment rates for married individuals. Our quantitative framework matches several other untargeted marital patterns, such as women and men's age at marriage, the positive assortative matching of partners based on their wages (or productivity), and the semi-elasticity of marriage rates to individuals' wages. It also reproduces the shares of couples by labor market status we observe in the data.

Next, since our framework features a government that collects income taxes and provides unemployment benefits and tax credits, we use the model as a laboratory to study the effects of changes to these fiscal margins. In particular, we analyze an increase in the generosity of unemployment compensation and a raise in the income thresholds of tax credits for households with a dependent child, regardless of their marital status. Throughout these counterfactuals, we keep the tax rate fixed, and ease the comparison across policies by making them equal in terms of overall fiscal cost (or surplus) generated. The goal is then to assess how these transfers affect the labor market outcomes of singles and married, men and women, and agents with and without children, and whether the effects we detect vary when marital choices respond endogenously to policy changes.

First, note that all individuals in our model are subject to productivity and fertility shocks, while workers face also unemployment risk. However, due to resource-sharing within couples, married agents can count on the income of their spouses to mitigate losses in income and consumption, which allows them to wait relatively longer in unemployment before accepting a job offer. Consistent with this, increasing the generosity of unemployment compensation decreases marriage rates, and raises the average wage of agents that have lower reservation-wage strategies. Gain are especially concentrated among singles, who have no access to within-household insurance, and women, who tend to receive worse job offers than men in our calibrated framework.

Second, we show that increasing the income thresholds of child-based tax credits raises individuals' incentives to form a couple and reduces out-of-the-labor-force rates across all demographic groups, but especially for married women. This is explained by the fact that, in our calibrated framework, married households face a higher likelihood of realized fertility, while joint-taxation discourages the labor supply of the second earner within couples, which is on average the woman.

Overall, we find that both policy experiments lead to positive welfare changes compared to our baseline economy. Nevertheless, welfare gains and total fiscal costs would be miscounted by 20-25% if households did not endogenously optimize their marital decisions throughout the counterfactuals, highlighting how changes in the provision of fiscal transfers can significantly alter the search strategies of households, not only in the labor but also in the marriage market. Our results stress the case for studying the provision of unemployment and child-related tax credits within quantitative frameworks that endogenize search in both the labor and the marriage market.

Related Literature. We build on the joint-search framework developed by Guler et al. (2012), but allow individuals to differ by gender, productivity, marital and fertility outcomes in order to study the interplay of endogenous family formation and job search decisions. Our work is also complementary to Pilossoph and Wee (2021), who analyze the WMP in the US as the result of higher reservation-wage strategies for married households. In our paper, we add endogenous marital decisions to explain both the WMP and the UMG,[2] and show that sorting and selection into couples are key to replicate a broader range of facts on employment outcomes and marital dynamics across men and women in the US. From a theoretical standpoint, we hence relate to Calvo et al. (2021) and their model of sorting in the marriage and labor markets, although their focus is on how complementarities across spouses in hours spent for home-production affect income inequality.

Our analysis is also linked to several works that have investigated the interaction of households' dynamics and labor market outcomes focusing on the *intensive* margin of labor supply, as in Ortigueira and Siassi (2013), Guner et al. (2012), Greenwood et al. (2014), Doepke and Tertilt (2016) and Pilossoph and Wee (2020). We however focus on the *extensive* margin of labor supply and explore how marriage affects job search choices and unemployment spells. In doing so, we relate to Bacher et al. (2022), who study the effect of spousal labor force entry across young and old households when a partner looses their job. Differently from their work, we analyze the two-way interaction between family and job choices by endogenizing the dynamics of the marriage market.

Finally, our paper contributes to a growing literature on fiscal policies in models with heterogeneous households of different family characteristics. For example, Guner et al. (2012), Borella et al. (2019) and Ortigueira and Siassi (2020) investigate the impact of joint-taxation on the labor market outcomes of married and singles – focusing on the intensive margin of labor supply. Guner et al. (2020) explores the macroeconomic effects of child benefits, and Choi and Valladares-Esteban (2019) study optimal unemployment insurance in an incomplete-market model with single and married households.[3] These frameworks abstract from endogenous marital decisions, and from how these decisions may react to policy changes, amplifying or reducing their impact. Although computational complexity prevents us to study both within-couple insurance and self-insurance through savings, our theoretical and quantitative model makes a first step towards the analysis of how fiscal redistribution affects and is affected by households' endogenous marrying decisions.

2 The Model

In what follows, we lay out a heterogeneous agents model to jointly analyze how households search for jobs in the labor market, and single agents search for a partner in the marriage market.

[2]See the evidence reported first in Choi and Valladares-Esteban (2018) and McConnell and Valladares-Esteban (2020).

[3]Ek and Holmlund (2010) study optimal unemployment insurance for couples using a Diamond-Mortensen-Pissarides framework as well, but without including individual heterogeneity and endogenous household's formation.

2.1 Model Primitives

The model is cast over an infinite horizon set up and time is continuous. The economy is populated by individuals whose gender is denoted by $g \in \{m, f\}$, in equal shares. Agents of both sexes are born single and out of the labor force: at the start of their life, they have no kids and they possess some heterogeneous initial productivity a_0, drawn from the truncated log-normal distribution $\log \mathcal{N}(\mu_{a_0}, \sigma_{a_0})$ over the support $[a_{min}, a_{max}]$. During their life, agents transition between periods of employment, unemployment and absence from the labor force, they are subject to fertility shocks and decide whether to remain single or marry. This gives rise to an endogenous distribution of married and single men and women over different productivities, labor market states and fertility outcomes. Moreover, households retire according to a Poisson process with arrival rate ξ, and agents in couples retire together. Note that we denote marital status by $\mathcal{M}_t \in \{s, c\}$ for singles and agents in couples respectively, and assume that a couple is formed by individuals of opposite sex.

Preferences. Agents have CRRA utility over consumption, which satisfies Inada conditions. The coefficient of risk aversion is denoted by γ and does not vary by households' marital status or gender. Individuals consume a single consumption good and they discount the future at rate ρ.

Idiosyncratic productivity. Productivity a evolves over time based on agents' labor market status:

$$\text{employed:} \quad da_t = \phi_e(\bar{a} - a_t)dt + \epsilon dW_t; \quad \text{not employed:} \quad da_t = \phi_{ne}(a_{min} - a_t)dt + \epsilon dW_t \tag{1}$$

where ϕ_e is the persistence in the productivity accumulation of employed agents, $\bar{a}$ is a mean productivity drift, ϵdW_t is the idiosyncratic innovation term, and dW denotes a standard Wiener Process. Individuals accumulate productivity when employed; when not employed (because either unemployed or out of the labor force), their productivity drifts instead towards the minimum a_{min} with persistence ϕ_{ne}. Agents can therefore loose and accumulate a at different rates, but neither these rates, nor the productivity drifts and idiosyncratic shocks vary by gender or marital status.

Fertility. Fertility is modeled as an exogenous process, whose Poisson arrival rate for couples – π^c – is higher than the one for singles – denoted by π^s. Although we do not endogenize the choice of having children, our modeling assumption is consistent with married agents being more likely to become parents. We use the notation $k_t \in \{0, 1\}$ to indicate whether a single or married household has a child in t.[4] With respect to the fertility arrival time ζ, we then have the following two cases:

$$\zeta \sim \begin{cases} Poisson(\pi^s), & \text{for single individuals} \\ Poisson(\pi^c), & \text{for married individuals} \end{cases} \tag{2}$$

[4]To simplify the computational problem and save on state variables, fertility realizes maximum once per household.

where π^c and π^s are interpreted as the time rates regulating the number of events – i.e. realized fertility – that happen per unit of time t. The probability distribution function of ζ is given by:

$$f(\zeta) = \pi^{\mathcal{M}} e^{-\pi^{\mathcal{M}} t} \qquad \text{for any marital status } \mathcal{M} \in \{s, c\}. \tag{3}$$

Since our data does not allow us to disentangle between the utility and the cost components of fertility, we simply assume that fertility does not enter agents' preferences. Parents pay instead the cost $\kappa_t = \kappa_1 + a_t^{\kappa_2}$, interpreted as a per-period cost related to childcare, health, education and other similar expenses. Child costs do not differ between either singles and married, or male and female agents; however, they vary by individuals' productivity – and hence, implicitly, by their income.

Single individuals. When out of the labor force (hereafter: outLF), singles consume a home-production good h^s_{g,k_t}, which varies according to agents' gender and fertility status. When it comes to income sources – loosely denoted by $y(a_t, g)$, singles consume wage $\omega(a_t, g)$ if they are working, and unemployment benefits $b(a_t)$ if they are not working, both net of progressive income taxes (or transfers) $\tau_{k_t}(y)$. The instantaneous utility of a single household is given by one of the following:

$$\text{employed:} \quad u((1-\tau_{k_t}(\cdot))\omega(a_t, g)); \quad \text{unemployed:} \quad u((1-\tau_{k_t}(\cdot))b(a_t)); \quad \text{outLF:} \quad u(h^s_{g,k_t})$$

Married individuals. Similarly to singles, married agents consume a home-production good when out of the labor force. When in the labor force, they earn a wage if they are working, and unemployment benefits if they are not working, both net of income taxes (or transfers). Importantly, married individuals join their sources of income/home production and enjoy half this sum as own consumption.[5] Taking a couple formed by i and j, their instantaneous utility is one of the following:

(i). $u\left(\frac{(1-\tau_{k_{ij,t}}(\cdot))(\omega(a_{i,t}, g_i) + \omega(a_{j,t}, g_j))}{2}\right)$ if both i and j are working;

(ii). $u\left(\frac{(1-\tau_{k_{ij,t}}(\cdot))(\omega(a_{i,t}, g_i) + b(a_{j,t}))}{2}\right)$ if i is working and j is unemployed;

(iii). $u\left(\frac{(1-\tau_{k_{ij,t}}(\cdot))(b(a_{i,t}) + \omega(a_{j,t}, g_j))}{2}\right)$ if j is working and i is unemployed;

(iv). $u\left(\frac{(1-\tau_{k_{ij,t}}(\cdot))(b(a_{i,t}) + b(a_{j,t}))}{2}\right)$ if both i and j are unemployed;

(v). $u\left(\frac{(1-\tau_{k_{ij,t}}(\cdot))\omega(a_{i,t}, g_i) + h^c_{g_j,k_{ij,t}}}{2}\right)$ if i is working and j is out of the labor force;

[5] It is beyond our scope to model within-couple bargaining, and we leave for future research to analyze whether asymmetries in surplus-sharing rules might affect the interplay between marriage choices and labor market outcomes.

(vi). $u\left(\frac{h^c_{g_i,k_{ij,t}} + (1-\tau_{k_{ij,t}}(\cdot))\omega(a_{j,t},g_j)}{2}\right)$ if j is working and i is out of the labor force;

(vii). $u\left(\frac{(1-\tau_{k_{ij,t}}(\cdot))b(a_{i,t}) + h^c_{g_j,k_{ij,t}}}{2}\right)$ if i is unemployed and j is out of the labor force;

(viii). $u\left(\frac{h^c_{g_i,k_{ij,t}} + (1-\tau_{k_{ij,t}}(\cdot))b(a_{j,t})}{2}\right)$ if j is unemployed and i is out of the labor force;

(ix). $u\left(\frac{h^c_{g_i,k_{ij,t}} + h^c_{g_j,k_{ij,t}}}{2}\right)$ if both i and j are out of the labor force.

2.2 Labor Markets

In any model period t, households can be either employed, unemployed or out of the labor force.
Unemployment. Job search is random, as in McCall (1970): when unemployed, individuals search and find job offers at rate λ_g, which we allow to vary by gender, as in Morchio and Moser (2024)[6]. Jobs are characterized by a wage offer $w(g)$, drawn from the distribution $f(w)$. Unemployment benefits are instead specified as $b(a) = b_1 + a^{b_2}$, they have a minimum level and are proportional to individual productivity.[7] When searching for jobs, agents compare the values of accepting an offer or continuing the search, and there exists a reservation wage $\tilde{w}$ for which the offer is accepted.

Employment. Wages are the combination of job offers $w(g)$ and agents' productivity a, so that, on average, high-productivity workers enjoy higher wages compared to low-productivity ones, and:

$$\omega(a,g) = w(g)e^a.$$

Wage offers vary by gender, and those of female agents differ from those of male agents by a wedge θ_w. We allow job-worker matches to end at the exogenous separation rate δ_g, which varies by gender, as in Morchio and Moser (2024), but we abstract from endogenous quits and on-the-job search. Once a match breaks, the worker flows back into unemployment and the job disappears.[8]

OutLF. Agents of any gender and marital status can leave the labor force at any time, both when employed or unemployed, and enjoy a home-production good. OutLF agents can re-join the labor

[6]Instead, we do not assume job finding and separation rates to vary by marital status; we will nonetheless show that the main mechanisms at play in the model – namely insurance within the household and selection into couples – are enough to imply shares of couples and singles across labor market statuses consistent with their data counterparts.

[7]Without adding wages pre-unemployment spell as a state variable, benefits can still reflect the compensation a worker could get in a job (and are a short-hand for the model's lack of savings). Similarly, we rely on productivity being persistent to base benefits on current productivity a_t as opposed to the level individuals had upon loosing their job.

[8]If we were to include employment-to-employment transitions, on-the-job search would incentivize both married and singles to quit unemployment faster and climb the job ladder while working. We speculate that such mechanism could have a relatively stronger effect on married individuals, who have also higher reservation wage strategies, further amplifying the unemployment rate gap between married and singles, and strengthening the narrative we have built.

force at any point, by drawing job offers from the distribution $f(w)$ at the gender-specific rate ν_g.

Value functions. The model features twelve value functions, based on the corresponding labor market status of single and joint-searchers. Take first a married couple in period t, composed of agents i and j with current productivities $a_{i,t}$ and $a_{j,t}$. Conditional on their genders g_i and g_j, current job offers $w_{i,t}(g_i)$ and $w_{j,t}(g_j)$, and realized fertility $k_{ij,t}$, their value can be one of the following:

1. $WW(a_{i,t}, a_{j,t}, w_{i,t}(g_i), w_{j,t}(g_j), k_{ij,t})$ if both i and j are employed;
2. $WU(a_{i,t}, a_{j,t}, w_{i,t}(g_i), g_j, k_{ij,t})$ if i is employed and j is unemployed;
3. $UW(a_{i,t}, a_{j,t}, g_i, w_{j,t}(g_j), k_{ij,t})$ if j is employed and i is unemployed;
4. $UU(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t})$ if both i and j are unemployed;
5. $WO(a_{i,t}, a_{j,t}, w_{i,t}(g_i), g_j, k_{ij,t})$ if i is employed and j is out of the labor force;
6. $OW(a_{i,t}, a_{j,t}, g_i, w_{j,t}(g_j), k_{ij,t})$ if j is employed and i is out of the labor force;
7. $UO(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t})$ if i is unemployed and j is out of the labor force;
8. $OU(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t})$ if j is unemployed and i is out of the labor force;
9. $OO(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t})$ if both i and j are out of the labor force.

The value for a single of productivity $a_{i,t}$, gender g_i, job offer $w_{i,t}(g_i)$ and realized fertility $k_{i,t}$ is:

10. $W(a_{i,t}, w_{i,t}(g_i), k_{i,t})$ if i is employed;
11. $U(a_{i,t}, g_i, k_{i,t})$ if i is unemployed;
12. $O(a_{i,t}, g_i, k_{i,t})$ if i is out of the labor force.

Taxes and transfers. We impose a progressive income tax system modeled on the basis of Heathcote et al. (2017), so that the amount of tax paid on household income $y(\cdot)$ is given by the following:

$$\max\left\{ \eta_1 y(\cdot)^{1-\eta_2},\, 0.5 \times y(\cdot) \right\}.$$

This expression delivers an average tax rate that increases with income, while capping the marginal rate to ensure that net earnings do not fall below a fixed share of gross income. We assume that married households file taxes together based on their *joint* income, i.e. the prevailing system in the US. Note that this is likely to discourage the extensive margin of labor supply for the second earner of any given couple, who is typically the woman (Borella et al. (2023)). We also include tax credits depending on the presence of children and modeled on the basis of the US Earned Income Tax

Credit (EITC). Individuals are eligible if gross household income $y(\cdot)$ is below \$20,950 or \$46,010, according to the number of dependents $k_t \in \{0,1\}$,[9] and the tax credit takes the following form:

$$\text{Tax credit}_{k_t}(y(\cdot)) = \begin{cases} \beta^{Y1}_{k_t} y(\cdot) & \text{if } 0 \leq y(\cdot) < y^{k_t}_{Y1}; \\ \beta^{Y1}_{k_t} y^{Y1}_{k_t} & \text{if } y^{Y1}_{k_t} \leq y(\cdot) < y^{Y2}_{k_t}; \\ \max\{\, \beta^{Y1}_{k_t} y^{Y1}_{k_t} - (\beta^{Y2}_{k_t}(y(\cdot) - y^{Y2}_{k_t}),\, 0\} & \text{if } y^{Y2}_{k_t} \leq y(\cdot). \end{cases}$$

Similarly to Garstenauer and Siassi (2024), the earnings subsidy rates in the phase-in region are denoted by $\beta^{Y1}_{k_t}$, while the phase-out rates are denoted by $\beta^{Y2}_{k_t}$. The parameter $y^{Y1}_{k_t}$ denotes the end of the phase-in region, and $y^{Y2}_{k_t}$ is instead the beginning of the phase-out region. If gross income lies between those two parameters, the tax credit stays constant at the maximum amount $\beta^{Y1}_{k_t} y^{Y1}_{k_t}$.

2.3 Marriage

Agents are born single and can marry or remain single. In each period, singles face the probability to meet potential partners with different productivities and labor market outcomes. Search in the marriage market is random, and meetings happen with intensity μ. Upon meeting, both agents choose whether to form a couple or not, as marriage requires *bilateral agreement*. There is no formal cost of marrying and no utility derived from being married. As such, the tradeoffs between marrying or not are mainly driven by the two main mechanisms that we proceed to explain below.

On the one hand, due to concave utility over consumption and because agents cannot save, matching can be advantageous for households, as individuals in couples can pool together their respective sources of income. Specifically, spousal income offers informal insurance against negative productivity shocks and unemployment risk, which can both lead to drops in consumption.[10] Moreover, when an individual has to bear child-related expenses, sharing them with a partner makes their budget constraint less binding, and frees up resources for one's own consumption.

On the other hand, since resources are shared within the household, marriage can be a costly choice, especially when a partner experiences negative productivity shocks or looses their job. This affects marriage decisions in two ways. First, based on the productivity and/or employment status of a potential partner met in t, some agents may prefer to remain single and keep searching. Second, in spite of the characteristics of said potential partner, agents may still defer the decision to marry if expecting to enjoy a higher wage in the future. Both cases show that – in our model – individuals positively select into joint-households based on productivity and employment out-

[9] The actual EITC includes investment income within gross income, which we abstract from as our model does not include wealth. Moreover, we cap the number of dependents to 1 as our model allows for fertility to realize only once.

[10] Abstracting from savings is a simplifying assumption to keep the model tractable. As a shorthand for the heterogeneity in self-insurance across individuals, we assume that unemployment benefits are increasing in productivity.

comes. Moreover, since both partners have to agree on marrying, the model fosters sorting within couples, as agents with high productivity and/or wage prefer to match with a partner of similar prospects to theirs. Finally, note that individuals anticipate they will more likely face child costs as a couple, which further strengthens selection and sorting within couples when deciding to marry.

Consider a single individual i at time t with productivity $a_{i,t}$, whose gender and parental status are denoted by g_i and $k_{i,t}$ respectively. Upon meeting individual j of productivity $a_{j,t}$, current job offer $w_{j,t}(g_j)$ and parental status $k_{j,t}$, agent i can decide whether to stay single or not according to:

- $\max\{W(a_{i,t}, w_{i,t}(g_i), k_{i,t}); WW(a_{i,t}, a_{j,t}, w_{i,t}(g_i), w_{j,t}(g_j), k_{ij,t})\}$ if individual i is employed;
- $\max\{U(a_{i,t}, g_i, k_{i,t}); UW(a_{i,t}, a_{j,t}, g_i, w_{j,t}(g_j), k_{ij,t})\}$ if individual i is unemployed;
- $\max\{O(a_{i,t}, g_i, k_{i,t}); OW(a_{i,t}, a_{j,t}, g_i, w_{j,t}(g_j), k_{ij,t})\}$ if individual i is out of the labor force.

A second scenario is that, upon meeting an individual j of productivity $a_{j,t}$ and opposite gender g_j – who is unemployed in t – agent i has to decide whether to stay single or match according to:

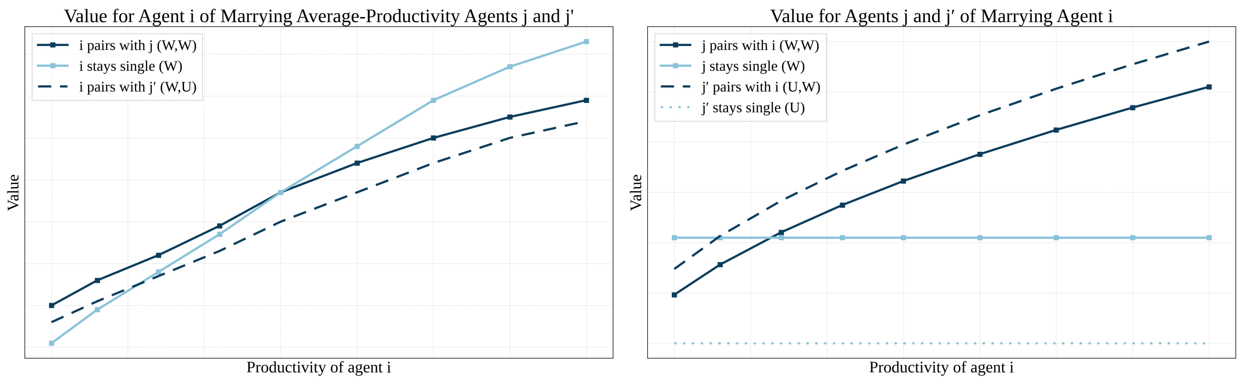
- $\max\{W(a_{i,t}, w_{i,t}(g_i), k_{i,t}); WU(a_{i,t}, a_{j,t}, w_{i,t}(g_i), g_j, k_{ij,t})\}$ if individual i is employed;
- $\max\{U(a_{i,t}, g_i, k_{i,t}); UU(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t})\}$ if individual i is unemployed;
- $\max\{O(a_{i,t}, g_i, k_{i,t}); OU(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t})\}$ if individual i is out of the labor force.

Third, agent i could meet a possible partner j of productivity $a_{j,t}$ and gender g_j, who is out of the labor force at time t. Agent i's choice in this case is whether to stay single or marry according to:

- $\max\{W(a_{i,t}, w_{i,t}(g_i), k_{i,t}); WO(a_{i,t}, a_{j,t}, w_{i,t}(g_i), g_j, k_{ij,t})\}$ if individual i is employed;
- $\max\{U(a_{i,t}, g_i, k_{i,t}); UO(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t})\}$ if individual i is unemployed;
- $\max\{O(a_{i,t}, g_i, k_{i,t}); OO(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t})\}$ if individual i is out of the labor force.

To better illustrate the choice of marrying, the left panel of Figure 1 considers the example of agent i meeting potential partners j and j', one employed and one unemployed, whose a is the average of the productivity distribution. First, since pooled income is shared in the couple, i prefers matching with an employed person over an unemployed one, as wages are typically higher than unemployment benefits. Second, as their own productivity increases, i prefers to search longer for a partner whose productivity is higher than the average one, despite the insurance provided within couples against productivity and labor market shocks. Taking the complementary perspective of j and j' in the right panel of Figure 1 clarifies the matches that each of these two potential partners would find optimal given i's employment status and productivity. As the value of remaining single can be higher than the one of marrying – and marrying is a bilateral choice, the model generates

Figure 1: Matching Problem



Comparative statics from the model solution. In the legend, "W" refers to working status, and "U" to unemployment.

positive selection and sorting into couples along agents' productivity and labor market outcomes. Finally, note that there is no divorce: once married, households stay married. While our analysis does not rely on this assumption, it is definitely one that we can relax in future work, especially in order to better capture the fact that divorce has gained demographic relevance in the past decade.[11]

2.4 Labor Market Differences by Gender and Marital Status

We here review the channels that deliver heterogeneities in wages and unemployment rates across demographics groups in our framework. To start, the distribution of job offers and the job finding and loosing probabilities do not depend on agents' marital status. As such, labor market differences between singles and married are endogenous outcomes of within-household insurance motives and agents' selection into joint-households. Specifically, within-couple insurance increases married households' reservation wage strategies, raising their salaries and the length of their unemployment spells. Agents also positively select into couples, which implies that high productivity workers – more likely to marry – are less likely to be unemployed at the moment of marrying, and have lower incentives to stay unemployed, as this leads to the depreciation of their productivity.

Overall, both within-household insurance and agents' positive selection into couples are consistent with the empirical observation that married households have on average higher wages. Only agents' positive selection into couples is however consistent with married households having lower unemployment rates. This further clarifies the three main contributions of our model: first, to characterize agents by time-varying heterogeneous productivities, which accumulate and deplete according to individuals' labor market status, thereby affecting their search strategies. Second, to model the endogenous and bilateral decision of marrying. The quantitative exercise will show that including these elements in an otherwise standard joint-search framework allows us to

[11]Divorce could represent the risk of loosing the within-couple insurance provided by spousal income, thus strengthening ex-ante selection into couples. In that case, the effects we quantify in Section 4 would be conservative estimates.

match closely the labor market outcomes of married and singles, the degree of assortative matching between spouses and the heterogeneity in marriage rates by agents' labor market outcomes.

Third, we hold the quantitative model accountable for a set of empirical differences in labor market outcomes not only by marital status, but by gender too. In particular, gender-specific job finding and separation rates heterogeneously affect the search strategies of men and women, while gender heterogeneities in home-production differentially shape their decisions with respect to being in or out of the labor force. We also allow for a gender wage gap directly embedded in job offers. These last two channels speak to existing gender differences in normative roles and child-rearing responsibilities within households, often cited as the main drivers of the gender pay gap (Goldin (2014)). Moreover, the third channel specifically could account for other residual differences in the earnings of men and women, for instance due (but not limited) to preferences or discrimination.

2.5 Characterization of Agents' Problem

We characterize the value functions of agents in our economy given their idiosyncratic productivity, gender, labor market, parental and marital status. To start, focus on a given time t and take a single household i of gender g_i, who possesses productivity $a_{i,t}$, works in a job characterized by current wage $w_{i,t}(g_i)$ and has currently no child, i.e. $k_{i,t} = 0$.[12] Their value function is given by:

$$
\begin{aligned}
\rho W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0) = & \underbrace{u\left((1-\tau^s_{k_{i,t}=0}(\cdot))w_{i,t}(g_i)e^{a_{i,t}}\right)}_{\text{instantaneous utility}} + \underbrace{\delta_g(U(a_{i,t}, g_i, k_{i,t} = 0) - W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0))}_{\text{if she gets unemployed}} \\
& + \underbrace{\xi(0 - W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0))}_{\text{if she retires}} + \underbrace{\pi^s(W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 1) - W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0))}_{\text{if she has a kid}} \\
& + \mu\Big\{ \int\int \underbrace{\max\{WW(a_{i,t}, a_{j,t}, w_{i,t}(g_i), w_{j,t}(g_j), k_{ij,t} \in \{0,1\}) - W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0), 0\}}_{\text{if she meets any employed person, with or without kids}} * \\
& \underbrace{* \mathbb{1}(WW(a_{i,t}, a_{j,t}, w_{i,t}(g_i), w_{j,t}(g_j), k_{ij,t} \in \{0,1\}) > W(a_{j,t}, w_{j,t}(g_j), k_{ij,t} \in \{0,1\}))* e(a_{j,t}, g_j, k_{ij,t} \in \{0,1\})dF(w)}_{\text{and the partner agrees on matching}} \\
& + \underbrace{\max\{WU(a_{i,t}, a_{j,t}, w_{i,t}(g_i), g_j, k_{i,t} = 0) - W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0), 0\}}_{\text{if she meets any unemployed person, with or without kids}} * \\
& * \underbrace{\mathbb{1}(UW(a_{i,t}, a_{j,t}, g_i, w_{j,t}(g_j), k_{ij,t} \in \{0,1\}) > U(a_{j,t}, g_i, g_j, k_{ij,t} \in \{0,1\}))v(a_{j,t}, g_j, k_{ij,t} \in \{0,1\})da_{j,t}}_{\text{and the partner agrees on matching}} \\
& + \underbrace{\max\{WO(a_{i,t}, a_{j,t}, w_{i,t}(g_i), g_j, k_{ij,t} \in \{0,1\}) - W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0), 0\}}_{\text{if she meets any outLF person, with or without kids}} * \\
& \underbrace{* \mathbb{1}(OW(a_{i,t}, a_{j,t}, g_i, w_{j,t}(g_j), k_{ij,t} \in \{0,1\}) > O(a_{j,t}, g_j, k_{ij,t} \in \{0,1\}))o(a_{j,t}, g_j, k_{ij,t} \in \{0,1\})da_{j,t}\Big\}}_{\text{and the partner agrees on matching}} \\
& + \underbrace{\phi_e(\bar{a} - a_{i,t})\frac{\partial W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0)}{\partial a_{i,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}}
\end{aligned}
$$

where ρ is the discount factor, δ_g is the gender-specific job destruction rate, ξ is the probability of retiring, π^s is the probability of having a kid for a single, and μ the probability of meeting a partner. Note that $k_{ij,t} = \max\{k_{i,t}, k_{j,t}\}$ as agents i and j become parents if any of the two has already a child upon matching. Moreover, $dF(w)$ is the distribution of job offers, while $e(a,k,g)$, $o(a,k,g)$ and $v(a,k,g)$ are the distributions of singles employed, out of the labor force, and unemployed that agent i can meet. Finally, the indicator function $\mathbb{1}(\cdot)$ signals whether the potential partner agent i has met agrees on matching. The value function above is then evaluated against the outside-option constraint, which ensures that agents can leave the labor force at any moment and is given by:

$$W(a_{i,t}, w_{i,t}(g_i), k_{i,t}) \geq O(a_{i,t}, g_i, k_{i,t})$$

Appendix B reports the value functions for unemployed and outLF singles – $U(a_{i,t}, g_i, k_{i,t})$ and $O(a_{i,t}, g_i, k_{i,t})$ – and all the value functions for couples, denoted by numbers (1)-(9) in Section 2.3.

[12] In case agent i was already a parent, simply replace the above with $k_{i,t} = 1$ and set the fertility arrival rate π^s to 0.

2.6 Solving for the Equilibrium

We conclude by outlining our solution algorithm. Let us focus on single households: the solution of the model is characterized by three distributions $o(a,k,g)$, $v(a,k,g)$, $e(a,w,k,g)$ - tracking outLF, unemployed and employed singles respectively - and value functions $O(a,k,g)$, $U(a,k)$, $W(a,w,k,g)$ - for outLF, unemployed and employed individuals at time t respectively (note that we simplify time and individual subscripts for the sake of this general exposition). The system of Hamiltonian-Jacobi-Bellman equations (HJB) is written using instantaneous generating operators:

$$
\begin{aligned}
(\rho+\xi)W(a,w,k,g) =& u((1-\tau_k^s(\cdot))w(g)e^a) + \mathcal{A}_{WU}U(a,k,g) + \mathcal{A}_{WW}W(a,w,k,g) \\
(\rho+\xi)U(a,k) =& u((1-\tau_k^s(\cdot))b(a)) + \mathcal{A}_{UU}U(a,k,g) + \mathcal{A}_{UW}W(a,\cdot,k,g) \\
(\rho+\xi)O(a,k,g) =& u(h_{g,k}^s) + \mathcal{A}_{OO}O(a,k,g) + \mathcal{A}_{OW}W(a,\cdot,k,g),
\end{aligned}
$$

so that $W(a,w,k,g) \geq O(a,k,g)$ and $U(a,k,g) \geq O(a,k,g)$. The flow intensities of type $\mathcal{A}$ matrices depend on the wage distribution $f(w)$ and value functions. For instance, $\mathcal{A}_{UW}$ is a transition matrix with non-zero entries for transitions from a given $U(a,k,g)$ to each $W(a,w,k,g)$ so that $W(a,w,k,g) \geq U(a,k,g)$ and the transition probability is $\lambda_g * f(w)$. $\mathcal{A}_{OW}$ is instead a transition matrix with non-zero entries for transitions from a given $O(a,k,g)$ to each $W(a,w,k,g)$ so that $W(a,w,k,g) \geq O(a,k,g)$ and the transition probability is $\nu_g * f(w)$. The choice between labor market and outLF values is treated instead as a linear complementarity problem. Using Kolmogorov forward equations, we solve for the distributions $e(a,w,k,g)$, $v(a,k,g)$ and $o(a,k,g)$ according to:

$$
\begin{aligned}
0 =& \mathcal{A}_{UW}^* v(a,k,g) + \mathcal{A}_{OW}^* o(a,k,g) + \mathcal{A}_{WW}^* e(a,w,k,g) - \xi \times e(a,w,k,g) \\
0 =& \mathcal{A}_{UU}^* v(a,k,g) + \mathcal{A}_{WU}^* e(a,w,k,g) + \mathcal{A}_{OU}^* o(a,k,g) - \xi \times (v(a,k,g) - v_0(a;k,g)) \\
0 =& \mathcal{A}_{OO}^* o(a,k,g) + \mathcal{A}_{WO}^* e(a,w,k,g) + \mathcal{A}_{UO}^* v(a,k,g) - \xi \times o(a,k,g)
\end{aligned}
$$

where $\mathcal{A}^*$ denotes the adjacent process and is equivalent to $\mathcal{A}'$ in the numerical solution. To find the solution, we iterate the following steps until convergence:

1. Augment the HJB equations with $\dfrac{W_{n+1}-W_n}{\Delta}$, $\dfrac{U_{n+1}-U_n}{\Delta}$ and $\dfrac{O_{n+1}-O_n}{\Delta}$ to get the updates on the value functions.

2. Solve for the stationary solutions to the Kolmogorov forward equations, such that $\int\int e(a,w,k,g))dadw + \int v(a,k,g)da + \int o(a,k,g)da = 1$, in order to get the corresponding updates on the households' distributions.

A similar case applies to joint-searchers, and the solution is characterized by nine additional distributions – $ee(a_i,a_j,w_i(g_i),w_j(g_j),k)$, $ve(a_i,a_j,w_j(g_j),g_i,k)$, $eo(a_i,a_j,w_i(g_i),g_j,k)$, $vv(a_i,a_j,g_i,g_j,k)$,

$ev(a_i, a_j, w_i(g_i), g_j, k)$, $ov(a_i, a_j, g_i, g_j, k)$, $vo(a_i, a_j, g_i, g_j, k)$, $oe(a_{i,t}, a_j, w_j(g_j), g_i, k)$, $oo(a_i, a_j, g_i, g_j, k)$ – along with value functions for given couples of agents i and j based on their productivity, gender, labor market and parental status, which are denoted by numbers (1)-(9) in Section 2.3.

A common approach to solve continuous-time models with outside options is to formulate the agent's problem as a HJB variational inequality (HJB-VI), with the associated linear complementarity conditions governing optimal switching between states. The approach is discussed in Stokey (2009) and more recently in Achdou et al. (2022), and this formulation is standard in environments with a single and absorbing outside option or with one-sided, irreversible switching constraints.

Our environment differs in that there is no absorbing state. Households can move both to and from employment, unemployment, and OLF. In particular, the value of the OLF option is itself endogenous, as households optimally re-enter the labor market depending on productivity, marital status, and future search opportunities. Thus the model features multiple reversible switching margins, so that the relevant inequalities are jointly determined across states rather than defined relative to a fixed outside option. Writing the household problem as a global HJB-VI would require solving a high-dimensional complementarity system where both sides of the inequality are endogenous continuation values, which would substantially complicate the numerical solution.

Instead, we implement optimal switching using constant Poisson transition intensities that activate whenever the outside option dominates. The same approach is chosen by Lange et al. (2020): as a concrete example, when either employed or unemployed, households compare the value of remaining in their current state to the value of switching to OLF. When the outside option yields a higher value, a switching intensity is turned on; otherwise, the intensity is zero. The level of switching intensity is chosen to be large relative to other transition rates in the model, so that conditional on preferring the outside option, households switch states almost immediately.

To improve numerical stability and convergence, we introduce a trembling-hand component that allows for a small amount of randomness in the switching decision. When the two value functions are identical, the trembling mechanism assigns equal probability to either choice. When values differ, switching probabilities are governed by a smooth function that drops sharply toward zero or one, so that small value differences are sufficient for the vast majority of households to choose the optimal action. The trembling intensity is set to be quantitatively negligible as its role is purely computational: it regularizes the switching rule near indifference points, preventing sharp reversals of the switching decision along the convergence path of the value-function iteration.

Given the solution to the value functions, the implied household dynamics define a continuous-time Markov process. In principle, the stationary distribution can be obtained by solving the Kolmogorov forward equation associated with the generator matrix. We compute the distribution using this method as a robustness. For the purposes of calibration, as many of the moments we target involve dynamic transitions and duration dependence (e.g., wage changes conditional on unemployment duration), we compute these objects by simulating the population of households.

3 Data and Measurement

Before describing the quantification of our framework, we present several facts that characterize the labor and marriage markets in the US, as the calibrated model will be held accountable for this set of empirical observations. First, we document the presence and extent of wage marital premia and unemployment marital gaps for both men and women in two datasets. Then, we provide suggestive evidence on the selection of highly-skilled individuals into joint-households, and how – as in our model – this may contribute to the observed labor market differences by marital status.

3.1 Wage and Unemployment Differences by Marital Status

To analyze wages and unemployment rates of married and singles, we begin by the Current Population Survey (CPS), a repeated annual cross-section of 65,000 households, and select the period between 1990 and 2020. CPS contains characteristics such as gender, ethnicity, age, marital status, number of children and education, as well as information on agents' employment, wage, hours worked, and occupation. When applicable, it also includes a section on the respondent's spouse.

We focus on married and single agents between 25 and 65 years old. In any given year, we define as "singles" those who never married before, and as "married" respondents that are legally married.[13] As for labor market outcomes, we count as "out of the labor force" those in the working age population who are neither employed nor unemployed, excluding students, retirees and agents with disabilities. Moreover, we define as unemployed those not working for pay but seeking employment at the time of the interview,[14] and exclude agents with no data on hourly earnings only when we focusing on the employed pool. We then run the following OLS specifications:

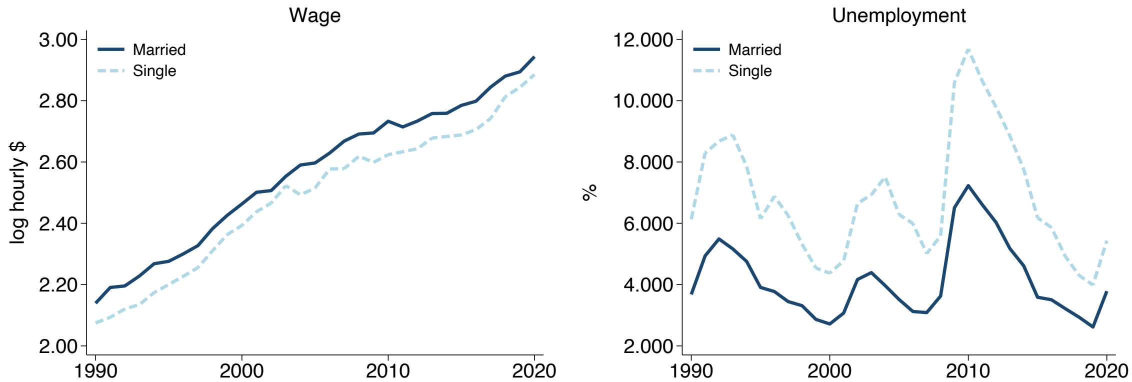
$$Y_{it} = \beta_0 + \beta_1 \mathbb{1}_{married_{it}} + \delta' \mathbf{\Gamma}_{it} + \alpha_t + \eta_{o(it)} \mathbb{1}_{employed} + \varepsilon_{it} \tag{4}$$

where Y_{it} = $\{wage_{it}, unemp_{it}\}$. The key explanatory variable is $\mathbb{1}_{married_{it}}$, a dummy variable equal to 1 if individual i is married at time t and to 0 if they are single. The regressions include a set of controls $\mathbf{\Gamma}$, which capture factors that may affect the income of agents, such as their gender, education, ethnicity, age, number of children and labor market status in the previous year. We also allow for year (α_t) and occupation ($\eta_{o(it)}$) fixed effects. For married individuals, we include the education and labor market status of the spouse. Survey weights are used to ensure representativeness.

As reported in Table A1, being married is on average associated with having a 10% higher

[13] Robust to count co-habitating couples as "married", and/or divorced, separated and widowed agents as "singles".
[14] We use yearly data for these initial descriptives, similar statistics using monthly CPS supplements are in Section 4.

Figure 2: Wage and Unemployment Differences by Marital Status (1990-2020)



Data: US Current Population Survey, 1990-2020. Survey weights are used. Controls: gender, age, ethnicity, number of kids, education, employment status in previous year, year and occupation fixed effects, spousal education and employment status.

hourly wage, a 20% higher yearly wage, and a 2.5 percentage points (hereafter: p.p.) lower unemployment rate. To illustrate this, Figure 2 plots the average (log) hourly wage and unemployment rate of married and singles as estimated in Equation 4, conditional on the same set of control variables. Being married is associated with having higher wages and lower unemployment rates, with these difference remaining particularly stable over time. Figure A.1 and Figure A.2 in Appendix further break down these gaps and show they hold across both men and women. Our results are qualitatively and quantitatively in line with the findings in Choi and Valladares-Esteban (2018).[15]

As discussed in Section 2.4, within-household insurance may allow unemployed agents in couples to search longer for a job, resulting in higher average wages compared to singles. Indeed, Pilossoph and Wee (2021) show that higher reservation-wage strategies account for 16-41% and 20-68% of the estimated WMP for men and women respectively. Yet, such mechanism alone has a counterfactual prediction on the unemployment rates of single and joint-households. If married agents waited longer to accept a job, they would have higher unemployment rates, contrary to what we document empirically. Hence, at least part of the differences in labor market outcomes between married and singles could be *unconditional* on marrying. In what follows, we argue that selection into marriage could be partially responsible for the WMP and UMG observed in US data.

3.2 Selection and Sorting into Joint-Households

We start from a simple hypothesis informed by our model: agents may select into joint-households along dimensions that are directly responsible for their labor market outcomes – such as their labor productivity. To provide evidence for this, we exploit the 1979 National Longitudinal Survey of Youth (NLSY79), comprising nearly 13,000 individuals followed since 1979 until nowadays.

[15]Evidence that married men have higher average wages than single ones dates back to Hill (1979), and recent studies document a WMP also among women (e.g.: Juhn and McCue (2016) and McConnell and Valladares-Esteban (2020)).

NLSY79 covers less individuals than CPS, but its panel dimension allows us to describe how their marital status evolved over time. Focusing on individuals between 25 and 65 years old, their (log) hourly wage ($wage_{it}$) and unemployment status ($unemp_{it}$), we run the following OLS regressions:

$$\{wage_{it}, unemp_{it}\} = \beta_0 + \beta_1 \mathbb{1}_{married_{it}} + \delta' \mathbf{\Gamma}_{it} + \alpha_t + \varepsilon_{it} \tag{5}$$

$$\{wage_{it}, unemp_{it}\} = \beta_0 + \beta_1 \mathbb{1}_{married\ next\ year_{it}} + \delta' \mathbf{\Gamma}_{it} + \alpha_t + +\varepsilon_{it}, \tag{6}$$

where $\mathbb{1}_{married}$ is an indicator equal to 1 if individuals are married at time t and to 0 if they are single, while $\mathbb{1}_{married\ next\ year}$ is an indicator equal to 1 if individuals marry within one year from the current period t, and to 0 if they remain singles. The two sets of regressions include a vector of controls $\mathbf{\Gamma}$ capturing factors that may also affect the income of agents, such as their gender, education, ethnicity, number of kids, age, labor market status in the previous year and an indicator for whether the respondent lives in a urban or rural area. We also allow for year fixed effects (α_t).

Table 1: Labor Market Outcomes in the National Longitudinal Survey of Youth 1979

	hourly wage	unemployment	hourly wage	unemployment
Married	0.1240***	-0.0203***		
	(0.0066)	(0.0024)		
Married Next Year			0.1117***	-0.0146**
			(0.0168)	(0.0062)
Controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	66,420	83,206	18,266	20,422
R^2	0.3621	0.0816	0.2510	0.1220

Notes: Robust stadard errors in parentheses. Survey weights are used. ***p<0.01, **p<0.05, *p<0.1. Control variables include gender, education, weeks worked in the previous calendar year, an urban/rural area indicator, ethnicity, parental status, and age.

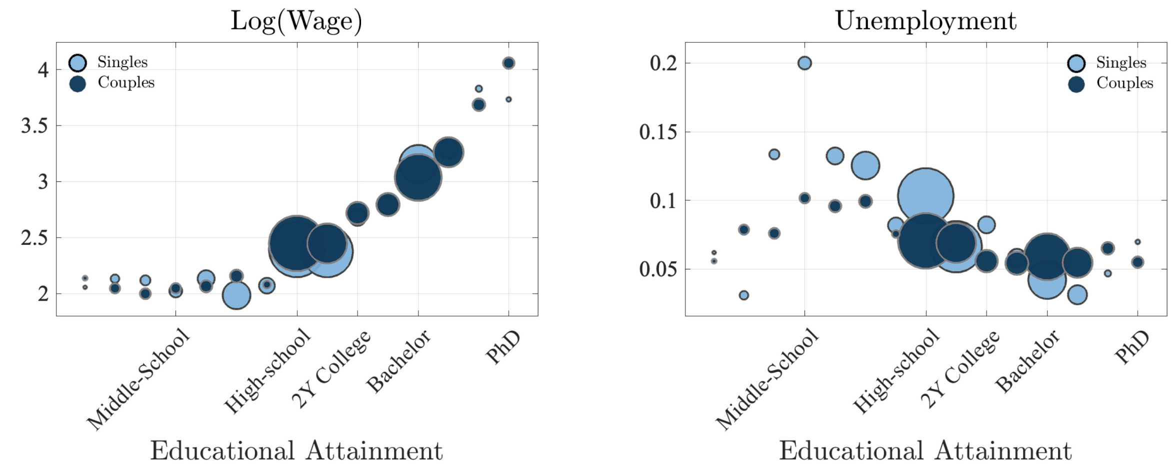
As reported in Columns (1) and (3) of Table 1, NLSY estimates for the WMP and UMG are consistent with results from CPS, indicating that being married correlates with higher wages and lower unemployment rates. Yet, Columns (2) and (4) illustrate that singles who marry in $t+1$ have both higher wages and a lower probability of being unemployed at time t compared to singles who do not marry in $t+1$. Hence, married agents seem to have better labor market outcomes also unconditional on marrying. In line with our model predictions, if highly productive workers select and sort into couples, married individuals may display lower unemployment rates and higher wages, as unemployment usually decreases – while wages increase – in agents' productivity.[16]

To further test this, one would need data on individuals' idiosyncratic productivity, which is typically hard to observe. As a proxy, we instead leverage available information on respondents'

[16] See Nakosteen and Zimmer (1987) for a first contribution to this debate.

education in CPS to compute (log) wages and unemployment rates by educational attainment for married and singles.[17] We then regress both labor market outcomes using the same controls as in Figure 2, and plot our estimates in Figure 3. Note that each circle is proportional to the share of married and singles within a given educational category. Two observations can be made: on the one hand, wages on average increase in the educational attainment of the households (our proxy for agents' skills). Similarly, unemployment rates decline for highly educated individuals, suggesting that the higher the education of a person, the better their labor market outcomes.

Figure 3: Selection Effect on Wages and Unemployment in the US (1990-2020)



Data: US Current Population Survey (1990-2020). The bin scatter groups households in the sample by their schooling years.

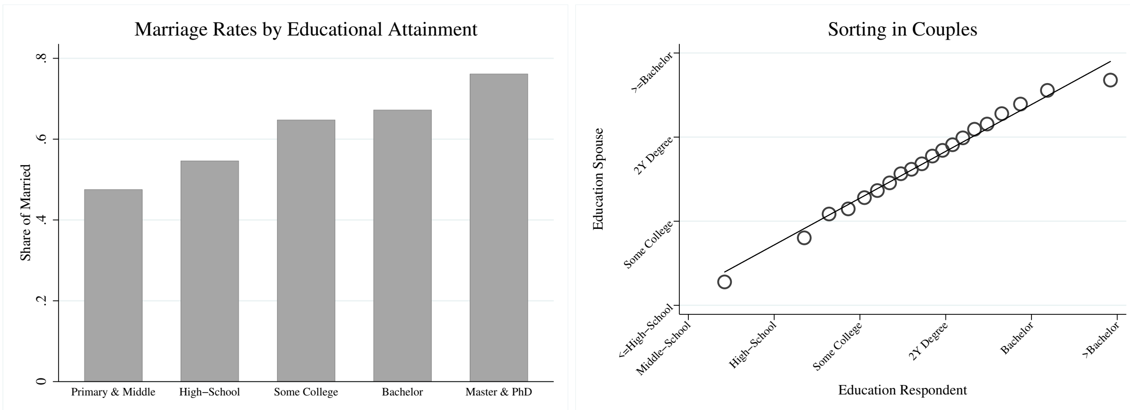
On the other hand, the size of the circles in Figure 3 suggests that the share of married among highly-educated individuals is higher. Since married agents are over-represented among the highly-educated, whose labor market outcomes are better, the different skill-composition of the single and married samples may be a potential driver of the WMP and UMG. Indeed, under the assumption that education does not fully predict households' income, unobserved variation in agents' productivity cannot be filtered by regression controls, and thus could contribute to the gaps we observe in wages and unemployment between married and singles. This mechanism could be also further reinforced by the presence of assortative matching within couples (i.e. Greenwood et al. (2014)).

According to this line of reasoning, we provide additional evidence of marital selection and sorting in the sample of CPS couples. First, we compute the share of married in each educational level, using the following categories: elementary and middle school, up to high-school diploma, some college (including 2 years associate degrees), 4-6 years of college (including Bachelor), master and PhD. The left panel of Figure 4 shows that marriage rates are increasing in individuals' education, as documented in Doepke and Tertilt (2016), with the semi-elasticity of marriage rates to an increase in educational attainment being around 19%. For instance, focusing on the 1990-

[17] A similar result holds in NLSY79. We use here CPS due to its larger sample size and higher representativeness.

2020 period, the share of married individuals among master and PhD graduates is 45% larger than among people with less than a high-school diploma. Albeit the overall decline in marriage rates documented in the US in recent decades, 80% of highly-educated households are indeed married.

Figure 4: Marital Patterns by Education in the US (1990-2020)



Data: US Current Population Survey (1990-2020). The bin scatter groups households in the sample by their schooling years.

Second, the right panel in Figure 4 reports the correlation between partners' educational attainments, focusing on households for which we have information on their spouse's education, and exploiting the number of years spent in school instead of coarse education categories. We document a significant degree of positive sorting within couples, as the correlation between married agents' educational attainments is above 50%. Finally, note that here we have focused on marriage rates by education, and on the correlation in spouses' educational attainments. However, a similar argument can be made measuring marriage rates by income quintiles and the correlation in wages between spouses, as reported in Figure A.3. We take these findings as strengthening the case for why selection into couples is a key channel to endogenously model in order to reconcile the empirical evidence on both the WMP and the UMG with existing theories of joint job-search.

4 Quantitative Exercise

In this section, we estimate the model on US data and assess its performance against the evidence presented in Section 3, untargeted in our exercise. We then analyze the interplay of marriage and job search, focusing on when and whom agents marry, and if these decisions interact with their labor market outcomes. As such, we disentangle two main mechanisms at play in our model. First, we illustrate how within-household insurance impacts agents' reservation-wage strategies. Second, we quantify the contribution of selection and sorting into marriage in affecting the productivity composition of the singles and married samples, and hence both the WMP and UMG.

4.1 Calibration

Our calibration is summarized in Table 2. Time is measured in months, and agents are born single and out of the labor force at 25 years old. Of the thirty-six parameters to calibrate, nine are fixed outside of the model, for which we choose common values in the literature. In particular, the risk aversion coefficient is set to $\gamma = 2$, the discount factor to $\rho = 0.003$, and the retirement probability to $\xi = 0.002$ to match an average working life of 40 years. As for taxes and transfers, we set the tax-related parameters η_1 and η_2 to 0.18 and 0.91 respectively, following Heathcote et al. (2017). The phase-in and phase-out income thresholds and subsidy rates concerning child-based tax credits are instead taken from Garstenauer and Siassi (2024) and expressed in 2018 thousand dollars.

All the remaining parameters are endogenously fitted to minimize the distance between targeted empirical moments and model-implied ones. First, our set up features heterogeneous agents that differ in idiosyncratic productivity a: we draw their initial a_0 from a log-normal distribution, whose mean is normalized to 0 and dispersion (σ_{a_0}) matches the volatility of young workers' wages, as reported in De Nardi et al. (2020). We also normalize the mass of jobs to 1 and assume that offers are drawn from a Pareto distribution of parameters (0,σ_w). To calibrate σ_w, we target the coefficient of variation of wage offers, which several US job-posting agencies (e.g. Burning Glass, Indeed, ZipRecruiter etc.) report to be around 0.4. Since the model features a gender gap in job offers – captured by the parameter θ_w, we set this wage penalty to help match the average 20% difference in realized labor earnings documented across US men and women (Goldin (2014)).[18]

Second, recall that, in our theory, realized fertility is modeled as a Poisson process with a probability distribution given by Equation 3. Using our CPS sample, we compute the shares of married and single households with at least one child, which are 0.72 and 0.2 respectively. We then use these shares to back up the fertility rates for single and married agents in the model noting that:

$$\int_0^\infty e^{-\frac{t}{480}} \pi^s e^{-\pi^s t} dt = 0.20 \quad \text{for singles} \tag{7}$$

$$\int_0^\infty e^{-\frac{t}{480}} \pi^c e^{-\pi^c t} dt = 0.72 \quad \text{for married} \tag{8}$$

where $\int_0^\infty e^{-\frac{t}{480}} dt$ is the probability of not being retired at time t, considering that the average (working) life of agents in our framework is 480 months. Solving these equations delivers the Poisson arrival rates $\pi^s = 0.0004$ and $\pi^c = 0.005$ for singles and married agents respectively. As for child-related expenses, we set the parameters κ_1 and κ_2 to reflect the fact that, in the US, child costs represent a larger share of household spending for low-income families (roughly 20% of their

[18]Note that the overall difference in average wages across men and women in our economy is the result of both this gender-specific wedge in job offers, the different job-finding and job-loosing rates, and the different home-production values individuals are assigned when out of the labor force, which are also calibrated within the model (see below).

Table 2: Calibration

Parameter	Value	Description
Exogenously Fixed		
γ	2	Coefficient of risk aversion
ρ	0.0034	Discount factor
ξ	0.0020	Probability of retirement
η_1	0.181	Tax schedule (scale)
η_1	0.906	Tax schedule (curvature)
$\beta_{k_t}^{Y1}$	[0.0765; 0.34]	Phase-in and out rates for child-credit [$k_t = 0; k_t = 1$]
$\beta_{k_t}^{Y2}$	[0.0765; 0.1598]	Phase-in and out rates for child-credit [$k_t = 0; k_t = 1$]
$y_{k_t}^{Y1}$	[6,750$; 10,150$]	Earnings end phase-in for child-credit [$k_t = 0; k_t = 1$]
$y_{k_t}^{Y2}$	[14,200$; 24,350$]	Earnings start phase-out for child-credit [$k_t = 0; k_t = 1$]
Endogenously Fitted		
π^s	0.0004	Fertility rate for singles
π^c	0.005	Fertility rate for couples
κ_1	880$	Child-related expenditure (intercept)
κ_2	0.35	Child-related expenditure (slope)
$h^s_{m,k=0}$	23.20	Home production single men w/o kids (c.u.)
$h^s_{m,k=1}$	22.50	Home production single men w/ kids (c.u.)
$h^c_{m,k=0}$	20.05	Home production married men w/o kids (c.u.)
$h^c_{m,k=1}$	19.35	Home production married men w/ kids (c.u.)
$h^s_{f,k=0}$	30.26	Home production single women w/o kids (c.u.)
$h^s_{f,k=1}$	29.61	Home production single women w/ kids (c.u.)
$h^c_{f,k=0}$	27.11	Home production married women w/o kids (c.u.)
$h^c_{f,k=1}$	26.46	Home production married women w/ kids (c.u.)
m	0.375	Marriage Probability
σ_{a_0}	0.365	Initial productivity dispersion
ϕ_e	0.007	Rate of productivity accumulation
ϵ	0.065	Productivity dispersion
$\bar{a}$	1.25	Long-run mean productivity
ϕ_{ne}	0.014	Rate of productivity depletion
σ_w	10	Pareto shape of the wage offer distribution
θ_w	0.90	Gender wage offer gap
δ_m	0.012	Job separation (men)
δ_f	0.015	Job separation (women)
λ_m	0.55	Job arrival rate (unemployed men)
λ_f	0.45	Job arrival rate (unemployed women)
ν_m	0.095	Job arrival rate (out-of-labor-force men)
ν_f	0.105	Job arrival rate (out-of-labor-force women)
b_1	960$	Unemployment benefit (intercept)
b_2	0.85	Unemployment benefit (slope)

Data sources: see text. Nominal values are expressed in 2018 dollars. The variable k_t takes a value of 0 if there is no child in a given household at time t, and 1 otherwise. The notation "c.u." refers to calibrated values that are expressed in consumption units.

income), averaging at twice the expenditure shares of high-income households (in 2018 dollars).[19]

Focusing on the marriage market, we set the meeting probability $\mu = 0.375$ to match the average fraction of married people in CPS, which is around 52% (see also Doepke and Tertilt (2016)). To clarify the magnitude of the meeting probability, each year a single in our economy meets on average six potential partners. This is the only moment related to household's formation that we directly target, whereas the model independently generates sorting and selection into couples.

Third, to calibrate the values of home production by gender, marital and fertility status, we match the shares of singles and married that are out of the labor force, further distinguishing between men and women and those with and without children. Since the opportunity cost of staying out of the labor force is significantly influenced by factors like societal norms – absent in our theory, we specifically target outLF shares for each demographic group. The model instead determines endogenously the shares of unemployed and employed workers across these groups.

Table 3: Targeted Moments

	Data	Model		Data	Model
Employment to unemployment (men)	0.015	0.015	Gender wage gap	20%	17%
Employment to unemployment (women)	0.012	0.012	Wage progression	0.55	0.52
Unemployment to employment (men)	0.26	0.27	Wage dispersion	0.70	0.75
Unemployment to employment (women)	0.23	0.23	Initial wage dispersion	0.35	0.33
Share whose 1-year wage change < 20%	0.65	0.64	Dispersion in job offers	0.40	0.45
OutLF to Employment (men)	0.052	0.054	Share of married households	0.52	0.52
OutLF to Employment (women)	0.04	0.46	Child cost (CC) as % of income	15%	19%
% wage loss for 1 extra month unemployed	1%	0.9%	Δ CC: bottom vs top earners	15 p.p.	15 p.p.
Unemployment benefits (UB) as % of income	35%	31%	Δ UB: bottom vs top earners	15 p.p.	20 p.p.
Single women OutLF, w/o kids	12.18%	12.71%	Single women OutLF, w/ kids	19.99%	20.21%
Single men OutLF, w/o kids	10.71%	9.98%	Single men OutLF, w/ kids	8.01%	7.92%
Married women OutLF, w/o kids	14.51%	14.17%	Married women OutLF, w/ kids	25.82%	25.41%
Married men OutLF, w/o kids	3.59%	3.67%	Married men OutLF, w/ kids	3.08%	3.11%

Data: US Current Population Survey (1990-2020) and external references (see text). OutLF stands for "out of the labor force".

Fourth, we turn to the parameters governing labor market transitions and unemployment benefits. Following Schaal (2017), Shimer (2005) and Nagypal (2007), job-loosing probabilities δ_g are set to match the monthly Employment to Unemployment (EU) rates of male and female workers in CPS. As for the search intensities of the unemployed –λ_g, we match the shares of men and women transitioning from Unemployment to Employment (UE) over two consecutive months, which are 26% and 23% respectively (similarly, we set ν_g to match the shares of men and women transition-

[19]See https://www.usda.gov/media/blog/2017/01/13/cost-raising-child. Such estimated cost does not include college expenses and may vary for rural versus urban areas, aspects from which we abstract in the current analysis.

ing from OutLF to Employment).[20] We then calibrate the unemployment benefit parameters b_1 and b_2 so that unemployment compensation increases with pre-unemployment wages, but not linearly. Specifically, we target the average unemployment benefit ($\sim$35% of the average wage) and the ratio between the compensation of earners above and below the median of the income distribution.[21]

Finally, the volatility of idiosyncratic productivity shocks ϵ is set to match the fraction of agents that change their wage by less than 20% in a year, as in Kaplan et al. (2018). The productivity drift $\bar{a}$ is calibrated to match the ratio between the average wage and the average wage of first-time employed individuals, as in De Nardi et al. (2020). As for the parameter governing productivity accumulation –ϕ_e, we follow Kaplan et al. (2018) and target the average (log) wage dispersion in the data. To calibrate instead the rate of productivity depletion –ϕ_{ne}, we target an average loss of 1% in starting wages after an additional month in unemployment – computed as the percentage change with respect to the wages agents had before an unemployment spell – following Neal (1995).[22]

All empirical targets and their model-implied counterparts are summarized in Table 3. Next, we assess how well our calibrated framework performs on untargeted dimensions related to the labor market outcomes of single and married men and women, as well as to their marital patterns.

4.1.1 Untargeted Moments: The Labor Market

The quantitative fit of the model is summarized in Table 4 and discussed in further detail below.

First, we replicate the difference in average salaries across married and singles, moderately overfitting but still matching 85% of the empirically-documented WMP. Two mechanisms determine this: on the one hand, intra-household insurance enables partners to wait in unemployment longer and choose better jobs. On the other hand, by allowing for endogenous marital choices, we allow agents to select and sort into couples. Ex-post, the married sample is composed by households of higher productivity and better labor market outcomes, further contributing to the WMP.

Our second validation exercise is with respect to the UMG. Absent endogenous household's formation, the mechanism at work in joint-search models is that married wait unemployed longer before accepting a job, resulting in higher average unemployment rates that are counterfactual to the data. Endogenizing marriage leads instead to heterogeneities in the productivity composition of the singles and married samples: due to selection into couples, married agents have on average higher productivity and hence less incentives to let it depreciate while unemployed. Consistent with this, our calibrated model predicts that the unemployment rate of married individuals is 1.77 p.p. lower than the one of singles, and hence explains 55% of the difference observed in US data.

[20] To compute labor market transition rates by gender, we exploit the monthly supplement of CPS between 1990 and 2020. Note that our estimates align with those by Mankart and Oikonomou (2017), which rely on 1994-2014 CPS data.

[21] Note that the maximum value for unemployment benefits is also capped at 50% the average wage in the economy.

[22] The parameter governing productivity depletion for unemployed and outLF individuals is calibrated to be twice as large as the one governing productivity accumulation, consistent with works by Jarosch (2021) and Huckfeldt (2016).

Table 4: Untargeted Moments

Average (Hourly) Wages	Data	Model	*Average Unemployment Rates*	Data	Model
For men	26.5$	27.0$	For men	5.09%	4.86%
For women	21.6$	21.3$	For women	3.72%	3.28%
For married	26.0$	26.4$	For married	3.44%	3.22%
For singles	21.2$	20.8$	For singles	6.51%	4.99%
For agents w/ kids	25.0$	25.8$	For agents w/ kids	3.90%	3.35%
For agents w/o kids	21.7$	21.2$	For agents w/o kids	5.28%	4.92%
Marriage Market					
Correlation in wages (between spouses)				0.35	0.24
Elasticity of marriage rates to wages				0.22	0.28
Age at marriage (men)				28.3	27.4
Age at marriage (women)				25.9	26.2

Empirical moments are from the US Current Population Survey (1990-2020). Hourly salaries are expressed in 2018 dollars ($).

In Table 5, we further disentangle the extent to which the mechanisms of within household's insurance and selection into couples shape labor market outcomes by marital status. For this counterfactual, we keep the values of all parameters fixed to the baseline ones but remove endogenous and bilateral matching decisions. Specifically, we assume that 52% of individuals are born married and stay married throughout their life, while those born singles do not marry.[23] Without endogenous marriage, the model would predict an unemployment marital gap of -1.95 p.p. instead of the empirically documented +3.07 p.p. one. The quantitative fit of the model in terms of WMP would also be lower, accounting for roughly 60% of the wage difference between married and singles.

Table 5: Labor Market Outcomes With and Without Endogenous Marriage Decisions

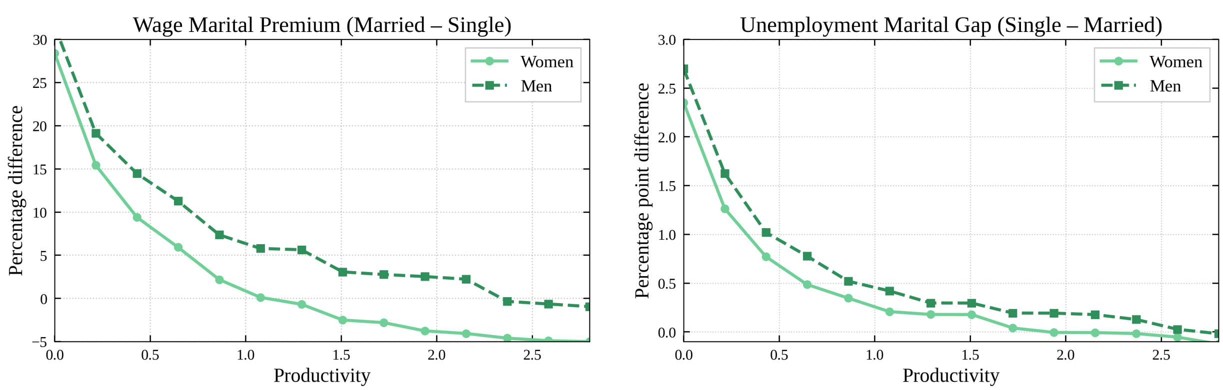
	Data	Model without endogenous marriage	Model with endogenous marriage
Wage Marital Premium	20.83%	14.30%	23.56%
Unemployment Marital Gap	3.07 p.p.	-1.95 p.p.	1.77 p.p.

Third, we explore how much of the heterogeneities in labor market outcomes by gender the calibrated model is able to match. To this end, Figure 5 plots the WMP and the UMG for men and women over their productivity, highlighting three main findings. When the productivity-composition of the married and single sample is controlled for, marital differences in wages and

[23]In this counterfactual, we match randomly men and women, so there is no assortative matching between spouses.

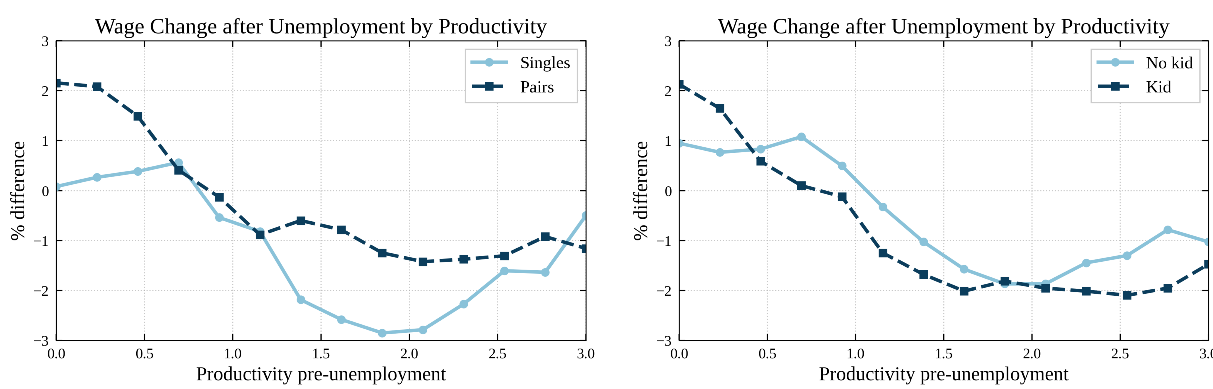
unemployment rates decrease significantly, regardless of agents' gender. Within-household insurance is left to explain a smaller fraction of the WMP, particularly for high-productivity agents who benefit the least from a long job search. Moreover, the UMG decreases with productivity, as productive workers have a strong incentive not to let their productivity depreciate, regardless of their marital status. Also, women have lower WMP and UMG than men, which reflect the wage offer gap – squeezing wages for both single and married women – and the fact that is with respect to out of the labor force rates – not unemployment – that single and married women differ the most.

Figure 5: Wage and Unemployment Rate By Individual Productivity



Fourth, Table 4 offers few insights on individuals with and without kids too: since realized fertility in the model entails child costs, parents tend to have lower unemployment rates and wages compared to agents without kids, regardless of their marital status. Realized fertility pushes the unemployed to accept relatively worse job offers and quit unemployment faster to sustain child costs without incurring substantial consumption drops. This is further clarified by the right panel of Figure 5: low-productivity married agents have significantly lower unemployment rates compared to singles, especially because married households have a higher likelihood of having kids.

Figure 6: Wage Changes After a Period in Unemployment, by Demographic Group



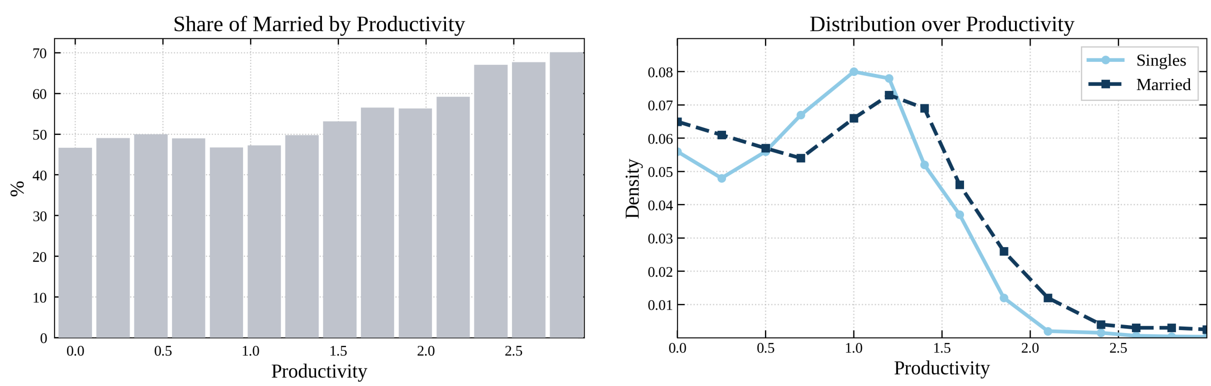
Finally, Figure 6 ties up the results of this subsection showing that earnings tend to drop after a period in unemployment, especially for highly-productive agents. While high-salary jobs are scarce – due to the Pareto shape of the wage offers distribution, it is the fact that agents deplete productivity while unemployed that significantly decreases their wage upon re-employment. When controlling for individual productivity, we also find that married agents secure on average higher wages upon re-employment, as within-household insurance allows them to wait relatively longer before accepting a job offer. On the contrary, child costs constitute an incentive to quit unemployment faster and accept relatively worse job offers, as documented in the right panel of Figure 6.

4.1.2 Untargeted Moments: The Marriage Market

A key novelty of our theory is to embed the decision of marrying in a joint-search framework, and our calibrated model indeed replicates several untargeted moments related to US marital patterns.

First, regarding the timing of marriage, the median age at marriage is 27 years old in our baseline economy, reasonably close to the empirical one. What ensures this fit is partly the fact that finding a partner takes time because of search frictions in the marriage market, and partly that agents prefer to secure a good wage before marrying, as marriage can be costly if the spouse – with whom income is shared – experiences negative productivity or unemployment shocks. Exogenous fertility strengthens this channel, as agents weight in the fact that joint-households are more likely subject to child costs. The model also correctly predicts that women marry earlier than men on average: since their income is lower, their marginal utility from accessing within-couple insurance is higher. Through the lens of our theory, the decrease in the gender pay gap over time is thus consistent with the rise in the share of women who prefer to stay single or delay marriage.

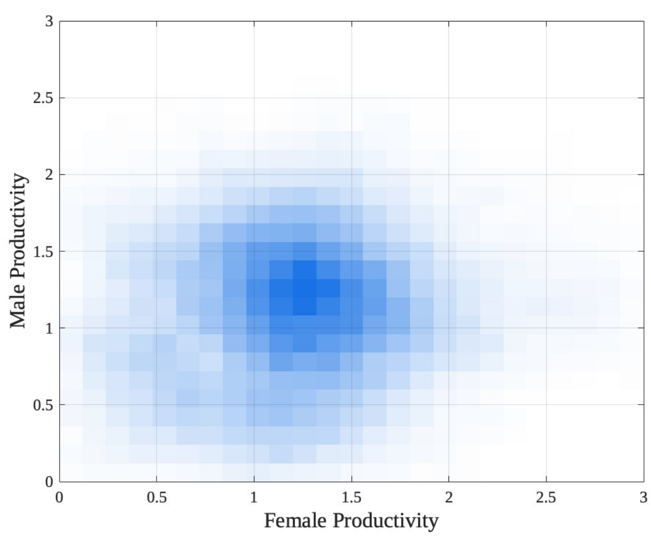
Figure 7: Marriage Rates and Households' Distribution over Productivity



Second, Figure 7 shows that individuals with high productivity – who tend to have high salaries and can better afford child costs – have higher marriage rates. Indeed, selection into marriage based on productivity allows us to match 73% of the empirically estimated elasticity of marriage rates to household's labor income, as reported in Table 4. Complementary to this, Figure 7 illustrates that the productivity distribution of married agents has a higher mean and a fatter right tail, further highlighting the compositional heterogeneities in the sample of married and singles.

Third, our calibrated model matches 69% of the correlation in wages within couples, as reported in Table 4. Couples' assortative matching is an endogenous outcome of our framework, which makes it consistent with extensive evidence of partners' sorting along wealth and income profiles, or along socio-demographic traits like education (Greenwood et al. (2014)). Our model abstracts from wealth, but individuals positively sort along productivity, and are more likely to marry partners of similar labor market outcomes. This is stressed in Figure 8, which plots the probability of marrying for agents of different productivities, with darker colors representing a higher likelihood of matching. Despite the incentives to marry due to spousal insurance, agents often prefer to search longer rather than matching with any partner, as bilateral agreement and costly household's formation push them to match with partners of equal or better productivity.

Figure 8: Distribution of Couples



Finally, Table 6 reports the shares of couples by labor market status in the model, compared to their empirical counterparts. Similarly to Mankart and Oikonomou (2017), we measure the shares of employed-employed (E,E), employed-outLF (E,O), employed-unemployed (E,U), unemployed-unemployed (U,U), unemployed-outLF (U,O) and outLF-outLF (O,O) couples using CPS data. Our framework endogenously replicates well the (untargeted) shares of couples by labor market status.

Summary. Endogenizing the decision to marry and modeling agents' heterogeneity in both gender and productivity make it possible to replicate wage and unemployment differences by gender and marital status, as well as marital patterns consistent with the data. Agents have an incentive to match, due to concave utility and the lack of savings to self-insure against idiosyncratic shocks

Table 6: Shares of Couples by Employment Status

	(E,E)	(E,O)∪(O,E)	(E,U)∪(U,E)	(U,U)	(U,O)∪(O,U)	(O,O)
Model	0.576	0.303	0.041	0.006	0.010	0.071
Data	0.550	0.324	0.042	0.004	0.008	0.082

Notes: Empirical shares of couples in the working age population in each labor market status computed using data from the US Current Population Survey (1990-2020). To ease the exposition: "E"=employed, "U"=unemployed and "O"= out of the labor force.

and unemployment risk. Yet, since couples share income and are more likely to bear child costs, marrying someone can be costly, particularly when a spouse is hit by adverse productivity or labor market shocks. As such, agents have a different propensity to marry based on their productivity and labor market status, and bilateral agreement generates positive assortative matching between spouses. We hence conclude that spousal insurance against idiosyncratic and unemployment risks can partially explain the WMP through higher reservation-wage strategies. However, it is by considering how heterogeneous agents select – and sort – into joint-households that our model can improve the quantitative fit of the WMP, and account for half of the UMG observed empirically.

5 Policy Counterfactuals

In this last section, we study how fiscal resources may be redistributed across households to enhance publicly-provided insurance in the economy. Since we have endogenized selection into joint households, the goal is to show whether and by how much a change to specific fiscal instruments in our model affects (and is affected by) the equilibrium responses in the labor and marriage markets.

Recall that progressive income taxes are levied on all agents in the labor force (i.e. $\tau_k = 0$ on home production), unemployment benefits are paid to unemployed workers only, and labor force participants receive tax credits based on their income and the presence of a child. We then compute the fiscal surplus T collected on labor force participants who earn taxable income $y(a, g)$, given by:

$$T \equiv \sum_g \sum_k \int_{i \in \mathcal{S}} \int \tau_k y(a, g) dF(w) da + \sum_k \int_{i \in \mathcal{C}} \int_{j \in \mathcal{C}} \int \int \tau_k (y(a, m) + y(a, f)) dF(w) dF(w) da da,$$

where the first term is the sum of income taxes collected across single agents in $\mathcal{S}$ – employed or unemployed – of any gender and fertility status, while the second term sums across agents in couples $\mathcal{C}$ of mixed genders with and without a child, where at least one agent is in the labor force. For both terms, income taxes are to be intended as net of child tax credits, following Section 2.2.

Fiscal resources – net of tax credits – need to cover for total unemployment benefits B, which are distributed across unemployed agents of any gender, fertility and marital status, and given by:

$$B \equiv \sum_{g} \sum_{k} \sum_{\mathcal{M}} \int b(a) da.$$

Note that, in our framework, agents are subject to idiosyncratic productivity shocks and unemployment risk. Both events decrease disposable income, and unemployment benefits on average replace only 35% of lost earnings. Yet, even if the volatility in the productivity process and the job destruction rate do not vary by marital status, married individuals suffer relatively less from these shocks because joint income is shared within couples, providing a source of informal insurance.

Our model also includes fertility shocks, and, even if we have assumed that the cost of raising a kid does not vary by marital status, married individuals are more likely to become parents. Moreover, while we have included child-based tax credits, income caps apply to all income sources within a household, which implies that married parents are less likely to qualify for tax credits. Weighing this and the previous consideration, we ask how the economy would react to an increase in unemployment compensation, and in the income caps of tax credits for households with kids. To ease comparisons, we make both interventions of similar magnitude in terms of fiscal costs.

In our first exercise, we keep unchanged the income tax rate and the system of fertility-based tax credits, and instead modify the schedule for unemployment benefits such that it features a 15% higher baseline rate b_1. Other parameters stay fixed. Table 7 shows the resulting effects on the wage and unemployment rate of men and women of different marital and parental status. Table 8 reports instead the resulting change in marital rates, aggregate welfare (in consumption-equivalent units) and fiscal pressure comparing the model versions with and without endogenous marriage.

Table 7: Effects of 15% Higher Unemployment Benefits (Relative to Baseline)

	Singles	Married	Women	Men	Agents with kid	Agents without kid
Wage	+3.07%	+1.04%	+1.38%	+0.23%	+0.57%	+1.97%
Unemployment Rate	+8.89%	+14.38%	+7.84%	+16.25%	+15.52%	+7.58%

As expected, an increase in the generosity of unemployment compensation pushes up the unemployment rates of all demographic groups relative to their values in our baseline economy, with peaks especially for married households, male workers, and individuals with a dependent child. This result aligns with the fact that, in our calibrated framework, men tend to receive better job offers, married agents have higher reservation-wage strategies, and they also represent the lion share of households with a dependent child. In a specular way, it is instead single households, female workers and agents without children that register the largest increases in average wages.

Table 8: Effects of 15% Higher Unemployment Benefits (Relative to Baseline)

	Marriage Rates	Aggregate Welfare	Fiscal Expenditure
With Endogenous Marital Choices	-2.12%	+0.46%	+1.05%
Without Endogenous Marital Choices	–	+0.55%	+0.15%

Next, in our second exercise, we keep unchanged the income tax rate and the schedule for unemployment benefits, and instead modify the system of fertility-based tax credits such that it features 20% higher income caps $\{y^{Y1}_{k=1}, y^{Y2}_{k=1}\}$ for households with a dependent child, regardless of their marital status. Other parameters stay fixed. Table 9 shows the resulting effects on the wage and unemployment rate of men and women of different marital and parental status. Table 10 reports instead the resulting change in marital rates, aggregate welfare (in consumption-equivalent units) and fiscal pressure comparing the model versions with and without endogenous marriage.

Table 9: Effects of 20% Higher Income Caps For Child-Based Tax Credits (Relative to Baseline)

	Singles	Married	Women	Men	Agents with kid	Agents without kid
Wage	+1.80%	-0.48%	+2.05%	-0.28%	-0.32%	+1.96%
Unemployment Rate	+2.50%	+5.86%	+1.57%	+7.28%	+6.90%	+0.09%

As reported in Table 9, an increase in the income thresholds to qualify for child-based tax credits pushes up the unemployment rates of our main demographic groups relative to their values in the baseline economy. These effects are small but positive across the board, and are the result of lower incentives to exit the labor force in order to avoid high fiscal pressure, as unemployment benefits are also taxed. As for the previous experiment, single households, female workers and agents without children register a relative increase in average wages, as more generous tax credits incentivize labor supply for these three categories. This is especially true for women, as joint taxation discourages participating in the labor market relatively more for them than for men.

Table 10: Effects of 20% Higher Income Caps For Child-Based Tax Credits (Relative to Baseline)

	Marriage Rates	Aggregate Welfare	Fiscal Expenditure
With Endogenous Marital Choices	+3.33%	+0.50%	+1.05%
Without Endogenous Marital Choices	–	+0.21%	+1.36%

Note that, while both policy experiments were designed to have the same fiscal cost in the model version with endogenous marriage, more generous child-based tax credits raise aggregate welfare by relatively more, potentially reflecting higher informal insurance through higher marriage rates. An important point to stress is that the effects of changing benefits and tax credits are mediated by the channel of endogenous marital decisions. Under endogenous selection into joint-households, marital rates decrease when unemployment compensation goes up, and they instead increase following an expansion in the income thresholds of child-based tax credits. Intuitively, a more generous public insurance against unemployment risk reduces the incentives of individuals to seek self-insurance within marriage. On the contrary, more generous child-based tax credits reduce the fiscal burden for couples, increasing individuals' incentives of household formation.

The key insight of these exercises is then grasped when comparing the aggregate welfare and fiscal cost changes between the versions of the model with and without endogenous marriage decisions. On the one hand, the welfare gains of more generous unemployment benefits are overstated by one fifth when agents cannot optimize their marital choices. This is because lower incentives to marry decrease the level of informal within-couple insurance achieved in the baseline economy. Moreover, the increase in fiscal costs following this hypothetical policy is understated when endogenous marital decisions are not accounted for, because marriage rates are counterfactually assumed to stay fixed, and taxes levied on couples are higher than those levied on single agents.

On the other hand, the welfare gains of more generous income thresholds for child-based tax credits are understated by one fourth when agents cannot optimize their marital choices. This is because higher incentives to marry increase the level of within-couple insurance achieved in this experiment compared to our baseline. The increase in fiscal costs is instead overstated when endogenous marital decisions are not accounted for, as marriage rates are counterfactually assumed to stay fixed, but taxes levied on couples are higher than those levied on single households.

The analysis is in no way normative, and our exercises have several limitations. The most crucial one seems the absence of self-insurance through savings in the model. Although unemployment compensation increases with agents' productivity in our framework, being able to accumulate wealth to smooth consumption swings could affect households' marital decisions, as well as the extent of the welfare gains achieved by increasing public insurance. Changes to the composition of the married sample may be less quantitatively relevant, as there is evidence of positive sorting in wealth across spouses, suggesting individuals do not treat marriage and wealth as substitutes. Self-insurance through savings could instead significantly modify not just the aggregate but also the distributional effects of more generous unemployment benefits and tax credits. Nonetheless, we believe our results stress the relevance of endogenizing marital decisions when considering policy changes to fiscal tools that directly or indirectly affect family-specific tradeoffs.

6 Conclusion

In this paper, we have built and quantified a model of search in the labor and marriage markets characterized by four main elements: endogenous household formation, heterogeneity in agents' productivity and gender, and fertility risk. Our framework extends the workhorse model of joint-search à la Guner et al. (2012) to allow for a further analysis of the heterogeneities in labor market outcomes across individuals of different gender, parental and marital status. We have also exploited our model as a quantitative laboratory to analyze how changes in unemployment benefits and child-based tax credits affect wages and unemployment rates across demographic categories. The key lesson from our counterfactuals is that the welfare gains of these hypothetical policies are over- or understated by 20% when agents cannot endogenously optimize their marriage decisions.

Empirically, we also document that married agents tend to have higher wages and lower unemployment rates. Prior works in this area had been successful at explaining the WMP through joint-searchers having higher reservation-wage strategies than singles, often at the expense of generating counterfactual predictions regarding the unemployment rates of married and singles. In our model economy, agents select and sort into joint-households based on their productivity, which induces key compositional differences in the samples of singles and married. Noticeably, within-couple insurance against productivity shocks and unemployment risk contributes to the quantitative fit of the WMP, but its explanatory power with respect to the UMG is null. When marriage decisions are instead endogenous, the model can account for both the WMP and the UMG. Once calibrated to match US data, our model replicates several untargeted moments that characterize the marriage market as well, such as the average age at marriage, the positive assortative matching of spouses based on income, and the increasing profile of marriage rates over household income.

In future work, we aim to expand our current framework to study further questions of fiscal redistribution across agents, for instance by comparing the optimal policies we could study within our model to the existing US legislation with respect to unemployment insurance and family benefits. To this end, we think it would be important to endogenize fertility choices, and allow individuals to self-insure against productivity shocks and unemployment risk through savings as well. We leave these and other interesting questions on labor and family dynamics for future research.

References

Achdou, Y., Han, J., Lasry, J.-M., Lions, P.-L., and Moll, B. (2022). Income and wealth distribution in macroeconomics: A continuous-time approach. *The Review of Economic Studies*, 89(1):45–86.

Bacher, A., Grübener, P., and Nord, L. (2022). Joint search over the life cycle.

Borella, M., De Nardi, M., and Yang, F. (2023). Are marriage-related taxes and social security benefits holding back female labour supply? *The Review of Economic Studies*, 90(1):102–131.

Borella, M., DeNardi, M., and Yang, F. (2019). Are marriage-related taxes and social security benefits holding back female labor supply? *NBER working paper no. 26097*.

Calvo, P. A., Lindenlaub, I., and Reynoso, A. (2021). Marriage market and labor market sorting. Technical report, National Bureau of Economic Research.

Choi, S. and Valladares-Esteban, A. (2018). The marriage unemployment gap. *The B.E. Journal of Macroeconomics*, 18(1).

Choi, S. and Valladares-Esteban, A. (2019). On households and unemployment insurance. *Quantitative Economics*, 11:437–469.

De Nardi, M., Fella, G., and Paz-Pardo, G. (2020). Nonlinear household earnings dynamics, self-insurance, and welfare. *Journal of the European Economic Association*, 18(2):890–926.

Doepke, M. and Tertilt, M. (2016). Families in Macroeconomics. In Taylor, J. B. and Uhlig, H., editors, *Handbook of Macroeconomics*, chapter 23, pages 1789–1891. Elsevier.

Ek, S. and Holmlund, B. (2010). Family job search, wage bargaining, and optimal unemployment insurance. *The B.E. Journal of Economic Analysis and Policy*, 1(47).

Flabbi, L. and Finn, C. (2015). Simultaneous search in the labor and marriage markets with endogenous schooling decisions. *BGSE Working Paper*.

Flabbi, L. and Mabli, J. (2018). Household search or individual search: Does it matter? *Journal of Labor Economics*, 36(1):1–46.

Garstenauer, V. and Siassi, N. (2024). Low-income families, maternal labor supply, and welfare reform. Technical report, ECON WPS-Working Papers in Economic Theory and Policy.

Gemici, A. (2011). Family migration and labor market outcomes. *Working Paper*.

Goldin, C. (2014). A grand gender convergence: Its last chapter. *American economic review*, 104(4):1091–1119.

Greenwood, J., Guner, N., Kocharkov, G., and Santos, C. (2014). Marry your like: Assortative mating and income inequality. *The American Economic Review*, 104.

Guler, B., Guvenen, F., and Violante, G. (2012). Joint-search theory: New opportunities and new frictions. *Journal of Monetary Economics*, 59(4):352–369.

Guner, N., Kaygusuz, R., and Ventura, G. (2012). Taxation and household labor supply. *The Review of Economic Studies*, 79(3):1113–1149.

Guner, N., Kaygusuz, R., and Ventura, G. (2020). Child-related transfers, household labour supply, and welfare. *The Review of Economic Studies*, 87(5):2290–2321.

Heathcote, J., Storesletten, K., and Violante, G. L. (2017). The macroeconomics of the quiet revolution: Understanding the implications of the rise in women's participation for economic growth and inequality. *Research in Economics*, 71(3):521–539.

Hill, M. S. (1979). The wage effects of marital status and children. *The Journal of Human Resources*, 14(4):579–594.

Huckfeldt, C. (2016). Understanding the scarring effect of recessions. *Report, Economics Department*.

Jarosch, G. (2021). Searching for job security and the consequences of job loss. Technical report, National Bureau of Economic Research.

Juhn, C. and McCue, K. (2016). Evolution of the marriage earnings gap for women. *American Economic Review*, 106(5):252–256.

Kaplan, G., Moll, B., and Violante, G. L. (2018). Monetary policy according to hank. *American Economic Review*, 108(3):697–743.

Lange, R.-J., Ralph, D., and Støre, K. (2020). Real-option valuation in multiple dimensions using poisson optional stopping times. *Journal of Financial and Quantitative Analysis*, 55(2):653–677.

Mankart, J. and Oikonomou, R. (2017). Household search and the aggregate labour market. *The Review of Economic Studies*, 84(4):1735–1788.

McCall, J. (1970). Economics of Information and Job Search. *The Quarterly Journal of Economics*, 84(1):113–126.

McConnell, B. and Valladares-Esteban, A. (2020). On the marriage wage premium. *Working Paper*.

Morchio, I. and Moser, C. (2024). The gender pay gap: Micro sources and macro consequences. Technical report, National Bureau of Economic Research.

Nagypal, E. (2007). Labor-market fluctuations and on-the-job search. *Manuscript, Northwestern University*.

Nakosteen, R. A. and Zimmer, M. A. (1987). Marital status and earnings of young men: A model with endogenous selection. *The Journal of Human Resources*, 22(2):248–268.

Neal, D. (1995). Industry-specific human capital: Evidence from displaced workers. *Journal of labor Economics*, 13(4):653–677.

Ortigueira, S. and Siassi, N. (2013). How Important is Intrahousehold Risk Sharing for Savings and Labor Supply? *Journal of Monetary Economics*, 60(6).

Ortigueira, S. and Siassi, N. (2020). The u.s. tax-transfer system and low-income households: Savings, labor supply, and household formation. *Mimeo*.

Pilossoph, L. and Wee, S. L. (2020). Assortative matching and household income inequality: A structural approach. *Working Paper*.

Pilossoph, L. and Wee, S. L. (2021). Household search and the marital wage premium. *American Economic Journal: Macroeconomics*, 13(4):55–109.

Schaal, E. (2017). Uncertainty and unemployment. *Econometrica*, 85(6):1675–1721.

Shimer, R. (2005). The cyclical behavior of equilibrium unemployment and vacancies. *American Economic Review*, 95(1):25–49.

Stokey, N. L. (2009). *The Economics of Inaction: Stochastic Control Models with Fixed Costs*. Princeton University Press, Princeton, NJ.

Appendix

A Empirical Analysis

A.1 Wages and Unemployment

Table A1: Wages and Unemployment Rate in CPS

	(log) Hourly Wage	(log) Yearly Wage	(log) Hourly Wage	(log) Yearly Wage	Unemployment Likelihood	Unemployment Likelihood
Married	0.2228***	0.4093***	0.1026***	0.1828***	-0.0418***	-0.0251***
	(0.0054)	(0.0108)	(0.0088)	(0.0177)	(0.0012)	(0.0018)
Controls	N	N	Y	Y	N	Y
Year FE	N	N	Y	Y	N	Y
Occupation FE	N	N	Y	Y	N	Y
Observations	44,950	435,186	20,089	195,464	393,309	176,716
R^2	0.0472	0.0039	0.4155	0.2820	0.0065	0.1415

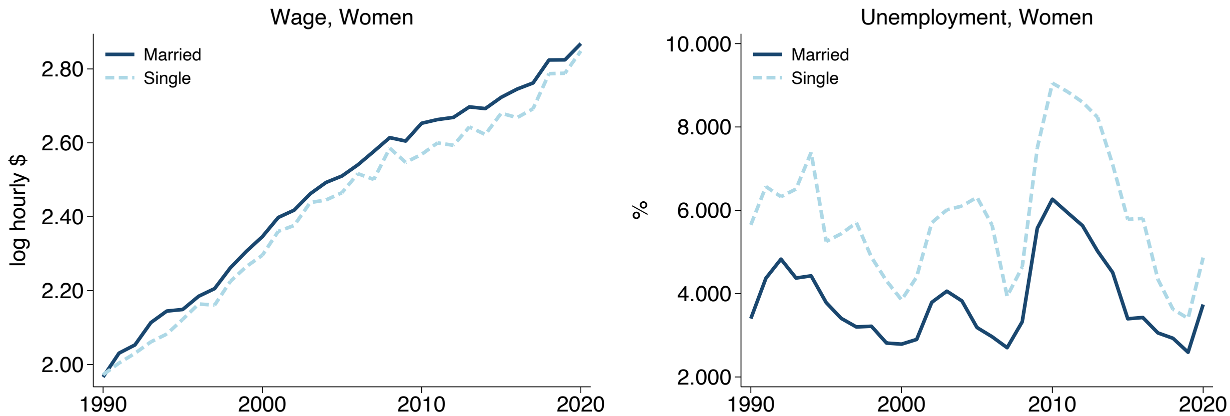
Notes: Data: US Current Population Survey, 1990-2020. Robust standard errors in parentheses. Survey weights are used. ***p<0.01, **p<0.05, *p<0.1. Control variables include gender, education, employment status in the previous calendar year, ethnicity, number of kids, age, spousal education and spousal current employment status.

In the following section, we unpack the results reported in Section 3 by analyzing the regression outcomes of Equation 4. We first document the differences in the hourly and yearly wages of single and married individuals and then consider their unemployment rates. Throughout the analysis, we make use of the CPS sample discussed in the main text, including the years between 1990 and 2020. As reported in Table A1, whether we consider hourly or yearly wages, being married is associated with higher labor income. This result is robust to controlling for other factors that may affect agents' income, such as their gender, education, ethnicity, age, number of children and labor market status in the previous year. We also allow for year (α_t) and occupation ($\eta_{o(it)}$) fixed effects. For married individuals, we include the education and labor market status of the spouse. Survey weights are used to ensure representativeness. In Table A1, we show that being married is also associated with a lower likelihood of being unemployed (with and without controls).

Moreover, although we establish the presence of a wage marital premium (WMP) and an unemployment marital gap (UMG) across both men and women, we further break down these two results by gender in Figure A.1 and Figure A.2. Both married women and men have higher wages and lower rates of unemployment compared to their single counterparts, and this is stable throughout the sample period considered. Yet, it is interesting to note that the WMP is significantly larger among the male subsample, while the opposite is true with respect to the UMG.

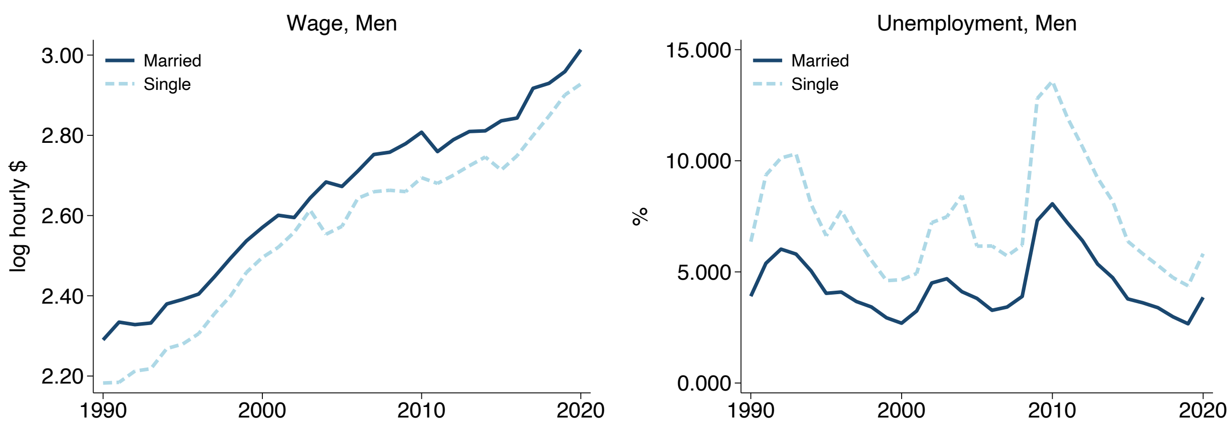
We also provide additional evidence of marital selection and sorting in the sample of CPS cou-

Figure A.1: Wage and Unemployment Differences by Marital Status: Women (1990-2020)



Data: US Current Population Survey, 1990-2020. Survey weights are used. Controls: gender, age, ethnicity, number of kids, education, employment status in previous year, year and occupation fixed effects, spousal education and employment status.

Figure A.2: Wage and Unemployment Differences by Marital Status: Men (1990-2020)



Data: US Current Population Survey, 1990-2020. Survey weights are used. Controls: gender, age, ethnicity, number of kids, education, employment status in previous year, year and occupation fixed effects, spousal education and employment status.

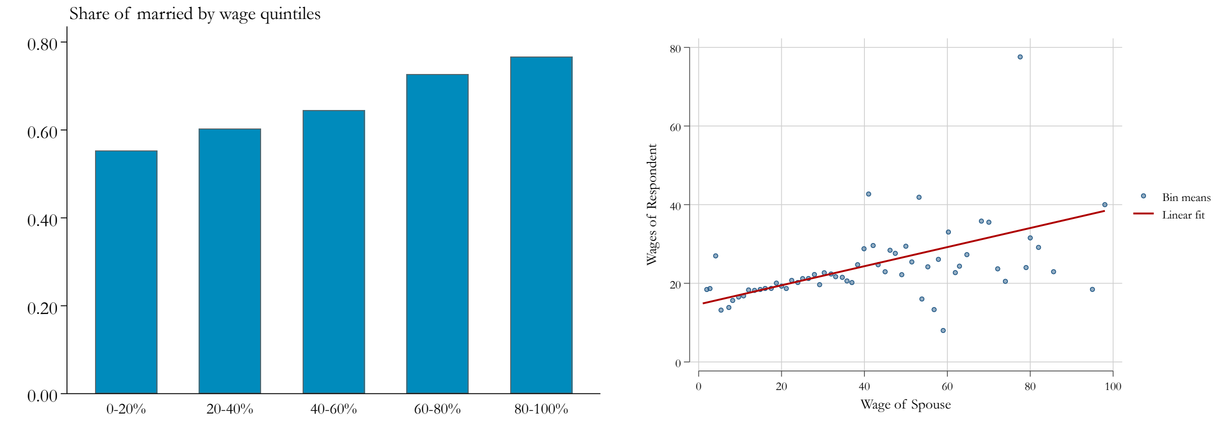
ples. The left panel of Figure A.3 shows that marriage rates are increasing in the wage quintile of individuals. Second, the right panel in Figure 4 reports the correlation between partners' hourly wages: focusing on households for which we have information on their spouse's income, we document a significant degree of sorting within couples, consistent with previous studies.

B Model

B.1 Value Functions

In this section, we report all the value functions of the model, for both single and married agents, whether they are unemployed, employed, or out of the labor force. Specifically, in the main body

Figure A.3: Marriage Rates and Sorting (1990-2020)



Data: US Current Population Survey. Survey weights are used. We exploit information on individuals' hourly wages.

of the paper, we have presented the value function of a single working individual; here we instead give details on the following value functions: $UU(a_i, a_j; g_i, g_j, k_{ij,t})$, $WU(a_i, a_j; w_i(g_i), g_j, k_{ij,t})$, $UW(a_j, a_i; w_j(g_j), g_i, k_{ij,t})$, $WW(a_i, a_j; w_i(g_i), w_j(g_j), k_{ij,t})$, $UO(a_i, a_j; g_i, g_j, k_{ij,t})$, $OU(a_i, a_j; g_i, g_j, k_{ij,t})$, $WO(a_i, a_j; w_i(g_i), g_j, k_{ij,t})$, $OW(a_i, a_j; w_j(g_j), g_i, k_{ij,t})$, $OO(a_i, a_j; g_i, g_j, k_{ij,t})$. Let us start by the value function of a single unemployed agent i with $k_{i,t} = 0$, which is given by:

$$\rho U(a_{i,t}, g_i, k_{i,t} = 0) = \underbrace{u((1 - \tau^s_{k_{i,t}=0}(\cdot))b(a_{i,t}))}_{\text{instantaneous utility}} + \underbrace{\pi^s(U(a_{i,t}, g_i, k_{i,t} = 1) - U(a_{i,t}, g_i, k_{i,t} = 0))}_{\text{if she has a kid}}$$

$$+ \underbrace{\xi(0 - U(a_{i,t}, g_i, k_{i,t} = 0))}_{\text{if she retires}} + \underbrace{\lambda_{g_i} \int \max\{W(a_{i,t}, w_{i,t}(g_i), k_{i,t} = 0) - U(a_{i,t}, g_i, k_{i,t} = 0), 0\} dF(w(g_i))}_{\text{if she finds job}}$$

$$+ \underbrace{\mu\Big(\int\int \max\{UW(a_{i,t}, a_{j,t}, g_i, w_{j,t}(g_j), k_{ij,t} \in \{0,1\}) - U(a_{i,t}, g_i, k_{i,t} = 0), 0\} *}_{\text{if she meets any employed person}}$$

$$* \underbrace{\mathbb{1}(WU(a_{j,t}, a_{i,t}, w_{j,t}(g_j), g_i, k_{i,t}) > W(a_{j,t}, w_{j,t}(g_j), k_{ij,t} \in \{0,1\}))e(a_{j,t}, w_{j,t}(g_j), g_j, k_{ij,t} \in \{0,1\})dw(g_j)}_{\text{and the partner agrees on matching}}$$

$$+ \underbrace{\max\{UU(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t} \in \{0,1\}) - U(a_{i,t}, g_i, k_{i,t} = 0), 0\} *}_{\text{if she meets any unemployed person}}$$

$$* \underbrace{\mathbb{1}(UU(a_{j,t}, a_{i,t}, g_j, g_i, k_{ij,t} \in \{0,1\})) > U(a_{j,t}, g_j, k_{ij,t} \in \{0,1\}))v(a_{j,t}, g_j, k_{ij,t} \in \{0,1\})da_{j,t}}_{\text{and the partner agrees on matching}}$$

$$+ \underbrace{\max\{UO(a_{i,t}, a_{j,t}, g_i, g_j, k_{ij,t} \in \{0,1\}) - U(a_{i,t}, g_i, k_{i,t} = 0), 0\} *}_{\text{if she meets any outLF person}}$$

$$* \underbrace{\mathbb{1}(OU(a_{j,t}, a_{i,t}, g_j, g_i, k_{ij,t} \in \{0,1\}) > O(a_{j,t}, g_j, g_i, k_{ij,t} \in \{0,1\}))o(a_{j,t}, g_j, k_{ij,t} \in \{0,1\})da_{j,t}\Big)}_{\text{and the partner agrees on matching}} +$$

$$+\underbrace{(a_{min}-\phi_{ne}(a_{i,t}))\frac{\partial U(a_{i,t},g_i,k_{i,t}=0)}{\partial a_{i,t}}+\frac{\epsilon^2}{2}\frac{\partial^2 U(a_{i,t},g_i,k_{i,t}=0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}}$$

where ρ is the discount factor, λ_g is the probability to exit unemployment, ξ is the probability of retiring, π^s is the probability of having a kid for a single agent, μ is the probability of meeting a possible partner on the marriage market, and $u((1-\tau^s_{k_{i,t}=0}(\cdot))b(a_{i,t}))$ is the utility over the unemployment benefit. Moreover, $dF(w)$, $e(a,w,k,g)$, $o(a,k,g)$ and $v(a,k,g)$ represent the distribution of job wages, single employed individuals, single outLF, and single unemployed agents respectively. Finally, the indicator $\mathbb{1}$ signals whether the potential partner met on the marriage market agrees on matching. The value function above is then evaluated subject to the outside-option constraint, which ensures that agents can decide to leave the labor force at any moment, given by:

$$U(a_{i,t},g_i,k_{ij,t}\in\{0,1\})\geq O(a_{i,t},g_i,k_{ij,t}\in\{0,1\})$$

The value function of a single agent out of the labor force and with $k_{i,t}=0$ is instead given by:

$$\rho O(a_{i,t},g_i,k_{i,t}=0)=\underbrace{u(h^s_{g_i,k_{i,t}=0})}_{\text{instantaneous utility}}+\underbrace{\pi^s(O(a_{i,t},g_i,k_{i,t}=1)-O(a_{i,t},g_i,k_{i,t}=0))}_{\text{if she has a kid}}+$$

$$+\underbrace{\xi(0-O(a_{i,t},g_i,k_{i,t}=0))}_{\text{if she retires}}+\underbrace{\nu_{g_i}\int\max\{W(a_{i,t},w_{i,t}(g_i),k_{i,t}=0)-O(a_{i,t},g_i,k_{i,t}=0),0\}dF(w(g_i))}_{\text{if she finds job}}+$$

$$+\underbrace{\mu\Big(\int\int\max\{OW(a_{i,t},a_{j,t},g_i,w_{j,t}(g_j),k_{ij,t}\in\{0,1\})-O(a_{i,t},g_i,k_{i,t}=0),0\}*}_{\text{if she meets any employed person}}$$

$$*\underbrace{\mathbb{1}(WO(a_{j,t},a_{i,t},w_{j,t}(g_j),g_i,k_{i,t})>W(a_{j,t},w_{j,t}(g_j),k_{ij,t}\in\{0,1\}))e(a_{j,t},w_{j,t}(g_j),g_j,k_{ij,t}\in\{0,1\})dw(g_j)+}_{\text{and the partner agrees on matching}}$$

$$+\underbrace{\max\{OU(a_{i,t},a_{j,t},g_i,g_j,k_{ij,t}\in\{0,1\})-O(a_{i,t},g_i,k_{i,t}=0),0\}*}_{\text{if she meets any unemployed person}}$$

$$*\underbrace{\mathbb{1}(UO(a_{j,t},a_{i,t},g_j,g_i,k_{ij,t}\in\{0,1\}))>U(a_{j,t},g_j,k_{ij,t}\in\{0,1\}))v(a_{j,t},g_j,k_{ij,t}\in\{0,1\})da_{j,t}+}_{\text{and the partner agrees on matching}}$$

$$+\underbrace{\max\{OO(a_{i,t},a_{j,t},g_i,g_j,k_{ij,t}\in\{0,1\})-O(a_{i,t},g_i,k_{i,t}=0),0\}*}_{\text{if she meets any outLF person}}$$

$$*\underbrace{\mathbb{1}(OO(a_{j,t},a_{i,t},g_j,g_i,k_{ij,t}\in\{0,1\})>O(a_{j,t},g_j,g_i,k_{ij,t}\in\{0,1\}))o(a_{j,t},g_j,k_{ij,t}\in\{0,1\})da_{j,t}\Big)+}_{\text{and the partner agrees on matching}}$$

$$+\underbrace{(a_{min}-\phi_{ne}(a_{i,t}))\frac{\partial O(a_{i,t},g_i,k_{i,t}=0)}{\partial a_{i,t}}+\frac{\epsilon^2}{2}\frac{\partial^2 O(a_{i,t},g_i,k_{i,t}=0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}}$$

We now turn to the value functions of married agents in our model economy. Since we do not allow for divorce and remarriage, married agents are not active on the marriage markets, but they still make choices in the labor markets jointly, and are subject to both exogenous fertility and retirement. In what follows, we refer to a couple made by agents i and j, where $g_i = f$ and $g_j = m$, that has no child at time t. First, the value function of a couple where both agents employed is:

$$\rho WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0)=\underbrace{u\left(\frac{(1-\tau^c_{k_{ij,t}=0}(\cdot))(\omega(a_{i,t},f)+\omega(a_{j,t},m))}{2}\right)}_{\text{instantaneous utility}}+$$

$$+\underbrace{\delta_f(UW(a_{i,t},a_{j,t},f,w_j(m),k_{ij,t}=0)-WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0))}_{\text{if she gets unemployed}}+$$

$$+\underbrace{\delta_m(WU(a_{i,t},a_{j,t},w_i(f),m,k_{ij,t}=0)-WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0))}_{\text{if spouse gets unemployed}}+$$

$$+\underbrace{\xi(0-WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0)))}_{\text{if they retire}}+$$

$$+\underbrace{\pi^c(WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=1))-WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0)))}_{\text{if they have a kid}}+$$

$$+\underbrace{(\bar{a}-\phi_e(a_{i,t}))\frac{\partial WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0)}{\partial a_{i,t}}+\frac{\epsilon^2}{2}\frac{\partial^2 WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}}+$$

$$+\underbrace{(\bar{a}-\phi_e(a_{j,t}))\frac{\partial WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0)}{\partial a_{j,t}}+\frac{\epsilon^2}{2}\frac{\partial^2 WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0)}{\partial a_{j,t}^2}}_{\text{change due to the stochastic process of } a_{j,t}}$$

where π^c is the probability of having a kid for a married couple. The value function above is then evaluated subject to two outside-option constraints, which ensures that both agent i and j can decide to leave the labor force at any moment (but not together in the same instant), given by:

$$WW(a_{i,t},a_{j,t},w_i(f),w_j(m),k_{ij,t}=0)\geq\{WO(a_{i,t},a_{j,t},w_i(f),m,k_{ij,t}=0);OW(a_{i,t},a_{j,t},f,w_j(m),k_{ij,t}=0)\})$$

Second, for a couple where one agent is employed and the other is unemployed, we can be in one of the following cases. If agent i is unemployed and agent j is employed, the value function is:

$$\rho UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0) = \underbrace{u\left(\frac{(1 - \tau^c_{k_{ij,t}=0}(\cdot))(b(a_{i,t}) + \omega(a_{j,t}, m))}{2}\right)}_{\text{instantaneous utility}} +$$
$$+ \underbrace{\delta_m(UU(a_{i,t}, a_{j,t}, f, m, k_{ij,t} = 0)) - UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0))}_{\text{if the spouse gets unemployed}}$$
$$+ \underbrace{\lambda_f \int \max\{WW(a_{i,t}, a_{j,t}, w_i(f), w_j(m), k_{ij,t} = 0) - UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0), 0\} dF(w)}_{\text{if she finds a job}} +$$
$$+ \underbrace{\xi(0 - UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0))}_{\text{if they retire}} +$$
$$+ \underbrace{\pi^c(UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 1) - UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0))}_{\text{if they have a kid}} +$$
$$+ \underbrace{(a_{min} - \phi_{ne}(a_{i,t}))\frac{\partial UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0)}{\partial a_{i,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0)}{\partial a^2_{i,t}}}_{\text{change due to the stochastic process of } a_{i,t}} +$$
$$+ \underbrace{(\bar{a} - \phi_e(a_{j,t}))\frac{\partial UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0)}{\partial a_{j,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0)}{\partial a^2_{j,t}}}_{\text{change due to the stochastic process of } a_{j,t}},$$

whereas if agent i is employed and agent j is unemployed we obtain the following value function:

$$\rho WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0) = \underbrace{u\left(\frac{(1 - \tau^c_{k_{ij,t}=0}(\cdot))(\omega(a_{i,t}, f) + b(a_{j,t}))}{2}\right)}_{\text{instantaneous utility}} +$$
$$+ \underbrace{\delta_f(UU(a_{i,t}, a_{j,t}, f, m, k_{ij,t} = 0) - WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0))}_{\text{if she gets unemployed}} +$$
$$+ \underbrace{\lambda_m \int \max\{WW(a_{i,t}, a_{j,t}, w_i(f), w_j(m), k_{ij,t} = 0) - WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0), 0\} dF(w)}_{\text{if the spouse finds a job}} +$$
$$+ \underbrace{\xi(0 - WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0))}_{\text{if they retire}} +$$
$$+ \underbrace{\pi^c(WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 1) - WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0))}_{\text{if they have a kid}} +$$

$$+ \underbrace{(\bar{a} - \phi_e(a_{i,t}))\frac{\partial WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0)}{\partial a_{i,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}} +$$

$$+ \underbrace{(a_{min} - \phi_{ne}(a_{j,t}))\frac{\partial WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0)}{\partial a_{j,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0)}{\partial a_{j,t}^2}}_{\text{change due to the stochastic process of } a_{j,t}}$$

Each of the two value functions above refers to couples with $k_{ij,t} = 0$, and is then evaluated subject to two outside-option constraints, which ensures that both agent i and j can decide to leave the labor force at any moment (but not together in the same instant). Specifically, it has to hold that:

$$WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0) \geq \{WO(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0); OU(a_{i,t}, a_{j,t}, f, m, k_{ij,t} = 0)\})$$
$$UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0) \geq \{UO(a_{i,t}, a_{j,t}, f, m, k_{ij,t} = 0); OW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0)\})$$

Third, when both agents are out of the labor force and $k_{ij,t} = 0$, their value function is given by:

$$\rho OO(a_i, a_j; f, m, k_{ij,t} = 0) = \underbrace{u\left(\frac{h^c_{f,k_{ij,t}=0} + h^c_{m,k_{ij,t}=0}}{2}\right)}_{\text{instantaneous utility}} + \underbrace{\xi(0 - OO(a_i, a_j; f, m, k_{ij,t} = 0))}_{\text{if they retire}} +$$

$$+ \underbrace{\pi^c(OO(a_i, a_j; f, m, k_{ij,t} = 1) - OO(a_i, a_j; f, m, k_{ij,t} = 0))}_{\text{if they have a kid}} +$$

$$+ \underbrace{\nu_f \int \max\{WO(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0) - OO(a_i, a_j; f, m, k_{ij,t} = 0), 0\} dF(w)}_{\text{if she finds a job}} +$$

$$+ \underbrace{\nu_m \int \max\{OW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0) - OO(a_i, a_j; f, m, k_{ij,t} = 0), 0\} dF(w)}_{\text{if the spouse finds a job}} +$$

$$+ \underbrace{(a_{min} - \phi_{ne}(a_{i,t}))\frac{\partial OO(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a_{i,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 OO(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}} +$$

$$+ \underbrace{(a_{min} - \phi_{ne}(a_{j,t}))\frac{\partial OO(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a_{j,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 OO(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a_{j,t}^2}}_{\text{change due to the stochastic process of } a_{j,t}}$$

Fourth, the value function of a couple where both agents are unemployed and $k_{ij,t} = 0$ is as follows:

$$\rho UU(a_i, a_j; f, m, k_{ij,t} = 0) = \underbrace{u\left(\frac{(1-\tau^c_{k_{ij,t}=0}(\cdot))(b(a_{i,t}) + b(a_{j,t}))}{2}\right)}_{\text{instantaneous utility}} +$$
$$+ \underbrace{\lambda_f \int \max\{WU(a_{i,t}, a_{j,t}, w_i(f), m, k_{ij,t} = 0) - UU(a_i, a_j; f, m, k_{ij,t} = 0), 0\} dF(w)}_{\text{if she finds a job}} +$$
$$+ \underbrace{\lambda_m \int \max\{UW(a_{i,t}, a_{j,t}, f, w_j(m), k_{ij,t} = 0) - UU(a_i, a_j; f, m, k_{ij,t} = 0), 0\} dF(w)}_{\text{if the spouse finds a job}} +$$
$$+ \underbrace{\xi(0 - UU(a_i, a_j; f, m, k_{ij,t} = 0))}_{\text{if they retire}} + \underbrace{\pi^c(UU(a_i, a_j; f, m, k_{ij,t} = 1) - UU(a_i, a_j; f, m, k_{ij,t} = 0))}_{\text{if they have a kid}} +$$
$$+ \underbrace{(a_{min} - \phi_{ne}(a_{i,t}))\frac{\partial UU(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a_{i,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 UU(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a^2_{i,t}}}_{\text{change due to the stochastic process of } a_{i,t}} +$$
$$+ \underbrace{(a_{min} - \phi_{ne}(a_{j,t}))\frac{\partial UU(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a_{j,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 UU(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a^2_{j,t}}}_{\text{change due to the stochastic process of } a_{j,t}}$$

Their value function is evaluated against two outside-option constraints, which ensure both agent i and j can leave the labor force at any moment (but not together in the same instant), given by:

$$UU(a_i, a_j; f, m, k_{ij,t} = 0) \geq \{UO(a_i, a_j; f, m, k_{ij,t} = 0); OU(a_i, a_j; f, m, k_{ij,t} = 0)\})$$

Fifth, the value function of a couple with $k_{ij,t} = 0$, one agent outLF and the other one working can be one of two alternatives. If agent i is outLF and agent j is employed, their value function is:

$$
\begin{aligned}
\rho OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0) = {} & \underbrace{u\left(\frac{h^c_{f,k_{ij,t}=0} + (1-\tau^c_{k_{ij,t}=0}(\cdot))\omega(a_{i,t}, m)}{2}\right)}_{\text{instantaneous utility}} + \\
& + \underbrace{\xi(0 - OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0))}_{\text{if they retire}} + \\
& + \underbrace{\nu_f \int \max\{WW(a_{i,t}, a_{j,t}, w_i(f), w_j(m), k_{ij,t} = 0) - OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0), 0\} dF(w)}_{\text{if she finds a job}} + \\
& + \underbrace{\delta_m(OU(a_i, a_j; f, m, k_{ij,t} = 0) - OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0))}_{\text{if the spouse gets unemployed}} + \\
& + \underbrace{\pi^c(OW(a_i, a_j; f, w_j(m), k_{ij,t} = 1) - OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0))}_{\text{if they have a kid}} + \\
& + \underbrace{(a_{min} - \phi_{ne}(a_{i,t}))\frac{\partial OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0)}{\partial a_{i,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}} + \\
& + \underbrace{(\bar{a} - \phi_e(a_{j,t}))\frac{\partial OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0)}{\partial a_{j,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0)}{\partial a_{j,t}^2}}_{\text{change due to the stochastic process of } a_{j,t}}
\end{aligned}
$$

Alternatively, if agent j is the one who is out of the labor force and agent i is employed, one gets:

$$
\begin{aligned}
\rho WO(a_i, a_j; w_i(f), m, k_{ij,t} = 0) = {} & \underbrace{u\left(\frac{(1-\tau^c_{k_{ij,t}=0}(\cdot))\omega(a_{i,t}, f) + h^c_{m,k_{ij,t}=0}}{2}\right)}_{\text{instantaneous utility}} + \\
& + \underbrace{\delta_f(UO(a_i, a_j; f, m, k_{ij,t} = 0) - WO(a_i, a_j; w_i(f), m, k_{ij,t} = 0))}_{\text{if she gets unemployed}} + \\
& + \underbrace{\xi(0 - WO(a_i, a_j; w_i(f), m, k_{ij,t} = 0))}_{\text{if they retire}} + \\
& + \underbrace{\pi^c(WO(a_i, a_j; w_i(f), m, k_{ij,t} = 1) - WO(a_i, a_j; w_i(f), m, k_{ij,t} = 0))}_{\text{if they have a kid}} + \\
& + \underbrace{\nu_m \int \max\{WW(a_{i,t}, a_{j,t}, w_i(f), w_j(m), k_{ij,t} = 0) - WO(a_i, a_j; w_i(f), m, k_{ij,t} = 0), 0\} dF(w)}_{\text{if the spouse finds a job}} +
\end{aligned}
$$

$$+\underbrace{(\bar{a}-\phi_e(a_{i,t}))\frac{\partial WO(a_i,a_j;w_i(f),m,k_{ij,t}=0)}{\partial a_{i,t}}+\frac{\epsilon^2}{2}\frac{\partial^2 WO(a_i,a_j;w_i(f),m,k_{ij,t}=0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}}+$$

$$+\underbrace{(a_{min}-\phi_{ne}(a_{j,t}))\frac{\partial WO(a_i,a_j;w_i(f),m,k_{ij,t}=0)}{\partial a_{j,t}}+\frac{\epsilon^2}{2}\frac{\partial^2 WO(a_i,a_j;w_i(f),m,k_{ij,t}=0)}{\partial a_{j,t}^2}}_{\text{change due to the stochastic process of } a_{j,t}}$$

Finally, we have the two last cases, referring to couples with $k_{ij,t}=0$ where one agent is unemployed and the other one is out of the labor force. If agent i is unemployed and agent j is outLF, one gets:

$$\rho OU(a_i,a_j;f,m,k_{ij,t}=0)=\underbrace{u\left(\frac{h^c_{f,k_{ij,t}=0}+(1-\tau^c_{k_{ij,t}=0}(\cdot))b(a_i)}{2}\right)}_{\text{instantaneous utility}}+\underbrace{\xi(0-OU(a_i,a_j;f,m,k_{ij,t}=0))}_{\text{if they retire}}+$$

$$+\underbrace{\nu_f\int\max\{WU(a_{i,t},a_{j,t},w_i(f),m,k_{ij,t}=0)-OU(a_i,a_j;f,m,k_{ij,t}=0),0\}dF(w)}_{\text{if she finds a job}}+$$

$$+\underbrace{\lambda_m\int\max\{OW(a_i,a_j;f,w_j(m),k_{ij,t}=0)-OU(a_i,a_j;f,m,k_{ij,t}=0),0\}dF(w)}_{\text{if the spouse finds a job}}+$$

$$+\underbrace{\pi^c(OU(a_i,a_j;f,m,k_{ij,t}=1)-OU(a_i,a_j;f,m,k_{ij,t}=0))}_{\text{if they have a kid}}+$$

$$+\underbrace{(a_{min}-\phi_{ne}(a_{i,t}))\frac{\partial OU(a_i,a_j;f,m,k_{ij,t}=0)}{\partial a_{i,t}}+\frac{\epsilon^2}{2}\frac{\partial^2 OU(a_i,a_j;f,m,k_{ij,t}=0)}{\partial a_{i,t}^2}}_{\text{change due to the stochastic process of } a_{i,t}}+$$

$$+\underbrace{(a_{min}-\phi_{ne}(a_{j,t}))\frac{\partial OU(a_i,a_j;f,m,k_{ij,t}=0)}{\partial a_{j,t}}+\frac{\epsilon^2}{2}\frac{\partial^2 OU(a_i,a_j;f,m,k_{ij,t}=0)}{\partial a_{j,t}^2}}_{\text{change due to the stochastic process of } a_{j,t}}$$

Alternatively, if agent j is the one out of the labor force and agent i is unemployed, one gets:

$$\rho UO(a_i, a_j; f, m, k_{ij,t} = 0) = \underbrace{u\left(\frac{(1-\tau^c_{k_{ij,t}=0}(\cdot))b(a_i) + h^c_{m,k_{ij,t}=0}}{2}\right)}_{\text{instantaneous utility}} + \underbrace{\xi(0 - UO(a_i, a_j; f, m, k_{ij,t} = 0))}_{\text{if they retire}} +$$
$$+ \underbrace{\lambda_f \int \max\{WO(a_i, a_j; w_i(f), m, k_{ij,t} = 0) - UO(a_i, a_j; f, m, k_{ij,t} = 0), 0\} dF(w)}_{\text{if she finds job}}$$
$$+ \underbrace{\nu_m \int \max\{OW(a_i, a_j; f, w_j(m), k_{ij,t} = 0) - UO(a_i, a_j; f, m, k_{ij,t} = 0), 0\} dF(w)}_{\text{if the spouse finds a job}} +$$
$$+ \underbrace{\pi^c(UO(a_i, a_j; f, m, k_{ij,t} = 1) - UO(a_i, a_j; f, m, k_{ij,t} = 0))}_{\text{if they have a kid}} +$$
$$+ \underbrace{(a_{min} - \phi_{ne}(a_{i,t}))\frac{\partial UO(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a_{i,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 UO(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a^2_{i,t}}}_{\text{change due to the stochastic process of } a_{i,t}} +$$
$$+ \underbrace{(a_{min} - \phi_{ne}(a_{j,t}))\frac{\partial UO(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a_{j,t}} + \frac{\epsilon^2}{2}\frac{\partial^2 UO(a_i, a_j; f, m, k_{ij,t} = 0)}{\partial a^2_{j,t}}}_{\text{change due to the stochastic process of } a_{j,t}}$$

Each of these value functions is evaluated against an outside-option constraint, which ensures that both agent i and j can leave the labor force when unemployed. Specifically, it has to hold that:

$$OU(a_i, a_j; f, m, k_{ij,t} = 0) \geq OO(a_i, a_j; f, m, k_{ij,t} = 0)$$
$$UO(a_i, a_j; f, m, k_{ij,t} = 0) \geq OO(a_i, a_j; f, m, k_{ij,t} = 0)$$

These nine value functions were derived assuming that the couple formed by agents i and j has no child at time t. If instead the couple was to have already a child in t, the indicator function would be $k_{ij,t} = 1$ and the only other change would be that the probability to have a kid π^c would be 0.