Marriage and Divorce under Labor Market Uncertainty*

Christian Holzner[1] and Bastian Schulz[2]

[1] *University of Munich, CESifo*
[2] *Aarhus University, Dale T. Mortensen Centre, CESifo*

February 15, 2022

— Work in progress —

Abstract

We extend the widely-used transferable-utility search-matching model of the marriage market by allowing men and women to make labor search intensity decisions both on and off the job based on their current and future marriage market status. For singles, reservation wages depend on current wages/transfers, home production, and the marriage market option value. For couples, reservation wages additionally depend on the type and labor market status of both spouses, a match-specific shock, and, importantly, the propensity to divorce upon transitioning between jobs in the labor market. Thus, divorces are triggered by either match-specific shocks or labor market transitions, but not all shocks/transitions lead to divorce. We structurally estimate the model with both one and two-dimensional heterogeneity using German micro data and a genetic algorithm. The estimated model allows us to decompose the observed divorce flow into divorces due to match-specific shocks and "labor market divorces". Preliminary findings suggest that the share of labor market divorces rose to more than 20% during the 2000s in Germany. Much of this increase is driven by previously unemployed married women who start working, a trend that can be linked to the labor market reforms of the mid 2000s. Our findings indicate that these reforms had significant marriage market ramifications in the form of more divorces. Counterfactual analysis is work in progress.

Keywords: Search, Matching, Sorting, Marriage, Divorce, Unemployment

JEL Classifications: J12, J31, J64, E24, E32, D10

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*First draft: January 2018. We thank Stéphane Bonhomme, Natalia Danzer, Matthias Doepke, Greg Kaplan, Helmut Rainer, and Michèle Tertilt for insightful comments and suggestions. Almut Balleer and Brigitte Hochmuth provided excellent discussions of our paper. Feedback from seminars in Munich and Aarhus and from the 2018 SaM, SEHO, SMYE, NORMAC, ES-EM, ES-EWM, CESifo, DFG SPP 1764 conferences, the 2019 T2M, EALE, VfS and DTMC conferences, and the CERGE-EI workshop on Gender and Family in the Labor Market has greatly improved the paper. This work started as part of the ifo Institute's research project "Economic Uncertainty and the Family" (EcUFam). We gratefully acknowledge financial support from the Leibniz Association and thank Patrick Schulze and Philipp Hochmuth for excellent research assistance. Bastian Schulz thanks the Aarhus University Research Foundation (Grant no. AUFF-F-2018-7-6), and the Dale T. Mortensen Centre at the Department of Economics and Business Economics, Aarhus University, for financial support. The numerical results presented in this work were obtained at the Centre for Scientific Computing, Aarhus University. Contact: christian.holzner@econ.lmu.de; bastian.schulz@econ.au.dk

1 Introduction

Among the many choices individuals make during their lifetime marriage is one of the most, if not the most, important decision. The marriage vow to be true to each other in good times and in bad, in sickness and in health and to love and honor each other for as long as one shall live reminds both partners that this is truly a decision taken under uncertainty. Strokes of fate like unexpected unemployment and severe sickness can stress a partnership and cause partners to drift apart and divorce.

The relative importance of economic shocks compared to other shocks disrupting a marriage is still poorly understood. The economic literature has documented that unemployment, especially male unemployment, is associated with an increase in the divorce rate.[1] Also, we know that marriage and divorce rates are negatively correlated with the unemployment rate over the business cycle.[2] Additionally, we know that marriage rates declined since the 1970s and that assortative matching with respect to education has increased.[3] Researchers have proposed explanations based on improvements in household technology since World War II and increased female labor supply,[4] as well as increased incentives for females to invest in education.[5] Very little is known, however, about the nature of the channels that connect marriage market decisions to the underlying source of economic shocks.

To investigate the importance of economic shocks, we integrate labor market shocks into a two-sided marriage market model with transferable utility and ex-ante heterogeneous men and women (Shimer and Smith, 2000; Jacquemet and Robin, 2013; Goussé et al., 2017). Individuals search for partners in the marriage market and, at the same time, switch between employment and unemployment. The employment statuses of both partners influence utility flows and the sharing of resources within the household. A negative shock, i.e., job loss of one spouse, may decrease the marital surplus sufficiently to trigger a divorce. Additionally, an idiosyncratic component captures non-economic factors of marriage (e.g. mutual affection). It is subject to shocks and may lead to separations as well. A complementarity in the household production function induces the tendency to sort positively. Given the German context, we also consider benefits from joint taxation, which have the opposite effect and encourage negative sorting. In the model, the balance between all these forces determines marriage and divorce flows, differentially across heterogeneous men and women.

[1] See Jensen and Smith (1990), Hansen (2005), and Amato and Beattie (2011) among others.

[2] See Schaller (2013), González-Val and Marcén (2017a), and González-Val and Marcén (2017b) among others.

[3] Both Doepke and Tertilt (2016) and Greenwood et al. (2017) offer excellent literature overviews, the latter with some cross-country facts.

[4] See Greenwood et al. (2005a) and Greenwood et al. (2005b). More recently, Greenwood et al. (2016) use a search model to analyze these trends empirically for the U.S. with an emphasis on sorting.

[5] See Nick and Walsh (2007); Chiappori et al. (2009)

The relative importance of each of these forces is an open empirical question. We thus take our model to the data. Using German micro data from various sources, we use our model as a tool to decompose marriage and divorce flows into the respective contributions of economic and non-economic forces. To this end, we develop a structural estimation procedure that allows us to back out key components of our model from the data. We estimate meeting rates, marriage probabilities, and separation rates, all differentiated according to individuals' education and labor market status.

The marriage rate depends on an individual's chance to meet somebody from a certain education group times the probability he/she is willing to marry. We show that the probabilities to marry (willingness to marry) upon meeting is highest for employed individuals with equally educated partners. A similar positive assortative matching pattern emerges for medium and highly educated individuals in all other labor market status combinations (male employed/female unemployed, male unemployed/female employed, and male unemployed/female unemployed). Low educated females still have reasonably high chances to marry with a medium or highly educated male if they stay out of the labor force (remain unemployed), most likely because of the high financial incentives provided by joint income taxation in Germany. Low educated, unemployed males have almost no chances to marry. Marriage rates are also driven by an individual's chance to meet somebody from a certain education group. Our estimates suggest that medium and highly educated individuals direct their search such that the number of meetings with individuals from the other sex with similar education level are higher than the number of meetings with lower educated individuals. Conversely, our estimates tend to suggest random meetings for low educated individuals.

We finally decompose the number of divorces into economic (labor market) factors and non-economic factors and show how their contributions evolve over time. The overall majority of divorces is driven by non-economic factors. Overall, less than 10% of divorces are due to labor market transitions of one spouse. However, the share of "labor market divorces" exhibits very interesting dynamics, it has increased by more than 20% since the mid 2000s. We take a granular view and investigate which types of heterogeneous couples have started to divorce more frequently in response to labor market transitions. Surprisingly, we find that positively sorted couples are the major contributor to this trend. In our sample, the largest and growing share of labor market divorces can be attributed to couples in which a previously unemployed highly educated female starts working. On the other hand, low education couples with a high likelihood of job loss contribute a shrinking number of labor market divorces. Both trends might be related to the booming German labor market. Low separation rates make marriages among low education individuals more stable. With high education, the option value of going on the marriage market with good employment perspectives can outweigh the value of staying married.

2 New Empirical Section

2.1 Data Sources

How do we link the data?

SOEP

IAP-PASS

Descriptives

By SOEP, PASS, and joint.

2.2 Empirical Analysis related to Modeling Choices

Labor Market Divorces

- Link to Folke and Rickne (2020), who do not find empirical support for the hypothesis that that job promotions give women the necessary independence to get a divorce. This supports an abstraction from labor market divorces due to promotions (job mobility). Note that the women in Folke and Rickne (2020) are already earning high wages before their promotions and likely work full time. So they don't consider the intensive margin choice of allocating time either to home production or to the labor market, which we focus on.

- Discuss Event Studies here: Happier after divorce? Who initiated?

- Labor Market reforms/Mini-jobs: Impact on female employment, transition rates, by age and education. See for example Weinkopf (2199), Burda and Seele (2017), Burda and Seele (2020). More literature that looks at the gender dimension of the German labor market?

- Linked Transitions: Show dependence patterns of transition rates -> Certain decisions in the two markets are linked

Related to the Surplus Function

- Does the divorce rate change if the income of one spouse rises due to job-to-job mobility? For husband and wife, by age and education.

- Does the married female (male) job finding rate fall in the husband's (wife's) income? By age and education.

Related to Search on the Job

- Do joint labor market transition (within one year, no divorce) lead to wage cuts for women (men)?

Marital Wage Premium

The marital wage premium (MWP) is a common empirical finding: married men earn more than single men. Married women earn less than single women. Moreover, the MWP is increasing in spousal education, which is hard to reconcile with a theory of household specialization (Pilossoph and Wee, 2021).

- Check in our data.
- Which model mechanisms are related to the MWP?
    1. *Not* search intensity, because single and married employed men have the same search intensity
    2. First selection margin: high-earning men are likely to get married, less likely to get divorced.
    3. Second selection margin, related to the wage offer distribution.

The Gender Wage Gap

If labor market divorces are quantitatively important, one implication of improved employment opportunities (Hartz reforms?) and resulting lower marital stability would be a decreasing wage gap.

- We should quantify the gender wage gap in our data, and see how it evolves over time. Both raw, explained, and residual gender wage gap.
- Where is the gender wage gap in our model? Should follow from the wage earnings distribution by gender.
- Is this a targeted or untargeted moment?
- Equally interesting would be to look at the model implications for marriage market sorting (selection out of marriage due to labor market divorces) and, additionally, within and between household inequality.

3 Theory

3.1 Preferences

The following frictional marriage and divorce model in the spirit of Shimer and Smith (2000) and Jacquemet and Robin (2013) incorporates labor market transitions and their influence on marriage and divorce decisions.

We consider a world with an exogenous number of males and females of type i or j denoted by n_i and n_j, respectively. In the empirical part we will have 20 types for both gender, which are the combination of 4 age groups and 5 education categories. Individuals discount the future at rate r.

All individuals can be employed or unemployed. Their labor market status of a woman (man) is indexed by l $(-l)$. For simplicity, we consider only employment (indexed by e) and unemployment (indexed by u), i.e., $l \in \{e, u\}$. Unemployment can be either voluntary or unvoluntary. The transition rates from unemployment to employment and from one job to another depend on the individuals' search intensity choice σ_m (σ_f) and an exogenous contact rate μ_i (μ_j), while the transition rate from employment into unemployment q_i (q_j) is assumed to be exogenous. We index male and female choice variables by m and f, the exogenous type-specific variables of man and women by i and j, and the exogenous gender specific variables by y for male and x for female. The type-specific wage offer distributions $F_i(w_i)$ and $F_j(w_j)$ for i and j are exogenously given, where the lower bounds are denoted by $\underline{w}_i$ and $\underline{w}_j$ and upper bounds are set to infinity.

Individuals' utility, $u(c, e, y)$, depends on private consumption c, private leisure e, and the household public good y. We assume that household production of a single female (similar for males) depends on her endogenous time input h_f and other exogenous characteristics X_j^l, which chapture a person's education level j and employment status l and household characteristics like number and age of children in the household, i.e., $y = H_j\left(h_f, X_j^l\right)$. Since our model captures labor market search on and off the job we abstract from endogenizing labor supply and assume that the number of working hours l_j^l are exogenously given. The time constraint for a single individual is hence given by $\overline{h} = h_f + e_f + l_j^l$. Like Gousse et al. (2017) we assume that the hours' constraint is never binding, i.e., $\overline{h}$ is sufficiently large. Private consumption equals labor income $(c_f = I_j^l)$ which is either equal to wage income w_j in case of employment or to unemployment income b_j in case of unemployment.

The present value of being a single V_j^l (employed and unemployed) satisfies the Bellman equation,

$$
\begin{aligned}
rV_j^l &= \max_{h_f,e_f} u\left(c_f,e_f,y\right) \qquad (1)\\
&+\sum\nolimits_i \lambda^{ul} s_i^u \int \max\left[V_{j,i}^{l,u}\left(z'\right)-V_j^l,0\right] dG\left(z'\right)\\
&+\sum\nolimits_i \lambda^{el} s_i^e \iint \max\left[V_{j,i}^{l,e}\left(z',w_i\right)-V_j^l,0\right] dG\left(z'\right) dH_i\left(w_i\right)\\
&+\max_{\sigma_f}\left[\sigma_f\mu_j\int \max\left[V_j^e\left(w_j'\right)-V_j^l,0\right] dF_j\left(w_j'\right)-c\left(\sigma_f\right)\right]\\
&+q_j\left[V_j^u\left(b_j\right)-V_j^l\left(I_j^l\right)\right],\\
&\text{s.t. } y=H_j\left(X_j^l,h_f\right),\ c_f\leq I_j^l,\ h_f+e_f\leq\overline{h}-l_j^l.
\end{aligned}
$$

Singles search in the marriage market for a partner and meet a partner at the labor market status specific specific meeting rate λ^{-ll}, where we denote the labor market status of a single male by $-l$ and the labor market status of a single female by l.

The wage earnings distribution for employed singles of type i, i.e., $H_i\left(w_i\right)$, it is endogenously determined. A meeting only results in a marriage if the value of being married exceeds the value of being single, i.e., $V_{j,i}^{l,-l}\left(.\right)-V_j^l>0$. Singles also switch between being unemployed and being employed. Unemployed and also employed workers choose their search intensity σ_f given the expected gains from searching and the convex search cost function $c\left(\sigma_f\right)$. Employed workers lose their job at the exogenous rate q_j.

Household public good production of married couples depends on the time input of both spouses $\left(h_m,h_f\right)$, and other exogenous characteristics X_{ij}^{-ll}, which chapture spouses' education and age as well as household characteristics like number and age of children in the household, and on an idiosyncratic bliss shock $z\in[0,\infty)$ drawn from the cumulative probability distribution G, i.e., $y=H_{ij}\left(z,h_m,h_f,X_{ij}^{-ll}\right)$. Private consumption of man and woman respectively are given by $c_m=I_i^{-l}-t$ and $c_f=I_j^l+t$, where t denotes the transfer from the man to the woman, which is renegotiated every time a bliss shock or a labor market transition occurs. The time inputs into household production $\left(h_m,h_f\right)$ as well as the search intensities for job search $\left(\sigma_m,\sigma_f\right)$ are determined with the transfer t by Nash-Bargaining.

The flow value of a married female $rV_{f,i}^{l,-l}$ for any given transfer t, $\left(h_m,h_f\right)$, and

(σ_m, σ_f) is given by,

$$
\begin{aligned}
rV_{f,i}^{l,-l} &= \max_{h_f, e_f} u\left(c_f, e_f, y\right) \qquad (2)\\
&+ \max_{\sigma_f}\left[\sigma_f \mu_j \int \left[\max\left[V_j^e\left(w_j'\right), V_{j,i}^{e,-l}\left(w_j'\right)\right] - V_{f,i}^{l,-l}\right] dF_j\left(w_j'\right) - c\left(\sigma_f\right)\right]\\
&+ q_j\left[\max\left[V_j^u, V_{j,i}^{u,-l}\right] - V_{f,i}^{l,-l}\right]\\
&+ \sigma_m \mu_i \int \left[\max\left[V_j^l, V_{j,i}^{l,e}\right] - V_{f,i}^{l,-l}\right] dF_i\left(w_i'\right)\\
&+ q_i\left[\max\left[V_j^l, V_{j,i}^{l,u}\right] - V_{f,i}^{l,-l}\right]\\
&+ \delta \int \left[\max\left[V_j^l, V_{j,i}^{l,-l}\left(z'\right)\right] - V_{f,i}^{l,-l}\right] dG\left(z'\right),
\end{aligned}
$$

$$
\text{s.t. } y = H_{ij}\left(z, h_m, h_f, X_{ij}^{-ll}\right),\ c_f = I_j^l + t,\ h_f + e_f \leq \overline{h} - l_j^l
$$

The household time input h_f is determined by Nash-Bargaining subject to the time constraint $h_f + e_f \leq \overline{h} - l_j^l$, and the optimal search intensity σ_f given the expected gains from searching and the convex search cost function $c(\sigma_f)$. $V_{j,i}^{e,-l}\left(w_j'\right)$ denotes the present value of the renegotiated new marriage contract after accepting a new job offering the wage w_j'. $V_j^e\left(w_j'\right)$ denotes the present value of being single if accepting a new job with wage w_j' leads to a divorce. A divorce can also occur if the individual loses the job (third row on the rhs). Similarly, a new job (fourth row on the rhs) or job loss of the partner (fifth row on the rhs) can lead to divorces. In the first case, the partner carries the associted search cost $c(\sigma_m)$. A divorce can also be triggered by a bliss shock (sixth row on the rhs). In which case $V_{j,i}^{l,-l}(z')$ denotes the present value of staying married after the renegotation following a bliss shock realization z'.

Individuals do not make long-run commitments. If a labor market transition or a bliss shock occurs, both partners renegotiate the transfers t, household production (h_m, h_f), and the search intensities (σ_m, σ_f) such that the Nash-Product,

$$
\left[V_{j,i}^{l,-l} - V_j^l\right]^{\beta_x}\left[V_{m,j}^{-l,l} - V_i^{-l}\right]^{\beta_y}, \qquad (3)
$$

is maximized. The bargaining power of the male and the female are given by β_x and β_y, with $\beta_x + \beta_y = 1$. V_j^l (V_i^{-l}) is the outside option of the single female (male) individual. If the marital surplus is positive for both individuals, i.e., $V_{j,i}^{l,-l} - V_j^l > 0$, both individuals marry.

3.2 Equilibrium solutions

3.2.1 Bargaining and transfer

Spouses decide on the transfers t, household production (h_m, h_f), and the search intensities (σ_m, σ_f) such that the Nash-Product (3) is maximized. If the marital surplus, denoted by S_{ij}^{-ll}, is positive then the optimal transfer is chosen such that the surplus is splitt according to the following rule,

$$V_{i,j}^{-l,l} - V_i^{-l} = \beta_y S_{ij}^{-ll} \text{ and } V_{j,i}^{l,-l} - V_j^{l} = \beta_x S_{ij}^{-ll}. \tag{4}$$

3.2.2 Household production

We assume quasi-linear preferences in consumption and leisure and a Cobb-Douglas household production function, i.e.,

$$\begin{aligned} u\left(c_f, e_f, y\right) &= c_f + \zeta_x e_f + y, \qquad (5)\\ \text{with } y &= \begin{cases} \left(X_j^l\right)^{1-\alpha_x} \left(h_f\right)^{\alpha_x} & \text{if single female,} \\ \left(z X_{ij}^{-ll}\right)^{(1-\gamma_y-\gamma_x)} \left(h_m\right)^{\gamma_y} \left(h_f\right)^{\gamma_x} & \text{if married.} \end{cases} \end{aligned}$$

As shown in Appendix A.1 these assumptions allow us to write the marital utility for a female and a male of type ij and labor market status $-ll$ as follows,

$$\begin{aligned} v_{ij}^{-ll}(z) &\equiv v_{i,j}^{-l,l} + v_{j,i}^{l,-l} - v_i^{-l} - v_j^{l} \qquad (6)\\ &= \left(\xi_{y,x} + \xi_{x,y}\right) z X_{ij}^{-ll} - \xi_y X_i^{-l} - \xi_x X_j^{l}, \end{aligned}$$

where ξ_x, ξ_y, $\xi_{y,x}$, and $\xi_{x,y}$ only depend on exogenous parameters as shown in Appendix A.1. The linearity in consumption implies that income changes, e.g. due to a job-to-job transition, affects the couples' joint utility $v_{i,j}^{-l,l} + v_{j,i}^{l,-l}$ in the same way as both individuals' utilities as singles, i.e., $v_i^{-l} + v_j^{l}$. Thus, any income gain/loss associated with a job change or a job loss increases/decreases the private consumption level of the person experiencing the gain/loss. As a consequence the quasi-linearity assumption in consumption guarantees that the marital utility is independent of spouses' current income.

3.2.3 Search intensities

The optimal search intensities of single and married individuals are given by (see Appendix A.1 for the derivation),

$$c'\left(\sigma_j^u\right) = \mu_j \int_{R_j^u}^{\infty} \frac{1 - F_j\left(w_j'\right)}{r + q_j + \sigma_j^e\left(w_j'\right)\mu_j\left[1 - F_j\left(w_j'\right)\right]} dw_j', \tag{7}$$

$$c'\left(\sigma_j^e\left(w_j\right)\right) = c'\left(\sigma_{j,i}^{e,-l}\left(w_j\right)\right) = \mu_j \int_{w_j}^{\infty} \frac{1 - F_j\left(w_j'\right)}{r + q_j + \sigma_j^e\left(w_j'\right)\mu_j\left[1 - F_j\left(w_j'\right)\right]} dw_j' \tag{8}$$

$$\begin{aligned} c'\left(\sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}(z)\right)\right) &= c'\left(\sigma_{j,i}^{e,-l}\left(R_{j,i}^{u,-l}(z)\right)\right) \qquad (9)\\ &\quad + \frac{\mu_j}{r}\left[R_j^u - R_{j,i}^{u,-l}(z)\right]\left[1 - F_j\left(R_{j,i}^{u,-l}(z)\right)\right], \end{aligned}$$

respectively, where R_j^u and $R_{j,i}^{u,-l}(z)$ denote the reservation wage of single and married females with type j and labor market status l. The search intensity condition of a single (7) is equal to the usual condition in the literature. The optimal search intensities of employed and unemployed singles differ only due to the reservation wages. Since the reservation wage of unemployed singles R_j^u, which we describe in detail below, is lower than the reservation wage of employed singles, which is equal to their current wage w_j, unemployed singles search (weakly) less than employed singles. As equation (8) shows the search intensity of an employed spouse $\sigma_{j,i}^{e,-l}(w_j)$ earning a wage w_j is equal to the search intensity of an employed single $\sigma_j^e(w_j)$ earning the same wage. This follows from the fact that an individual income change - without a labor market status change - only affects the individual's private consumption but not the marital flow utility. Hence for an employed married worker, who only changes the job, the gains form searching are the same as for an employed single worker. This is different for married unemployed workers. Since they adjust their household time input if they start to work, the marital utility changes with the labor market status. This is also the reason why the reservation wage of an unemployed married individual $R_{j,i}^{u,-l}(z)$ depends on the bliss value z. Consequently the search intensity of an unemployed married individual $\sigma_{j,i}^{u,-l}(.)$ differs from the search intensity of an employed married individual $\sigma_{j,i}^{e,-l}(.)$ due to the associated losses or gains in the marital utility surplus, which in equation (9) is captured by the difference in the respective reservation wages.

3.2.4 Marital surplus

The marital surplus is - as already mentioned - independent of spouses' incomes. The quasi-linearity assumption ensures that the marital utility (6) will depend only on the couple's bliss value z but not on the current income of the partners. Furthermore, since household production and search intensities are chosen to maximize marital surplus, it follows from the Envelope Theorem that changes in spouses' income do not have an indirect effect on the surplus via household production and search intensities. As a result marital surplus $S_{ij}^{-ll}(z)$ is independent of spouses' income and can be written as follows,

$$\begin{aligned}
[r+\delta+q_i+q_j]\,S_{ij}^{-ll}(z) \quad = \quad & (\xi_{y,x}+\xi_{x,y})\,zX_{ij}^{-ll}-\xi_y X_i^{-l}-\xi_x X_j^{l} \\
&+\sigma_{i,j}^{-l,l}c'\left(\sigma_{i,j}^{-l,l}\right)-c\left(\sigma_{i,j}^{-l,l}\right)-\sigma_i^{-l}c'\left(\sigma_i^{-l}\right)+c\left(\sigma_i^{-l}\right) \\
&+\sigma_{j,i}^{l,-l}c'\left(\sigma_{j,i}^{l,-l}\right)-c\left(\sigma_{j,i}^{l,-l}\right)-\sigma_j^{l}c'\left(\sigma_j^{l}\right)+c\left(\sigma_j^{l}\right) \\
&+q_i\max\left[0,S_{ij}^{ul}(z)\right]+q_j\max\left[0,S_{ij}^{-lu}(z)\right] \\
&-\beta_y\textstyle\sum_j\sum_l\lambda^{-ll}s_j^l\displaystyle\int\max\left[S_{ij}^{-ll}(z'),0\right]dG(z') \\
&-\beta_x\textstyle\sum_i\sum_{-l}\lambda^{-ll}s_i^{-l}\displaystyle\int\max\left[S_{ij}^{-ll}(z'),0\right]dG(z') \\
&+\delta\int\max\left[S_{ij}^{-ll}(z'),0\right]dG(z'),
\end{aligned} \tag{10}$$

where we used the Bellman equations of single and married individuals (1) and (2), the optimal search intensity decisions, and the surplus splitting rule (4).

Since the marital surplus is independent of the current wages of both partners and is strictly increasing in the bliss value z we can define the divorce cutoff bliss values z_{ij}^{-ll}, for $-ll \in \{ee, ue, eu, uu\}$, at which the surplus is equal to zero, i.e., $S_{ij}^{-ll}\left(z_{ij}^{-ll}\right) = 0$. Partners with $z \geq z_{ij}^{-ll}$ will marry/stay married and partners with $z < z_{ij}^{-ll}$ will divorce. This allows us to write the probability α_{ij}^{-ll} that a couple of type ij and labor market status $-ll$ is willing to marry upon meeting as,

$$\alpha_{ij}^{-ll} = \left(1 - G\left(z_{ij}^{-ll}\right)\right). \tag{11}$$

3.2.5 Reservation wages

If an individual is employed the reservation wage is equal to the current wage irrsepective of whether the individual is single or married. If a single is unemployed then the reservation wage is defined by $V_j^e\left(R_j^u\right) = V_j^u$. Using the optimal search intensity conditions for singles (7) and (8), which implies that an unemployed individual is searching as much as an individual earning the reservation wage, we can write the reservation wage as follows,

$$R_j^u = b_j - \zeta_x\left(l_j^u - l_j^e\right) + \xi_y\left(X_j^u - X_j^e\right) + \beta_x \sum\nolimits_i \sum\nolimits_{-l}\left(\lambda^{-lu}\overline{S}_{z_{ij}^{-lu}}^{-lu} - \lambda^{-le}\overline{S}_{z_{ij}^{-le}}^{-le}\right) s_i^{-l}. \tag{12}$$

where $\overline{S}_{z_{ij}^{-ll}}^{-ll} \equiv \int_{z_{ij}^{-ll}}^{\infty} S_{ij}^{-ll}(z)\, dG(z)$. Since starting to work leads to less leisure, $l_j^u < l_j^e$, and different needs for houshold production, $X_j^u \neq X_j^e$, an individual that starts to work wants to be compensated for the associated utility losses (or gains). A change in the labor market status from unemployment to employment also affects the prospects in the labor market. The last term on the rhs in equation (12) captures the associated change in the option value of the marriage market.

A married individual takes in addition to a single into account which effect the accep-tence decision of a job has on martial surplus. Hence, the reservation wage of a married unemployed is given by (see Appendix A.1 for the derivation),

$$R_{j,i}^{u,-l}(z) = R_j^u + r\left(S_{ij}^{-lu}(z) - \max\left[0, S_{ij}^{-le}(z)\right]\right). \tag{13}$$

A married individual faces on top of a single individual additional gains or losses associted with the effect of a change in the labor market status on the marital surplus. If the bliss value z is high enough (above z_{ij}^{-le}) the individual will stay married and the marital surplus of a female of type j changes from unemployment $S_{ij}^{-lu}(z)$ to employmet $S_{ij}^{-le}(z)$. If the bliss value z is small (below z_{ij}^{-le}) the labor market transition will lead to a divorce and hence to a loss of the marial surplus, i.e., $S_{ij}^{-le}(z) = 0$.

3.3 Steady state flows and measures

The endogenous number of single females (males) of type j (i) and labor market status l ($-l$) is denoted by s_j^l (s_i^{-l}). By m_{ij}^{-ll} we denote the endogenous number of individuals in married couples of type ij and labor market status $-ll$.

The inflow, i.e., the number of new marriages of type ij and labor market status $-ll$ formed, is given by $\lambda^{-ll}\alpha_{ij}^{-ll}s_i^{-l}s_j^l$, where α_{ij}^{-ll} denotes the probability that a couple of type ij and labor market status $-ll$ is willing to marry upon meeting. There are additional inflows into the group m_{ij}^{-ll} from couples of labor market status $m_{ij}^{-l'l}$ and $m_{ij}^{-ll'}$ if one of the respective partners changes the labor market status. The probability that a couple stays together after a change of the labor market status from $-l'l$ to $-ll$ depends on whether the current bliss value z is above or below the new divorce cutoff z_{ij}^{-ll}. In case the considered person gets laid off, which happens at rate q_i (q_j), the probability that the couple stays together is equal to 1 if $z_{ij}^{-ll} \leq z_{ij}^{-l'l}$ and equal to $\alpha_{ij}^{-ll}/\alpha_{ij}^{-l'l} < 1$ if $z_{ij}^{-ll} > z_{ij}^{-l'l}$, i.e., equal to $\min\left[\left(\alpha_{ij}^{-ll}/\alpha_{ij}^{-l'l}\right),1\right]$. The respective transition rates for males and females are given by,

$$\overline{\tau}_{i,j}^{e,l} = q_i \min\left[\left(\alpha_{ij}^{ul}/\alpha_{ij}^{el}\right),1\right] \text{ and } \overline{\tau}_{j,i}^{e,-l} = q_j \min\left[\left(\alpha_{ij}^{-lu}/\alpha_{ij}^{-le}\right),1\right],$$

In case of an unemployment to employment transition, the respective probabilities that a couple stays together are given by integrating over the job finding rates for those individuals, who are married at bliss values above the new cutoff, i.e.,

$$\overline{\tau}_{i,j}^{u,l} = \begin{cases} \mu_i \int_{z_{ij}^{ul}}^{\infty} \sigma_{i,j}^{u,l}\left(R_{i,j}^{u,l}(z')\right)\left[1-F_i\left(R_{i,j}^{u,l}(z')\right)\right]dG(z') & \text{if } z_{ij}^{el} \leq z_{ij}^{ul}, \\ \mu_i \int_{z_{ij}^{el}}^{\infty} \sigma_{i,j}^{u,l}\left(R_{i,j}^{u,l}(z')\right)\left[1-F_i\left(R_{i,j}^{u,l}(z')\right)\right]dG(z') & \text{if } z_{ij}^{el} > z_{ij}^{ul}, \end{cases}$$

$$\overline{\tau}_{j,i}^{u,-l} = \begin{cases} \mu_j \int_{z_{ij}^{-lu}}^{\infty} \sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}(z')\right)\left[1-F_j\left(R_{j,i}^{u,-l}(z')\right)\right]dG(z') & \text{if } z_{ij}^{-le} \leq z_{ij}^{-lu}, \\ \mu_j \int_{z_{ij}^{-le}}^{\infty} \sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}(z')\right)\left[1-F_j\left(R_{j,i}^{u,-l}(z')\right)\right]dG(z') & \text{if } z_{ij}^{-le} > z_{ij}^{-lu}. \end{cases}$$

The outflow consists of divorces driven by love shocks, $\delta\left(1-\alpha_{ij}^{-ll}\right)$, and labor market transitions that lead to a divorce, $\underline{\tau}_{i,j}^{-l,l} + \underline{\tau}_{j,i}^{l,-l}$, where

$$\underline{\tau}_{i,j}^{e,l} = q_i\left[1-\min\left[\left(\alpha_{ij}^{ul}/\alpha_{ij}^{el}\right),1\right]\right] \text{ and } \underline{\tau}_{j,i}^{e,-l} = q_j\left[1-\min\left[\left(\alpha_{ij}^{-lu}/\alpha_{ij}^{-le}\right),1\right]\right],$$

$$\underline{\tau}_{i,j}^{u,l} = \begin{cases} 0 & \text{if } z_{ij}^{el} \leq z_{ij}^{ul}, \\ \mu_i \int_{z_{ij}^{ul}}^{z_{ij}^{el}} \sigma_{i,j}^{u,l}\left(R_{i,j}^{u,l}(z')\right)\left[1-F_i\left(R_{i,j}^{u,l}(z')\right)\right]dG(z') & \text{if } z_{ij}^{el} > z_{ij}^{ul}, \end{cases}$$

$$\underline{\tau}_{j,i}^{u,-l} = \begin{cases} 0 & \text{if } z_{ij}^{-le} \leq z_{ij}^{-lu}, \\ \mu_j \int_{z_{ij}^{-lu}}^{z_{ij}^{-le}} \sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}(z')\right)\left[1-F_j\left(R_{j,i}^{u,-l}(z')\right)\right]dG(z') & \text{if } z_{ij}^{-le} > z_{ij}^{-lu}, \end{cases}$$

plus labor market transitions without divorces but with a change in labor market status,

$\overline{\tau}_{i,j}^{-l,l} + \overline{\tau}_{j,i}^{l,-l}$. Equating in- and outflows implies,

$$\lambda^{-ll}\alpha_{ij}^{-ll}s_i^{-l}s_j^l + \overline{\tau}_{i,j}^{-l',l}m_{ij}^{-l'l} + \overline{\tau}_{j,i}^{l',-l}m_{ij}^{-ll'} = \left[\delta\left(1-\alpha_{ij}^{-ll}\right) + \underline{\tau}_{i,j}^{-l,l} + \overline{\tau}_{i,j}^{-l,l} + \underline{\tau}_{j,i}^{l,-l} + \overline{\tau}_{j,i}^{l,-l}\right]m_{ij}^{-ll}. \tag{14}$$

Let us now consider the flow equations for the respective single groups. The outflow of a single female of type j with labor market status l is given by the rate at which she marries with a single male of type i with labor market status $-l''$, i.e., the rate $\lambda^{-l''l}\alpha_{ij}^{-l''l}s_i^{-l''}$, plus the rate at which the single female changes her labor market status, i.e., the quitting rate $\tau_j^e = q_j$ in case of employment and the job finding rate $\tau_j^u = \mu_j\sigma_j^e\left(R_j^u\right)\left[1-F_j\left(R_j^u\right)\right]$ in case of unemployment. The inflow is given by the rate at which single females with the opposite labor market status l' change their status (at rate $\tau_j^{l'}$) and the rate at which the respective marriages break up. This happens when a bliss shock occurs ($\delta\left(1-\alpha_{ij}^{-l''l}\right)m_{ij}^{-l''l}$) or when married women (men) in marriages with labor market status combination $-l''l$ ($-l''l'$) changes the labor market status at rate $\underline{\tau}_{j,i}^{l',-l''}$ ($\underline{\tau}_{i,j}^{-l'',l}$). Equating in- and outflows implies,

$$\begin{aligned} & \tau_j^{l'}s_j^{l'} + \sum_i\sum_{-l''}\left(\delta\left(1-\alpha_{ij}^{-l''l}\right) + \underline{\tau}_{i,j}^{-l'',l}\right)m_{ij}^{-l''l} + \sum_i\sum_{-l''}\underline{\tau}_{j,i}^{l',-l''}m_{ij}^{-l''l'} \\ = & \sum_i\sum_{-l''}\lambda^{-l''l}\alpha_{ij}^{-l''l}s_i^{-l''}s_j^l + \tau_j^l s_j^l. \end{aligned} \tag{15}$$

To get the number of singles of a certain type and labor market status we use the market clearing condition, i.e.,

$$n_j = s_j^l + s_j^{l'} + \textstyle\sum_i\sum_{-l''}\sum_l m_{ij}^{-l''l}.$$

Substituting and rearranging then implies the following formula for singles of type j and labor market status l,

$$\begin{aligned} s_j^l = & \frac{\sum_i\sum_{-l''}\left(\delta\left(1-\alpha_{ij}^{-l''l}\right) + \underline{\tau}_{i,j}^{-l'',l}\right)m_{ij}^{-l''l} + \sum_i\sum_{-l''}\underline{\tau}_{j,i}^{l',-l''}m_{ij}^{-l''l'}}{\tau_j^l + \tau_j^{l'} + \sum_i\sum_{-l''}\lambda^{-l''l}\alpha_{ij}^{-l''l}s_i^{-l''}} \\ & + \frac{\tau_j^{l'}\left(n_j - \sum_i\sum_{-l''}\sum_l m_{ij}^{-l''l}\right)}{\tau_j^l + \tau_j^{l'} + \sum_i\sum_{-l''}\lambda^{-l''l}\alpha_{ij}^{-l''l}s_i^{-l''}}. \end{aligned} \tag{16}$$

The measures of singles are obtained by finding the fixed point of the system of equations (14) and (16) for all m_{ij}^{-ll}, s_i^{-l} and s_j^l.

Let us know derive the steady state wage earnings distribution $H_j(w_j)$ for individuals of type j. Firms only offer wages above the lowest reservation wage of singles and married individuals, i.e., $w_j \geq \min\left[R_j^u, R_{j,i}^{u,u}\left(z_{ij}^{uu}\right), R_{j,i}^{u,e}\left(z_{ij}^{eu}\right)\right]$. The inflow of singles into the group of individuals earning a wage no higher than w_j is therefore given by $\mu_j\sigma_j^u\left[F_j(w_j) - F_j\left(R_j^u\right)\right]s_j^u$. The probability that married individuals enter employment at a wage no higher than w_j is given by $\mu_j \sigma_{j,i}^{u,-l''}(z) \max\left[F_j(w_j) - F_j\left(R_j^{u,-l''}(z)\right), 0\right]$, i.e., it is zero if the reservation wage exceeds the wage w_j. The outflow of employed workers with type j earning a wage w_j is either due to the exogenous job separation shock or because they found a better paying job. In steady state inflows have to equal outflows, i.e.,

$$\begin{aligned}
& \mu_j \sigma_j^u \left[F_j(w_j) - F_j\left(R_j^u\right)\right] s_j^u \qquad (17) \\
& + \mu_j \sum_i \sum_{-l'' \in \{u,e\}} \int_{z_{ij}^{-l''u}}^{\infty} \sigma_{j,i}^{u,-l''}\left(R_{j,i}^{u,-l''}(z')\right) \max\left[F_j(w_j) - F_j\left(R_{j,i}^{u,-l''}(z')\right), 0\right] dG(z')\, m_{ij}^{-l''u} \\
= & \left[q_j H_j(w_j) + \mu_j \left[1 - F_j(w_j)\right] \int_{\min\left[R_j^u, R_{j,i}^{u,u}\left(z_{ij}^{uu}\right), R_{j,i}^{u,e}\left(z_{ij}^{eu}\right)\right]}^{w_j} \sigma_j^e\left(w_j'\right) dH_j\left(w_j'\right)\right] \times \\
& \left(s_j^e + \textstyle\sum_i \sum_{-l''} m_{ij}^{-l''e}\right).
\end{aligned}$$

3.4 Equilibrium

The equilibrium is characterized by a set of surplus functions $S_{ij}^{-ll}(z)$, search intensities for unemployed married and single individuals $\left\{\sigma_{i.j}^{u,l}(z), \sigma_{j,i}^{u,-l}(z)\right\}$ and $\left\{\sigma_i^u, \sigma_j^u\right\}$, cutoff bliss values z_{ij}^{-ll}, and joint distributions of married couples m_{ij}^{-ll} for each type ij and labor market status $-ll$ as well as the measure of singles s_i^{-l} and s_j^l of type i (j) and labor market status $-l$ (l). We compute the equilibrium in the following way: Given a set of initial conditions, the cutoff bliss values z_{ij}^{-ll} determine $\alpha_{ij}^{-ll} \equiv \left(1 - G\left(z_{ij}^{-ll}\right)\right)$. Given α_{ij}^{-ll} we can use equations (14), (40) and (39), i.e., a set of four equations for m_{ij}^{-ll} for each $-ll \in \{ee, ue, eu, uu\}$ and a set of two equations determining s_i^{-l} and s_j^l for each $l \in \{e, u\}$, respectively, to compute m_{ij}^{-ll}, s_i^{-l} and s_j^l. The number of singles s_i^{-l} and s_j^l of type i (j) and labor market status $-l$ (l) enter the surplus functions $S_{ij}^{-ll}(z)$ for all types ij and labor market status $-ll$. The bliss values z_{ij}^{-ll} for all types ij and labor market status combinations $-ll$ are then pinned-down at a value such that the respective surplus is zero, i.e., $S_{ij}^{-ll}\left(z_{ij}^{-ll}\right) = 0$. The problem involves alternating between solving the fixed-point systems of $S_{ij}^{-ll}(z)$, $\left\{\sigma_{i,j}^{u,l}(z), \sigma_{j,i}^{u,-l}(z)\right\}$ and $\left\{\sigma_i^u, \sigma_j^u\right\}$ on the one hand and z_{ij}^{-ll} on the other hand until convergence. Appendix A.2 describes in detail how the fixed point system is computed numerically.

4 Structural Estimation

4.1 Model parameters

The following functional form assumptions help us to keep the set of parameters limited to a manageable size.

4.1.1 Types, preferences and household production parameters

Females and males are of different types, indexed by i and j. We allow for 20 different types, which are the combination of 4 age groups and 5 education categories. The age groups are 21 to 30, 31 to 40, 41 to 50, and 51 to 60 year olds. The five education categories are defined by the years of education (the exact definition is given in Appendix B.1). The years of education range from 9 years of education (compulsory years of schooling) to 17 years of eduction for individuals with a university degree or higher. The respective type-distributions n_i and n_j, i.e., the gender specific densities over types, are taken from the data.

The preference and household production parameters are assumed to be only gender specific. The female and male leisure parameters, ζ_x and ζ_y, the household production parameters of single females and males, α_x and α_y, and the household production parameters for married females and males, γ_x and γ_y, are estimated via GMM as described below. The bargaining power parameters β_x and β_y are also assumed to be independent of the individuals' type and labor market status set equal to 0.5. Similarly, the interest rate r is set to 0.05.

The household public good is assumed to depend on age, years of education, and the existence of certain age-groups of children in the household. As inputs into our estimation we take the sample means of the respective type-groups, where we differentiate the type-groups with respect to marriage and labor market status if there is some variation across marriage and labor market status within a given type-group like in age and children in the household. By construction there is no variation in the years of education. The household public good of a single female or male are assumed to have the following functional form,

$$\begin{aligned} X_i^{-l} &= \beta^0_{X_i^l} + \beta^1_{X_i^l} \ln\left(age_i^{-l}\right) + \beta^2_{X_i^l} \ln(edu_i) + \beta^3_{X_i^l} kid05_i^{-l} + \beta^4_{X_i^l} kid614_i^{-l}, \quad (18)\\ X_j^{l} &= \beta^0_{X_j^l} + \beta^1_{X_j^l} \ln\left(age_j^{l}\right) + \beta^2_{X_j^l} \ln(edu_j) + \beta^3_{X_j^l} kid05_j^{l} + \beta^4_{X_j^l} kid614_j^{l}, \quad (19)\end{aligned}$$

for $-l, l \in \{e, u\}$. In case of married couples the household public good also depends on the age- and education-difference between spouses, i.e.,

$$\begin{aligned} X_{ij}^{-ll} = \; & \beta^0_{X_{ij}^{-ll}} + \beta^1_{X_{ij}^{-ll}} \ln\left(age_i^{-l}\right) + \beta^2_{X_{ij}^{-ll}} \ln\left(age_j^{l}\right) + \beta^3_{X_{ij}^{-ll}} \left|age_i^{-l} - age_j^{l}\right| \quad (20)\\ & + \beta^4_{X_{ij}^{-ll}} \ln\left(edu_i\right) + \beta^5_{X_{ij}^{-ll}} \ln\left(edu_j\right) + \beta^6_{X_{ij}^{-ll}} \left|edu_i - edu_j\right| \\ & + \beta^7_{X_{ij}^{-ll}} kid05_{ij}^{-ll} + \beta^8_{X_{ij}^{-ll}} kid614_{ij}^{-ll}, \end{aligned}$$

for $-ll \in \{ee, ue, eu, uu\}$. The set of $\beta^{\cdot\cdot}_{X_{\cdots}}$-parameters is estimated via GMM.

4.1.2 Labor market parameters

The job-finding probabilities depend on the exogenous type-specific meeting rates μ_i and μ_j and the endogenous search intensity σ. The type-specific meeting rates are parameterized by age and years of education associated with the respective type, i.e.,

$$\mu_i = \beta^0_{\mu_i} + \beta^1_{\mu_i} \ln(age_i) + \beta^2_{\mu_i} \ln(edu_i) \text{ and } \mu_j = \beta^0_{\mu_j} + \beta^1_{\mu_j} \ln(age_j) + \beta^2_{\mu_j} \ln(edu_j).$$

Here, the sample means age_i and age_j are calculated independent of the labor market status of the individuals, because our model assumes the same meeting rates for both off and on-the-job search. The search intensity is determined by cost of searching and the potential wage gains. To simplify the compuation of the fixed point we assume that the search cost function follows a quadratic function, i.e.,

$$c(\sigma) = \frac{1}{2}\sigma^2.$$

The gains from searching depend (among others) on the wage offer distribution, which we assume to follow a truncated exponential-distributions, i.e.,

$$F_i(w_i) = 1 - \frac{e^{-\vartheta_i w_i}}{e^{-\vartheta_i \underline{w}_i}} \text{ and } F_j(w_j) = 1 - \frac{e^{-\vartheta_j w_j}}{e^{-\vartheta_j \underline{w}_j}},$$

where the type-specific shape parameters are again a function of age and years of education, i.e.,

$$\vartheta_i = \beta^0_{\vartheta_i} + \beta^1_{\vartheta_i} \ln(age_i) + \beta^2_{\vartheta_i} \ln(edu_i) \text{ and } \vartheta_j = \beta^0_{\vartheta_j} + \beta^1_{\vartheta_j} \ln(age_j) + \beta^2_{\vartheta_j} \ln(edu_j).$$

The lower bounds of the wage offer distributions $\underline{w}_i$ and $\underline{w}_j$ are taken from the data. The type specific lower bound equals the wage at the first quantile of the wage earnings distribution. The functional form assumption implies an infinite upper bound. The type-specific levels of unemployment benefits b_i and b_j that also influence the search intensity via the reservation wage are taken from the data. The reservation wage also depends on the forgone time associated with taking up work. The forgone time is measured by the difference in working hours associated with employment and unemployment, $l^u_j - l^e_j$. The respective l^u_j and l^e_j are also taken from the data.

The job destruction rates are assumed to be functions of age, years of education and children in the household, i.e.,

$$\begin{aligned} q_i &= \left(1 + \exp\left(\beta^0_{q_i} + \beta^1_{q_i} \ln(age^e_i) + \beta^2_{q_i} \ln(edu_i) + \beta^3_{q_i} kid05^e_i + \beta^4_{q_i} kid614^e_i\right)\right)^{-1}, \\ q_j &= \left(1 + \exp\left(\beta^0_{q_j} + \beta^1_{q_j} \ln\left(age^e_j\right) + \beta^2_{q_j} \ln(edu_j) + \beta^3_{q_j} kid05^e_j + \beta^4_{q_j} kid614^e_j\right)\right)^{-1}. \end{aligned}$$

The dependence on children in the household captures the fact that parents (married or single parent) are less likely to experience an EU-transition. The parameter sets $\left\{\beta_{\mu\cdots}^{\cdots}\right\}$,$\{\beta_{\vartheta\cdots}^{\cdots}\}$, and $\left\{,\beta_{q\cdots}^{\cdots}\right\}$ are estimated via GMM as described below.

4.1.3 Marriage market parameters

We assume that the meeting rates in the marriage market λ^{-ll} are labor market status specific, i.e., vary with $-ll \in \{ee, ue, eu, uu\}$. A matching only occurs if both find the job acceptable, which depends on the bliss value z. We assume that bliss values z are log-normally distributed, i.e.,

$$G(z) = \Phi\left(\frac{\ln z - \mu_z}{\sigma_z}\right),$$

with the mean and standard deviation given by μ_z and σ_z. The distribution is assumed to be the same for all types. We also assume that the bliss shock parameter δ is the same for all married couples. The parameter set $\{\lambda^{\cdots}, \mu_z, \sigma_z, \delta\}$ is also estimated via GMM.

4.1.4 Set of paramters

We have three different types of parameter sets, (i) the parameters that are fixed without estimation $\{r, \beta_x, \beta_y\}$, (ii) the input parameters $\{age_{\cdots}^{\cdots}, edu_{\cdots}, kid05_{\cdots}^{\cdots}, kid614_{\cdots}^{\cdots}\}$ and $\left\{n_i, n_j, \underline{w}_i, \underline{w}_j, b_i, b_j, l_i^{\cdots}, l_j^{\cdots}\right\}$ taken from the data, and (iii) the parameter sets $\{\zeta_x, \zeta_y\}$, $\{\alpha_x, \alpha_y, \gamma_x, \gamma_y\}$, $\left\{\beta_{X\cdots}^{\cdots}\right\}$, $\left\{\beta_{\mu\cdots}^{\cdots}\right\}$, $\{\beta_{\vartheta\cdots}^{\cdots}\}$, $\left\{\beta_{q\cdots}^{\cdots}\right\}$, and $\{\lambda^{\cdots}, \mu_z, \sigma_z, \delta\}$ estimated via GMM using the following identification strategy.

4.2 Identification and GMM estimation

We estimate our model parameters using GMM. Given that our model is highly non-linear we do not have a one-to-one relationship between moments and estimated parameters. Nevertheless, certain parameters are very closely linked to certain labor or marriage market transitions. We will therefore base our identification mainly on labor and marriage market transitions. In the case of the parameters determining the household public good we will in addition use the time input into household production.

In our data we observe the marriage market status only on a yearly basis. We therefore regard time as discrete and allow for simultaneous labor and marriage market transitions.

4.2.1 Marriage and divorce parameters

Marriage market transitions identify mainly the parameters $\{\lambda^{\cdots}, \mu_z, \sigma_z, \delta\}$. To see this note that the transition probability $\Pr\left(s_j^l \to m_{ij}^{-ll}\right)$ that a single female of type j with labor market status l in period t is married to a type i male with labor market status

$-l$ in period $t+1$ depends on λ^{-ll} and $\alpha_{ij}^{-ll} = 1 - G\left(z_{ij}^{-ll}\right) = 1 - \Phi\left(\ln z_{ij}^{-ll} - \mu_z/\sigma_z\right)$. Similarly, the transition probability $\Pr\left(m_{ij}^{-ll} \to s_i^{-l}, s_j^{l}\right)$ that a married couple divorces (given that the labor market status stays unchanged) is driven by the love shock rate δ times the probability that the new bliss value lies below the cutoff z_{ij}^{-ll}, i.e., by $\left(1 - \alpha_{ij}^{-ll}\right)$. The exact formulas for all transitions possible, including those where labor and marriage market transitions can occur within the same year, are given in Appendix B.2.

4.2.2 Labor market parameters

The parameters $\{\zeta_x, \zeta_y\}$, $\left\{\beta_{X\cdots}^{\cdots}\right\}$, $\left\{\beta_{\mu\ldots}^{\cdots}\right\}$, $\{\beta_{\vartheta\ldots}^{\cdots}\}$, and $\left\{\beta_{q\ldots}^{\cdots}\right\}$ are mainly identified using labor market transitions. These includes first of all the transition probabilities e.g. $\Pr\left(s_j^{l} \to s_j^{l'}\right)$ or $\Pr\left(m_{ij}^{-ll} \to m_{ij}^{-ll'}\right)$ that a single or married individual changes labor market status, but also simultaneous labor and marriage market transitions. Appendix B.2 presents the exact formulas for all possible transition probabilities. Employment-to-unemployment transitions identify mainly the parameters $\left\{\beta_{q\ldots}^{\cdots}\right\}$. All other parameters are mainly identified by unemployment-to-employment transitions and job-to-job transitions. The latter are a function of the contact rate parameters $\left\{\beta_{\mu\ldots}^{\cdots}\right\}$ and the respective search intensity. The search intensity in turn depends on the wage offer distribution and the reservation wage. The wage offer distribution parameters $\{\beta_{\vartheta\ldots}^{\cdots}\}$ are mainly identified by job-to-job transitions, since the respective transition probabilities, $\mu_j \sigma_j^e(w_j)\left[1 - F_j(w_j)\right]$, depend on the position in the wage offer distribution. The reservation wage of unemployed individuals is a function of the difference in working hours and the household public good, i.e.,

$$R_j^u = b_j - \zeta_x\left(l_j^u - l_j^e\right) + \xi_x\left(X_j^u - X_j^e\right) + C_j.$$

where C_j stands for the change in the marital surplus associated with finding a job. The job finding probability linked to a certain reservation wage therefore identifies the perference parameters $\{\zeta_x, \zeta_y\}$ given the observed difference in working hours $l_j^u - l_j^e$. However, the household public good production parameter α_x in $\xi_x = (1-\alpha_x)\left(\frac{\alpha_x}{\zeta_x}\right)^{\alpha_x/(1-\alpha_x)}$ (and α_y, respectively), cannot be directly indentified, since we do not observe the difference in the household public good $X_j^u - X_j^e$. The same is true for the household production parameters $\{\gamma_x, \gamma_y\}$ in the reservation wages of unemployed married individuals, which according to equations (44) and (45) in Appendix A.2 depend on the differences in the household public good in case the unemployed individual finds a job.

4.2.3 Household public good parameters

The household public good parameters $\{\alpha_x, \alpha_y, \gamma_x, \gamma_y\}$ and $\left\{\beta_{X\cdots}^{\cdots}\right\}$ will mainly be identified through the effect of the household public good on the reservation wage and the reservation wage's impact on search intensity and thus on the job finding rate. For the reservation wage only the difference between the household public good of being unemployed and of being employed matters. Identification of the household public good parameters via the job finding is therefore only possible, if we are able to tie down the household public good for one labor market status. We do this by using the time input into household production while being unemployed. The reason is that when taking the model to the data we have to take into account that individuals might also purchase some of the input into home production on the market. A person might for example decide to employ a cleaner or to eat out. This is more likely to be the case for employed individuals than for unemployed. It is therefore likely that the household time input for employed individuals taken from the data is biased downwards. The household time input of unemployed workes is less likely to suffer from such a bias. We therefore decided to tie down the household public good parameters using the time input of unemployed individuals. The link between time inputs into household production and the household public goods are given by the respective first order conditons, i.e.,

$$h_i^u = \left(\frac{\alpha_y}{\zeta_y}\right)^{1/(1-\alpha_y)} X_i^u, \text{ and } h_j^u = \left(\frac{\alpha_x}{\zeta_x}\right)^{1/(1-\alpha_x)} X_j^u,$$

for singles and

$$\begin{aligned} h_{i,j}^{u,u} &= \frac{\int_{z_{ij}^{uu}}^{\infty} z' dG\left(z'\right)}{\int_{z_{ij}^{uu}}^{\infty} dG\left(z'\right)} X_{ij}^{uu} \left(2\frac{\gamma_y}{\zeta_y}\right)^{(1-\gamma_x)/(1-\gamma_y-\gamma_x)} \left(2\frac{\gamma_x}{\zeta_x}\right)^{\gamma_x/(1-\gamma_y-\gamma_x)}, \\ h_{j,i}^{u,u} &= \frac{\int_{z_{ij}^{uu}}^{\infty} z' dG\left(z'\right)}{\int_{z_{ij}^{uu}}^{\infty} dG\left(z'\right)} X_{ij}^{uu} \left(2\frac{\gamma_y}{\zeta_y}\right)^{\gamma_y/(1-\gamma_y-\gamma_x)} \left(2\frac{\gamma_x}{\zeta_x}\right)^{(1-\gamma_y)/(1-\gamma_y-\gamma_x)}, \end{aligned}$$

for married individuals. With the functional form assumptions about the household public good in equations (18) to (20) we are able to tie down the $\beta_{\ddot{X}_{\dots}}$-parameters for unemployed individuals by noting that the $\beta_{\ddot{X}_{\dots}}$-parameters in the household time input equation only need to be multipled by the respective constant, i.e., $\widehat{\beta}_{\ddot{X}_j^u} = \left(\frac{\alpha_y}{\zeta_y}\right)^{1/(1-\alpha_y)} \beta_{\ddot{X}_j^u}$ for unemployed single women if the dependent moment is the time input h_j^u (and similarly for unemployed single men and unemployed married women and men).

4.3 Estimation results

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In GSEOP and PASS data we observe an individual's labor and marriage market status only on a yearly basis. We therefore regard time as discrete and allow for simultaneous labor and marriage market transitions. We estimate the model using the transition probabilities between being single and being married as well as being employed and being unemployed. Job-to-job changes are also considered.

Some transitions are very rare, especially some marriage market transitions. We only use those transition probabilities as moments that are calculated on at least 25 observations. To ensure that also rare transitions enter the estimation we aggregate transitions over different types, e.g. $\sum_j \Pr\left(m_{ij}^{-ll} \rightarrow s_i^{-l'}, s_j^{l'}\right)$ and $\sum_i \Pr\left(m_{ij}^{-ll} \rightarrow s_i^{-l'}, s_j^{l'}\right)$, and take again only those moments that are based on at least 25 observations.

Based on the time use question in the GSEOP we include the following categories into household production; regular domestic work (like washing, cleaning, cooking, etc.), childcare, errands, and repairs.

5 Conclusions

This piece of research has connected the two-sided marriage market model of Goussé et al. (2017) to the labor market. The uncertainty that singles and married couples face regarding their labor market status is, as we show theoretically and empirically, an important driving force of matching decisions in the marriage market. Using three sources of German micro data, we document that the German marriage market is coined by positive sorting of in the marriage market based on education, income, and employment status. The trend towards more educational sorting, however, has stalled in recent years.

We perform a structural empirical analysis that allows us to back out key elements of our marriage market model from the data, specifically meeting rates and matching probabilities. We find that search patterns in the marriage market appear to be directed for highly educated individuals while single with low education search randomly. Based on our data and the estimated model parameters, we decompose the aggregate flow of divorces into the share induced by labor market transitions and by match-specific shocks. Transitions from employment to unemployment or vice versa make up only a fraction of all divorces. This fraction, however, shows an interesting dynamic. The share of labor market divorces has grown by more than 20% since the mid 2000s and most of the additional divorcées are highly educated and were married to highly educated individuals. Most of these marriages break up when a previously unemployed woman starts working, especially if the husband stays unemployed. In 2013, 5.3% of all divorces happened when a previously unemployed woman started to work. This percentage share equals 27,968 divorces. The case that the literature has previously analyzed, divorce upon male job loss, accounts only for a shrinking fraction of all divorces in Germany.

One possible explanation for the differential changes of different couple types in the overall number of labor market divorce relates to the booming German labor market in the second half of the 2000s. Many low education couples divorce for reasons of economic hardship and related stress in the relationship when they become unemployed. This divorce hazard may have been mitigated by the shrinking unemployment rate in Germany and the good general macroeconomic environment. High education couples who are the source of assortative matching in the marriage market, however, seem to divorce for other reasons. When a high education women starts working, for instance, this might change the balance of power and the resource sharing in a household. Due to favorable outside options of two employed persons, the option value of searching for a new partner in the marriage market might become dominant.

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A Theoretical appendix

A.1 Derivations of optimality conditions

A.1.1 Nash-Bargaining

Spouses decide on the transfers t, household production (h_m, h_f), and the search intensities (σ_m, σ_f) such that the Nash-Product (3) is maximized. The FOC with respect to the transfer t impies,

$$t : \frac{\beta_x}{V_{j,i}^{l,-l} - V_j^l} = \frac{\beta_y}{V_{i,j}^{-l,l} - V_i^{-l}}. \tag{21}$$

The marital surplus for a female and a male of type ij and labor market status $-ll$, is given by,

$$S_{ij}^{-ll} \equiv \left[V_{j,i}^{l,-l} - V_j^l\right] + \left[V_{i,j}^{-l,l} - V_i^{-l}\right]. \tag{22}$$

Equation (21) therefore implies the following surplus splitting rule,

$$V_{i,j}^{-l,l} - V_i^{-l} = \beta_y S_{ij}^{-ll} \text{ and } V_{j,i}^{l,-l} - V_j^l = \beta_x S_{ij}^{-ll}. \tag{23}$$

Using equation (21) allows us to write the other FOCs as follows,

$$h_{i,j}^{-l,l} \; : \; \frac{\partial V_{f,i}^{l,-l}}{\partial h_m} + \frac{\partial V_{m,j}^{-l,l}}{\partial h_m} = 0 \text{ and } h_{j,i}^{l,-l} : \frac{\partial V_{f,i}^{l,-l}}{\partial h_f} + \frac{\partial V_{m,j}^{-l,l}}{\partial h_f} = 0, \tag{24}$$

$$\sigma_{i,j}^{-l,l} \; : \; \frac{\partial V_{f,i}^{l,-l}}{\partial h_m} + \frac{\partial V_{m,j}^{-l,l}}{\partial h_m} = 0 \text{ and } \sigma_{j,i}^{l,-l} : \frac{\partial V_{f,i}^{l,-l}}{\partial h_f} + \frac{\partial V_{m,j}^{-l,l}}{\partial h_f} = 0. \tag{25}$$

A.1.2 Household production

If single: The FOC of equation (1) with respect to h_f under the utility specification (5) is given by $\alpha_x y = \zeta_x h_f$. Substituting the optimal time input (using the FOCs in equation (24)) back into the household production fuction implies $y = \left(X_j^l\right)\left(\frac{\alpha_x}{\zeta_x}\right)^{\alpha_x/(1-\alpha_x)}$. Substituting y back into the above FOC gives h_f as functions of the exogenous parameters. Substituting the respective h_f into equation (5) using the time constraints $e = \overline{h} - l_j^l - h_f$ gives the indirect utility functions for single males and females,

$$\begin{aligned} v_j^l &= I_j^l + \zeta_x\left(\overline{h} - l_j^l\right) + \xi_x X_j^l, \\ v_i^{-l} &= I_i^{-l} + \zeta_y\left(\overline{h} - l_i^{-l}\right) + \xi_y X_i^{-l}, \end{aligned} \tag{26}$$

with $\xi_x = (1-\alpha_x)\left(\frac{\alpha_x}{\zeta_x}\right)^{\alpha_x/(1-\alpha_x)}$ and $\xi_y = (1-\alpha_y)\left(\frac{\alpha_y}{\zeta_y}\right)^{\alpha_y/(1-\alpha_y)}$.

If married: The FOC of equation (2) with respect to (h_m, h_f) under the utility specification (5) are given by,

$$\begin{aligned}
\frac{\partial V_{f,i}^{l,-l}}{\partial h_m} &= \frac{\gamma_y}{h_m} y, \text{ and } \frac{\partial V_{m,j}^{-l,l}}{\partial h_m} = -\zeta_y + \frac{\gamma_y}{h_m} y, \\
\frac{\partial V_{f,i}^{l,-l}}{\partial h_f} &= -\zeta_x + \frac{\gamma_x}{h_f} y, \text{ and } \frac{\partial V_{m,j}^{-l,l}}{\partial h_f} = \frac{\gamma_x}{h_f} y.
\end{aligned}$$

Substituting the optimal time input (using the FOCs in equation (24)) back into the household production fuction implies,

$$y = zX_{ij}^{-ll} \left(2\frac{\gamma_y}{\zeta_y}\right)^{\gamma_y/(1-\gamma_y-\gamma_x)} \left(2\frac{\gamma_x}{\zeta_x}\right)^{\gamma_x/(1-\gamma_y-\gamma_x)}.$$

Substituting y back into the above FOC gives (h_m, h_f) as functions of the exogenous parameters, i.e.,

$$\begin{aligned}
h_{i,j}^{-l,l} &= zX_{ij}^{-ll} \left(2\frac{\gamma_y}{\zeta_y}\right)^{(1-\gamma_x)/(1-\gamma_y-\gamma_x)} \left(2\frac{\gamma_x}{\zeta_x}\right)^{\gamma_x/(1-\gamma_y-\gamma_x)}, \\
h_{j,i}^{l,-l} &= zX_{ij}^{-ll} \left(2\frac{\gamma_y}{\zeta_y}\right)^{\gamma_y/(1-\gamma_y-\gamma_x)} \left(2\frac{\gamma_x}{\zeta_x}\right)^{(1-\gamma_y)/(1-\gamma_y-\gamma_x)}.
\end{aligned}$$

Substituting these into equation (5) using the time constraints $e = \overline{h} - l_j^l - h_f$ and $e = \overline{h} - l_i^{-l} - h_m$ implies

$$\begin{aligned}
v_{i,j}^{-l,l} &= I_i^{-l} - t + \zeta_y \left(\overline{h} - l_i^{-l}\right) + \xi_{y,x} zX_{ij}^{-ll}, \\
v_{j,i}^{l,-l} &= I_j^l + t + \zeta_x \left(\overline{h} - l_j^l\right) + \xi_{x,y} zX_{ij}^{-ll},
\end{aligned} \tag{27}$$

with $\xi_{y,x} = (1 - 2\gamma_y)\,\xi$ and $\xi_{x,y} = (1 - 2\gamma_x)\,\xi$ with $\xi = \left(2\frac{\gamma_y}{\zeta}\right)^{\gamma_y/(1-\gamma_y-\gamma_x)} \left(2\frac{\gamma_x}{\zeta}\right)^{\gamma_x/(1-\gamma_y-\gamma_x)}$.

Using the indirect utility functions in equations (26) and (27) allows us to write the marital utility for a female and a male of type ij and labor market status $-ll$ as stated in equation (6).

A.1.3 Search intensities part 1

The optimal search intensity of a female single σ_j^l is given by the FOC of equation (1) with respect to σ_f, i.e.,

$$c'\left(\sigma_j^l\right) = \mu_j \int \max\left[V_j^e\left(w_j'\right) - V_j^l, 0\right] dF_j\left(w_j'\right). \tag{28}$$

The optimal search intensity of a (j,l)-type female married with a $(i,-l)$-type male $\sigma_{j,i}^{l,-l}$ is according to the FOC in equation (25) and the Bellman equation (2) - for both male and female - given by

$$
\begin{aligned}
c'\left(\sigma_{j,i}^{l,-l}\right) &= \mu_j \int \left[\max\left[V_j^e\left(w_j'\right), V_{j,i}^{e,-l}\left(w_j'\right)\right] - V_{j,i}^{l,-l}\right] dF_j\left(w_j'\right) \qquad (29)\\
&+\mu_j \int \left[\max\left[V_i^{-l}, V_{i,j}^{-l,e}\right] - V_{i,j}^{-l,l}\right] dF_j\left(w_j'\right)\\
&= \mu_j \int \left[\max\left[0, V_{j,i}^{e,-l}\left(w_j'\right) - V_j^e\left(w_j'\right)\right] - \left[V_{j,i}^{l,-l} - V_j^l\right] - \left[V_j^e\left(w_j'\right) - V_j^l\right]\right] dF_j\left(w_j'\right)\\
&+\mu_j \int \left[\max\left[0, V_{i,j}^{-l,e} - V_i^{-l}\right] - \left[V_{i,j}^{-l,l} - V_i^{-l}\right]\right] dF_j\left(w_j'\right)\\
&= \mu_j \int \left[\max\left[0, S_{ij}^{-le}\right] - S_{ij}^{-ll} + \left[V_j^e\left(w_j'\right) - V_j^l\right]\right] dF_j\left(w_j'\right),
\end{aligned}
$$

where the last equality used the surplus splitting rule (23).

A.1.4 Reservation wages

If single: The reservation wage of an unemployed single is given in equation (12).

If married: The reservation wage of an unemployed married female is defined such that the married couple is indifferent between being employment at the reservation wage $R_{j,i}^{u,-l}(z)$ and remaining unemployment. That is the joint gain of both partners is zero, where the "gain" might include a divorce, i.e.,

$$
\begin{aligned}
0 &= \max\left[V_j^e\left(R_{j,i}^{u,-l}(z)\right), V_{j,i}^{e,-l}\left(R_{j,i}^{u,-l}(z)\right)\right] - V_{j,i}^{u,-l}(z) + \max\left[V_i^{-l}, V_{i,j}^{-l,e}\right] - V_{i,j}^{-l,u}(z)\\
&= V_j^e\left(R_{j,i}^{u,-l}(z)\right) - V_j^u + \max\left[0, S_{ij}^{-le}(z)\right] - S_{ij}^{-lu}(z), \qquad (30)
\end{aligned}
$$

where the second equation is derived following the same steps as above for the optimal search intensity of married individuals (29). Similar as for the derivation of the single reservation wage we can substitute the Bellman equations (1) and (2) and use the fact that the gains from searching and hence the search intensity is the same for an employed individual with the reservation wage and an unemployed individual. This allows us to write the reservation wage as,

$$
R_{j,i}^{u,-l}(z) = R_j^u - r\max\left[0, S_{ij}^{-le}(z)\right] + rS_{ij}^{-lu}(z). \qquad (31)
$$

We can derive the reservation wage condition for an employed married female in the same way as for unemployed married females in equation (30), i.e.,

$$
V_j^e\left(R_{j,i}^{e,-l}\right) - V_j^e + \max\left[0, S_{ij}^{-le}(z)\right] - S_{ij}^{-lu}(z) \Longrightarrow R_{j,i}^{e,-l} = R_j^e - r\max\left[0, S_{ij}^{-le}(z)\right] + rS_{ij}^{-le}(z).
$$

Since the marital surplus $S_{ij}^{-le}(z)$ is independent of the income of the spouses it follows that the reservation wage of employed married individuals is the same as of employed singles, which equals the current wage, i.e., $R_{j,i}^{e,-l} = w_j$.

A.1.5 Search intensities part 2

Given reservation wages we are able to derive the optimal search intensity conditions as functions of exogenous parameters.

The optimal search intensity of a single female given in equation (28) can be written as $c'\left(\sigma_j^l\right) = \mu_j \int_{R\left(I_j^l\right)} \left[V_j^e\left(w_j'\right) - V_j^l\right] dF_j\left(w_j'\right)$. Differentiating equation (1) for $l = e$ implies,

$$\frac{\partial V_j^e}{\partial w_j} = \frac{1}{r + q_j + \sigma_j^e\left(w_j\right)\mu_j\left[1 - F_j\left(w_j\right)\right]},$$

since the surplus $S_{ij}^{-ll}\left(z\right)$ is independent of spouses income. Integration by parts then gives the optimal search intensity conditions (7) and (8).

Similarly, we can derive the optimal search intensity of a married female using equation (29). Since the surplus $S_{ij}^{-ll}\left(z\right)$ is independent of spouses income we can write the gains from searching as follows,

$$\begin{aligned}
& \mu_j \int\limits_{R_{j,i}^{l,-l}(z)}^{\infty} \left[V_j^e\left(w_j'\right) - V_j^u + \max\left[0, S_{ij}^{-le}\left(z\right)\right] - S_{ij}^{-lu}\left(z\right)\right] dF_j\left(w_j'\right) \\
= \; & \mu_j \int\limits_{R_{j,i}^{l,-l}(z)}^{\infty} \left[V_j^e\left(w_j'\right) - V_j^u\right] dF_j\left(w_j'\right) \\
& + \mu_j\left[\max\left[0, S_{ij}^{-le}\left(z\right)\right] - S_{ij}^{-ll}\left(z\right)\right]\left[1 - F_j\left(R_{j,i}^{l,-l}\left(z\right)\right)\right]
\end{aligned}$$

In case of employed individuals $\max\left[0, S_{ij}^{-le}\left(z\right)\right] = S_{ij}^{-le}\left(z\right)$ and $R_{j,i}^{e,-l} = w_j$ implies that the search intensity is identical to employed singles, i.e., $\sigma_{j,i}^{e,-l}\left(w_j\right) = \sigma_j^e\left(w_j\right)$. In case of unemployed married individuals, we can use equation (31) to obtain the optimal search intensity condition (9).

A.1.6 Wage earnings distribution

To obtain the formula for the wage earnings distribution we rearrange equation (17) using equation (**??**), i.e.,

$$\begin{aligned}
& \mu_j \sigma_j^e\left(R_j^u\right)\left[1 - F_j\left(R_j^u\right)\right] s_j^u \\
& + \mu_j \sum_i \sum_{-l} \int_{z_{ij}^{-lu}}^{\infty} \sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}\left(z'\right)\right)\left[1 - F_j\left(R_{j,i}^{u,-l}\left(z'\right)\right)\right] dG\left(z'\right) m_{ij}^{-lu} \\
= \; & q_j\left(s_j^e + \sum_i \sum_{-l} m_{ij}^{-le}\right),
\end{aligned}$$

gives,

$$\frac{\frac{\sigma_j^e\left(R_j^u\right)\left[F_j(w_j)-F_j\left(R_j^u\right)\right]}{1-F_j(w_j)}s_j^u+\sum_i\sum_{-l}\int_{z_{ij}^{-lu}}^{\infty}\frac{\sigma_{j,i}^{u,-l''}\left(R_{j,i}^{u,-l}(z')\right)\left[F_j(w_j)-F_j\left(R_{j,i}^{u,-l}(z')\right)\right]I_{w_j>R_{j,i}^{u,-l}(z')}}{1-F_j(w_j)}dG\left(z'\right)m_{ij}^{-lu}}{\sigma_j^e\left(R_j^u\right)\left[1-F_j\left(R_j^u\right)\right]s_j^u+\sum_i\sum_{-l}\int_{z_{ij}^{-lu}}^{\infty}\sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}\left(z'\right)\right)\left[1-F_j\left(R_{j,i}^{u,-l}\left(z'\right)\right)\right]dG\left(z'\right)m_{ij}^{-lu}} \tag{32}$$

$$= \frac{H_j\left(w_j\right)}{1-F_j\left(w_j\right)}+\frac{\mu_j}{q_j}\int_{\min\left[R_j^u,R_{j,i}^{u,u}\left(z_{ij}^{uu}\right),R_{j,i}^{u,e}\left(z_{ij}^{eu}\right)\right]}^{w_j}\sigma_j^e\left(w_j'\right)dH_j\left(w_j'\right),$$

where $I_{w_j>R_{j,i}^{u,-l}(z')}$ is an indicator function which equals 1 if $w_j > R_{j,i}^{u,-l}\left(z'\right)$ and zero otherwise. Taking the derivative with respect to w_j and rearranging implies,

$$\frac{\sum_i\sum_{-l}\int_{z_{ij}^{-lu}}^{\infty}\sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}\left(z'\right)\right)\left[1-F_j\left(R_{j,i}^{u,-l}\left(z'\right)\right)\right]\left(I_{w_j>R_{j,i}^{u,-l}(z')}-1\right)dG\left(z'\right)m_{ij}^{-lu}}{\sigma_j^e\left(R_j^u\right)\left[1-F_j\left(R_j^u\right)\right]s_j^u+\sum_i\sum_{-l}\int_{z_{ij}^{-lu}}^{\infty}\sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}\left(z'\right)\right)\left[1-F_j\left(R_{j,i}^{u,-l}\left(z'\right)\right)\right]dG\left(z'\right)m_{ij}^{-lu}} \tag{33}$$

$$\times\frac{f_j\left(w_j\right)}{\overline{H}_j\left(w_j\right)\overline{F}_j\left(w_j\right)}$$

$$= \frac{h_j\left(w_j\right)}{\overline{H}_j\left(w_j\right)}-\frac{f_j\left(w_j\right)}{\overline{F}_j\left(w_j\right)}+\frac{\mu_j}{q_j}\sigma_j^e\left(w_j'\right)\overline{F}_j\left(w_j\right)\frac{h_j\left(w_j\right)}{\overline{H}_j\left(w_j\right)},$$

where $1-F_j\left(w_j\right)\equiv\overline{F}_j\left(w_j\right)$ and $1-H_j\left(w_j\right)\equiv\overline{H}_j\left(w_j\right)$. Using the functional form for the wage offer distribution, i.e., $\overline{F}_j\left(w_j\right)=e^{-\vartheta_j w_j}/e^{-\vartheta_j \underline{w}_j}$ implies $f_j\left(w_j\right)=\vartheta_j\overline{F}_j\left(w_j\right)$, leads to

$$\frac{dH_j\left(w_j\right)}{dw_j}=q_j\vartheta_j\frac{1-H_j+\frac{\sum_i\sum_{-l}\int_{z_{ij}^{-lu}}^{\infty}\sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}(z')\right)\left[1-F_j\left(R_{j,i}^{u,-l}(z')\right)\right]\left(I_{w_j>R_{j,i}^{u,-l}(z')}-1\right)dG(z')m_{ij}^{-lu}}{\sigma_j^e\left(R_j^u\right)\left[1-F_j\left(R_j^u\right)\right]s_j^u+\sum_i\sum_{-l}\int_{z_{ij}^{-lu}}^{\infty}\sigma_{j,i}^{u,-l}\left(R_{j,i}^{u,-l}(z')\right)\left[1-F_j\left(R_{j,i}^{u,-l}(z')\right)\right]dG(z')m_{ij}^{-lu}}}{q_j+\mu_j\sigma_j^e\left(w_j\right)e^{-\vartheta_j\max\left[w_j-\underline{w}_j,0\right]}}. \tag{34}$$

Solving differential equation (34) numerically with the boundary condition $H_j\left(\underline{w}_j\right)=0$ gives the wage earnings distribution $H_j\left(w_j\right)$.

A.2 Computation of the fixed point

The first step to determine the surplus functions $S_{ij}^{-ll}(z)$ and the cutoff values z_{ij}^{-ll} is to compute integrated surpluses $\overline{S}_{z_{ij}^{ll}}^{l'l}$, where the subindex z_{ij}^{ll} indicates the support over which the surplus is integrated, i.e.,

$$\overline{S}_{z_{ij}^{-l'l'}}^{-ll} \equiv \int_{z_{ij}^{-l'l'}}^{\infty} S_{ij}^{-ll}(z)\, dG(z).$$

We assume that z is log-normally distributed, i.e.,

$$\begin{aligned} G(z) &= \Phi\left(\frac{\ln z - \mu_z}{\sigma_z}\right), \\ g(z) &= \varphi\left(\frac{\ln z - \mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z}, \end{aligned}$$

where Φ and φ are the cdf and pdf of the standard normal distribution. This gives the following integrated surplus functions,

$$\begin{aligned} \left[r+\delta+q_i+q_j\right]\overline{S}_{z_{ij}^{-ll}}^{ee} &= \left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{ee}\Phi\left(\frac{\mu_z+\sigma_z^2-\ln z_{ij}^{-ll}}{\sigma_z}\right)e^{\mu_z+\frac{1}{2}\sigma_z^2} \\ &\quad+\left(\delta\overline{S}_{z_{ij}^{ee}}^{ee}-\Theta_{ij}^{ee}\right)\left[1-\Phi\left(\frac{\ln z_{ij}^{-ll}-\mu_z}{\sigma_z}\right)\right] \\ &\quad+q_i\eta_{ij}^{(-ll,ue)}\overline{S}_{z_{ij}^{-ll}}^{ue}+q_i\left(1-\eta_{ij}^{(-ll,ue)}\right)\overline{S}_{z_{ij}^{ue}}^{ue} \\ &\quad+q_j\eta_{ij}^{(-ll,eu)}\overline{S}_{z_{ij}^{-ll}}^{eu}+q_j\left(1-\eta_{ij}^{(-ll,eu)}\right)\overline{S}_{z_{ij}^{eu}}^{eu}, \end{aligned} \tag{35}$$

$$\begin{aligned} \left[r+\delta+q_j\right]\overline{S}_{z_{ij}^{-ll}}^{ue} &= \left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{ue}\Phi\left(\frac{\mu_z+\sigma_z^2-\ln z_{ij}^{-ll}}{\sigma_z}\right)e^{\mu_z+\frac{1}{2}\sigma_z^2} \\ &\quad+\left(\delta\overline{S}_{z_{ij}^{ue}}^{ue}-\Theta_{ij}^{ue}\right)\left[1-\Phi\left(\frac{\ln z_{ij}^{-ll}-\mu_z}{\sigma_z}\right)\right] \\ &\quad+\eta_{ij}^{(-ll,ee)}\Psi_{i,z_{ij}^{-ll}}^{u,e}+\left(1-\eta_{ij}^{(-ll,ee)}\right)\Psi_{i,z_{ij}^{ee}}^{u,e} \\ &\quad+q_j\eta_{ij}^{(-ll,uu)}\overline{S}_{z_{ij}^{-ll}}^{uu}+q_j\left(1-\eta_{ij}^{(-ll,uu)}\right)\overline{S}_{z_{ij}^{uu}}^{uu}, \end{aligned} \tag{36}$$

$$\begin{aligned} \left[r+\delta+q_i\right]\overline{S}_{z_{ij}^{-ll}}^{eu} &= \left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{eu}\Phi\left(\frac{\mu_z+\sigma_z^2-\ln z_{ij}^{-ll}}{\sigma_z}\right)e^{\mu_z+\frac{1}{2}\sigma_z^2} \\ &\quad+\left(\delta\overline{S}_{z_{ij}^{eu}}^{eu}-\Theta_{ij}^{eu}\right)\left[1-\Phi\left(\frac{\ln z_{ij}^{-ll}-\mu_z}{\sigma_z}\right)\right] \\ &\quad+q_i\eta_{ij}^{(-ll,uu)}\overline{S}_{z_{ij}^{-ll}}^{uu}+q_i\left(1-\eta_{ij}^{(-ll,uu)}\right)\overline{S}_{z_{ij}^{uu}}^{uu} \\ &\quad+\eta_{ij}^{(-ll,ee)}\Psi_{j,z_{ij}^{-ll}}^{u,e}+\left(1-\eta_{ij}^{(-ll,ee)}\right)\Psi_{j,z_{ij}^{ee}}^{u,e}, \end{aligned} \tag{37}$$

$$
\begin{aligned}
[r+\delta]\,\overline{S}^{uu}_{z^{-ll}_{ij}} \;=\;& \left(\xi_{y,x}+\xi_{x,y}\right)X^{uu}_{ij}\Phi\left(\frac{\mu_z+\sigma_z^2-\ln z^{-ll}_{ij}}{\sigma_z}\right)e^{\mu_z+\frac{1}{2}\sigma_z^2} \\
&+\left(\delta\overline{S}^{uu}_{z^{uu}_{ij}}-\Theta^{uu}_{ij}\right)\left[1-\Phi\left(\frac{\ln z^{-ll}_{ij}-\mu_z}{\sigma_z}\right)\right] \\
&+\eta^{(-ll,eu)}_{ij}\Psi^{u,u}_{i,z^{-ll}_{ij}}+\left(1-\eta^{(-ll,eu)}_{ij}\right)\Psi^{u,u}_{i,z^{eu}_{ij}} \\
&+\eta^{(-ll,ue)}_{ij}\Psi^{u,u}_{j,z^{-ll}_{ij}}+\left(1-\eta^{(-ll,ue)}_{ij}\right)\Psi^{u,u}_{j,z^{ue}_{ij}}
\end{aligned} \tag{38}
$$

where

$$
\begin{aligned}
\Theta^{ee}_{ij} &= \xi_y X^e_i+\xi_x X^e_j+\beta_y\sum\nolimits_j\sum\nolimits_l\lambda^{el}s^l_j\overline{S}^{el}_{z^{el}_{ij}}+\beta_x\sum\nolimits_i\sum\nolimits_{-l}\lambda^{-le}s^{-l}_i\overline{S}^{-le}_{z^{-le}_{ij}}, \\
\Theta^{ue}_{ij} &= \xi_y X^u_i+\xi_x X^e_j+\beta_y\sum\nolimits_j\sum\nolimits_l\lambda^{ul}s^l_j\overline{S}^{ul}_{z^{ul}_{ij}}+\beta_x\sum\nolimits_i\sum\nolimits_{-l}\lambda^{-le}s^{-l}_i\overline{S}^{-le}_{z^{-le}_{ij}} \\
&\quad+\sigma^u_i c'\left(\sigma^u_i\right)-c\left(\sigma^u_i\right), \\
\Theta^{eu}_{ij} &= \xi_y X^e_i+\xi_x X^u_j+\beta_y\sum\nolimits_j\sum\nolimits_l\lambda^{el}s^l_j\overline{S}^{el}_{z^{el}_{ij}}+\beta_x\sum\nolimits_i\sum\nolimits_{-l}\lambda^{-lu}s^{-l}_i\overline{S}^{-lu}_{z^{-lu}_{ij}} \\
&\quad+\sigma^u_j c'\left(\sigma^u_j\right)-c\left(\sigma^u_j\right), \\
\Theta^{uu}_{ij} &= \xi_y X^u_i+\xi_x X^u_j+\beta_y\sum\nolimits_j\sum\nolimits_l\lambda^{ul}s^l_j\overline{S}^{ul}_{z^{ul}_{ij}}+\beta_x\sum\nolimits_i\sum\nolimits_{-l}\lambda^{-lu}s^{-l}_i\overline{S}^{-lu}_{z^{-lu}_{ij}} \\
&\quad+\sigma^u_i c'\left(\sigma^u_i\right)-c\left(\sigma^u_i\right)+\sigma^u_j c'\left(\sigma^u_j\right)-c\left(\sigma^u_j\right),
\end{aligned}
$$

and

$$
\eta^{(-ll,-l'l)}_{ij}=\begin{cases} 0 & \text{if } z^{-ll}_{ij}\le z^{-l'l}_{ij}, \\ 1 & \text{if } z^{-ll}_{ij}> z^{-l'l}_{ij}. \end{cases}
$$

The measure of singles s^l_j (s^l_i) can be obtained from equation (**??**),

$$
s^u_j = \frac{q_j}{q_j+\mu_j\sigma^e_j\left(R^u_j\right)\left[1-F_j\left(R^u_j\right)\right]}n_j-\sum_i\sum_{-l''}\frac{\underline{\tau}^{u,-l''}_{j,i}+\overline{\tau}^{u,-l''}_{j,i}+q_j}{q_j+\mu_j\sigma^e_j\left(R^u_j\right)\left[1-F_j\left(R^u_j\right)\right]}m^{-l''u}_{ij} \tag{39}
$$

$$
\begin{aligned}
s^e_j =\;& \frac{\mu_j\sigma^e_j\left(R^u_j\right)\left[1-F_j\left(R^u_j\right)\right]}{q_j+\mu_j\sigma^e_j\left(R^u_j\right)\left[1-F_j\left(R^u_j\right)\right]}n_j-\sum_i\sum_{-l''}m^{-l''e}_{ij} \\
&+\sum_i\sum_{-l''}\frac{\underline{\tau}^{u,-l''}_{j,i}+\overline{\tau}^{u,-l''}_{j,i}-\mu_j\sigma^e_j\left(R^u_j\right)\left[1-F_j\left(R^u_j\right)\right]}{q_j+\mu_j\sigma^e_j\left(R^u_j\right)\left[1-F_j\left(R^u_j\right)\right]}m^{-l''u}_{ij}.
\end{aligned} \tag{40}
$$

To obtain search intensities σ^u_j (σ^u_i) of single unemployed assume the following functional forms for the search cost function,

$$
c\left(\sigma\right)=\frac{1}{2}\sigma^2,
$$

and the wage offer distributions (truncated exponential-distributions),

$$F_j(w_j) = 1 - \frac{e^{-\vartheta_j w_j}}{e^{-\vartheta_j \underline{w}_j}}.$$

Using these functional forms we can obtain an implicit function defining the search intensity $\sigma_j^u = \sigma_j^e\left(R_j^u\right)$ from differentiating the first order condition, i.e.,

$$\begin{aligned}
\sigma_j^e(w_j) &= \int_{w_j}^{\infty} \frac{\mu_j e^{-\vartheta_j w_j'}}{(r+q_j)\, e^{-\vartheta_j \underline{w}_j} + \sigma_j^e\left(w_j'\right) \mu_j e^{-\vartheta_j w_j'}} dw' \\
\implies \frac{d\sigma_j^e}{dw_j} &= -\frac{\mu_j e^{-\vartheta_j w_j}}{(r+q_j)\, e^{-\vartheta_j \underline{w}_j} + \sigma_j^e \mu_j e^{-\vartheta_j w_j}}.
\end{aligned} \quad (41)$$

Rearranging and integrating implies,

$$\begin{aligned}
\frac{dw_j}{d\sigma_j^e} &= -\frac{(r+q_j)}{\mu_j} \frac{e^{-\vartheta_j \underline{w}_j}}{e^{-\vartheta_j w_j}} - \sigma_j^e, \\
\frac{e^{-\vartheta_j w_j}}{e^{-\vartheta_j \underline{w}_j}} &= \frac{1}{2} \frac{(r+q_j)}{\mu_j} e^{\vartheta_j \frac{1}{2}\left(\sigma_j^e\right)^2} erf\left(\frac{1}{2}\sigma_j^e \sqrt{2\vartheta_j}\right) \sqrt{2\vartheta_j \pi},
\end{aligned}$$

where $erf(x)$ equals the Gauss error function. The solution can be easily checked by applying the implicit function theorem and using $\partial erf(x)/\partial x = (2/\sqrt{\pi})\, e^{-x^2}$. Using the relation of the Gauss error function with the standard normal cumulative distribution function $\Phi(.)$, i.e., $erf(x) = 2\Phi\left(x\sqrt{2}\right) - 1$ allows us to write the implicit function defining σ_j^e as a function of w_j, i.e.,

$$\frac{1}{2} \frac{(r+q_j)}{\mu_j} e^{\vartheta_j \frac{1}{2}\left(\sigma_j^e(w_j)\right)^2} \left(2\Phi\left(\sigma_j^e(w_j)\sqrt{\vartheta_j}\right) - 1\right) \sqrt{2\vartheta_j \pi} = \frac{e^{-\vartheta_j w_j}}{e^{-\vartheta_j \underline{w}_j}} = e^{-\vartheta_j \max\left[w_j - \underline{w}_j, 0\right]}. \quad (42)$$

The numerical approximation of this implicit function can be speeded up using the first derivative given in equation (41) and the following second derivative,

$$\frac{d^2\sigma_j^e}{d(w_j)^2} = \left(\mu_j e^{-\vartheta_j w_j}\right)^2 \frac{\vartheta_j (r+q_j)\, e^{-\vartheta_j \underline{w}_j} \left((r+q_j)\, e^{-\vartheta_j \underline{w}_j} + \sigma_j^e \mu_j e^{-\vartheta_j w_j}\right) - \left(\mu_j e^{-\vartheta_j w_j}\right)^2}{\left((r+q_j)\, e^{-\vartheta_j \underline{w}_j} + \sigma_j^e \mu_j e^{-\vartheta_j w_j}\right)^3}.$$

The reservation wage of single unemployed individuals is given by equation (12), i.e.,

$$R_j^u = b_j - \zeta_x\left(l_j^u - l_j^e\right) + \xi_y\left(X_j^u - X_j^e\right) + \beta_x \sum\nolimits_i \sum\nolimits_{-l} \left(\lambda^{-lu} \overline{S}_{z_{ij}^{-lu}}^{-lu} - \lambda^{-le} \overline{S}_{z_{ij}^{-le}}^{-le}\right) s_i^{-l}. \quad (43)$$

The search intensities of unemployed married individuals $\sigma_{j,i}^{u,-l}(z)$ $(\sigma_{i,j}^{u,l}(z))$ is given by using equation (9), i.e.,

$$\begin{aligned}\sigma_{j,i}^{u,-l}(z) &= \sigma_j^e\left(R_{j,i}^{u,-l}(z)\right) - \frac{\mu_j}{r}\left[R_{j,i}^{u,-l}(z) - R_j^u\right]\frac{e^{-\vartheta_j R_{j,i}^{u,-l}(z)}}{e^{-\vartheta_j \underline{w}_j}} \\ &= \sigma_j^e\left(R_{j,i}^{u,-l}(z)\right) - \frac{\mu_j}{r}\left[R_{j,i}^{u,-l}(z) - R_j^u\right]e^{-\vartheta_j \max\left[R_{j,i}^{u,-l}(z)-\underline{w}_j,0\right]},\end{aligned}$$

where using equations (**??**) to (**??**) allows us to write the respective reservation wages of the married female as follows,

$$R_{j,i}^{u,u}(z) = \begin{cases} R_j^u + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta}X_{ij}^{uu}\left(z - z_{ij}^{uu}\right) & \text{if } z \le z_{ij}^{ue}, \\ R_j^u + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta}X_{ij}^{uu}\left(z_{ij}^{ue} - z_{ij}^{uu}\right) + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_j}\left(X_{ij}^{uu} - X_{ij}^{ue}\right)\left(z - z_{ij}^{ue}\right) & \text{if } z > z_{ij}^{ue}, \end{cases} \tag{44}$$

$$R_{j,i}^{u,e}(z) = \begin{cases} R_j^u + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i}X_{ij}^{eu}\left(z - z_{ij}^{eu}\right) & \text{if } z \le z_{ij}^{ee}, \text{ and } z \le z_{ij}^{uu}, \\ R_j^u + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i}\left(X_{ij}^{eu} + \frac{q_i}{r+\delta}X_{ij}^{uu}\right)\left(z - z_{ij}^{eu}\right) & \text{if } z \le z_{ij}^{ee}, \text{ and } z > z_{ij}^{uu}, \\ R_j^u + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i}X_{ij}^{eu}\left(z_{ij}^{ee} - z_{ij}^{eu}\right) & \text{if } z > z_{ij}^{ee},\ z \le z_{ij}^{uu}, \\ +\frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i+q_j}\left(X_{ij}^{eu} - X_{ij}^{ee}\right)\left(z - z_{ij}^{-ee}\right) & \text{and } z \le z_{ij}^{ue}, \\ R_j^u + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i}X_{ij}^{eu}\left(z_{ij}^{ee} - z_{ij}^{eu}\right) & \text{if } z > z_{ij}^{ee},\ z \le z_{ij}^{uu}, \\ +\frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i+q_j}\left(X_{ij}^{eu} - X_{ij}^{ee} - \frac{q_i}{r+\delta+q_j}X_{ij}^{ue}\right)\left(z - z_{ij}^{ee}\right) & \text{and } z > z_{ij}^{ue}, \\ R_j^u + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i}\left(X_{ij}^{eu} + \frac{q_i}{r+\delta}X_{ij}^{uu}\right)\left(z_{ij}^{ee} - z_{ij}^{eu}\right) & \text{if } z > z_{ij}^{ee},\ z > z_{ij}^{uu}, \\ +\frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i+q_j}\left(X_{ij}^{eu} - X_{ij}^{ee} + \frac{q_i}{r+\delta}X_{ij}^{uu}\right)\left(z - z_{ij}^{ee}\right) & \text{and } z \le z_{ij}^{ue}, \\ R_j^u + \frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i}\left(X_{ij}^{eu} + \frac{q_i}{r+\delta}X_{ij}^{uu}\right)\left(z_{ij}^{ee} - z_{ij}^{eu}\right) & \text{if } z > z_{ij}^{ee},\ z > z_{ij}^{uu}, \\ +\frac{r(\xi_{y,x}+\xi_{x,y})}{r+\delta+q_i+q_j}\left(X_{ij}^{eu} - X_{ij}^{ee} + \frac{q_i}{r+\delta+q_j}\left(X_{ij}^{uu} - X_{ij}^{ue}\right)\right)\left(z - z_{ij}^{ee}\right) & \text{and } z > z_{ij}^{ue}, \end{cases} \tag{45}$$

Taking the functional form of the search cost function we get,

$$\sigma c'(\sigma) - c(\sigma) = \frac{1}{2}\sigma^2$$

This allows us to write

$$\begin{aligned}
\Psi^{u,e}_{i,z^{-ll}_{ij}} &= \int_{z^{-ll}_{ij}}^{\infty}\left[\sigma^{u,e}_{i,j}(z)\,c'\left(\sigma^{u,e}_{i,j}(z)\right)-c\left(\sigma^{u,e}_{i,j}(z)\right)\right]dG(z) \\
&= \frac{1}{2}\int_{z^{-ll}_{ij}}^{\infty}\left(\sigma^{u,e}_{i,j}(z)\right)^{2}\varphi\left(\frac{\ln z-\mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z}dz \\
&= \frac{1}{2}\int_{z^{-ll}_{ij}}^{\infty}\left(\sigma^{e}_{i}\left(R^{u,e}_{i,j}(z)\right)+\frac{\mu_i}{r}\left(R^{u}_{i}-R^{u,e}_{i,j}(z)\right)e^{-\vartheta_j\max\left[R^{u,e}_{i,j}(z)-\underline{w}_j,0\right]}\right)^{2}\varphi\left(\frac{\ln z-\mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z}dz,
\end{aligned}\tag{46}$$

$$\Psi^{u,e}_{j,z^{-ll}_{ij}} = \frac{1}{2}\int_{z^{-ll}_{ij}}^{\infty}\left(\sigma^{e}_{j}\left(R^{u,e}_{j,i}(z)\right)+\frac{\mu_j}{r}\left[R^{u}_{j}-R^{u,e}_{j,i}(z)\right]e^{-\vartheta_j\max\left[R^{u,e}_{j,i}(z)-\underline{w}_j,0\right]}\right)^{2}\varphi\left(\frac{\ln z-\mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z}dz,\tag{47}$$

$$\Psi^{u,u}_{i,z^{-ll}_{ij}} = \frac{1}{2}\int_{z^{-ll}_{ij}}^{\infty}\left(\sigma^{e}_{i}\left(R^{u,u}_{i,j}(z)\right)+\frac{\mu_i}{r}\left(R^{u}_{i}-R^{u,u}_{i,j}(z)\right)e^{-\vartheta_j\max\left[R^{u,u}_{i,j}(z)-\underline{w}_j,0\right]}\right)^{2}\varphi\left(\frac{\ln z-\mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z}dz,\tag{48}$$

$$\Psi^{u,u}_{j,z^{-ll}_{ij}} = \frac{1}{2}\int_{z^{-ll}_{ij}}^{\infty}\left(\sigma^{e}_{j}\left(R^{u,u}_{j,i}(z)\right)+\frac{\mu_j}{r}\left[R^{u}_{j}-R^{u,u}_{j,i}(z)\right]e^{-\vartheta_j\max\left[R^{u,u}_{j,i}(z)-\underline{w}_j,0\right]}\right)^{2}\varphi\left(\frac{\ln z-\mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z}dz.\tag{49}$$

Finally, we can calculate the transition rate for married unemployed into employment, i.e.,

$$\underline{\tau}^{u,l}_{i,j} = \begin{cases} 0 & \text{if } z^{el}_{ij}\leq z^{ul}_{ij}, \\ \mu_i\int_{z^{ul}_{ij}}^{z^{el}_{ij}}\left(\sigma^{e}_{j}\left(R^{u,-l}_{j,i}(z')\right)+\frac{\mu_j}{r}\left[R^{u}_{j}-R^{u,-l}_{j,i}(z')\right]e^{-\vartheta_j\max\left[R^{u,-l}_{j,i}(z')-\underline{w}_j,0\right]}\right) & \\ \qquad\times e^{-\vartheta_j\max\left[R^{u,-l}_{j,i}(z')-\underline{w}_j,0\right]}\varphi\left(\frac{\ln z'-\mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z'}dz' & \text{if } z^{el}_{ij}>z^{ul}_{ij}, \end{cases}$$

$$\overline{\tau}^{u,-l}_{j,i} = \begin{cases} \mu_i\int_{z^{ul}_{ij}}^{\infty}\left(\sigma^{e}_{j}\left(R^{u,-l}_{j,i}(z')\right)+\frac{\mu_j}{r}\left[R^{u}_{j}-R^{u,-l}_{j,i}(z')\right]e^{-\vartheta_j\max\left[R^{u,-l}_{j,i}(z')-\underline{w}_j,0\right]}\right) & \\ \qquad\times e^{-\vartheta_j\max\left[R^{u,-l}_{j,i}(z')-\underline{w}_j,0\right]}\varphi\left(\frac{\ln z'-\mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z'}dz' & \text{if } z^{el}_{ij}\leq z^{ul}_{ij}, \\ \mu_i\int_{z^{el}_{ij}}^{\infty}\left(\sigma^{e}_{j}\left(R^{u,-l}_{j,i}(z')\right)+\frac{\mu_j}{r}\left[R^{u}_{j}-R^{u,-l}_{j,i}(z')\right]e^{-\vartheta_j\max\left[R^{u,-l}_{j,i}(z')-\underline{w}_j,0\right]}\right) & \\ \qquad\times e^{-\vartheta_j\max\left[R^{u,-l}_{j,i}(z')-\underline{w}_j,0\right]}\varphi\left(\frac{\ln z'-\mu_z}{\sigma_z}\right)\frac{1}{\sigma_z z'}dz' & \text{if } z^{el}_{ij}>z^{ul}_{ij}, \end{cases}$$

Equations (35) to (38) have to be solved simultaneously for the four cutoff values $\left\{z^{ee}_{ij}, z^{ue}_{ij}, z^{eu}_{ij}, z^{uu}_{ij}\right\}$. This involves first solving for the differential equation (41) to obtain σ^{u}_{i} and σ^{u}_{j}, $\left\{R^{u,e}_{i,j}(z), R^{u,e}_{j,i}(z), R^{u,u}_{i,j}(z), R^{u,u}_{j,i}(z)\right\}$ according to equations (44) and (45), $\left\{\Psi^{u,e}_{i,z^{-ll}_{ij}}, \Psi^{u,e}_{j,z^{-ll}_{ij}}, \Psi^{u,u}_{i,z^{-ll}_{ij}}, \Psi^{u,u}_{j,z^{-ll}_{ij}}\right\}$ according to equations (46) to (49), and $\left\{\tau^{u,e}_{i,j}, \tau^{u,e}_{j,i}, \tau^{u,u}_{i,j}, \tau^{u,u}_{j,i}\right\}$. The values $\overline{S}^{-l'l}_{z^{-ll}_{ij}}, \overline{S}^{-ll'}_{z^{-ll}_{ij}}$, and $\overline{S}^{-l'l'}_{z^{-ll}_{ij}}$ for each $z^{-ll}_{ij}\in\left\{z^{ee}_{ij}, z^{ue}_{ij}, z^{eu}_{ij}, z^{uu}_{ij}\right\}$ are not needed for further analysis. They are only required to find the fixed-points $\overline{S}^{-ll}_{z^{-ll}_{ij}}$ for each labor market status $-ll\in\{ee, eu, ue, uu\}$. Given the fixed-points $\overline{S}^{-ll}_{z^{-ll}_{ij}}$ for each labor market status

$-ll$, we can use the following equation system based on the surplus function given in equations (**??**) to (**??**) to find the z_{ij}^{-ll} associated with each labor market status ll, i.e.,

$$
\begin{aligned}
[r+\delta+q_i+q_j]\,S_{ij}^{ee}\left(z_{ij}^{-ll}\right) &= z_{ij}^{-ll}\left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{ee}+\delta\overline{S}_{z_{ij}^{ee}}^{ee}-\Theta_{ij}^{ee}\\
&\quad +q_i\max\left[0,S_{ij}^{ue}\left(z_{ij}^{-ll}\right)\right]+q_j\max\left[0,S_{ij}^{eu}\left(z_{ij}^{-ll}\right)\right],\\
[r+\delta+q_j]\,S_{ij}^{ue}\left(z_{ij}^{-ll}\right) &= z_{ij}^{-ll}\left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{ue}+\delta\overline{S}_{z_{ij}^{ue}}^{ue}-\Theta_{ij}^{ue}\\
&\quad +\tfrac{1}{2}\left(\sigma_{i,j}^{u,e}\left(z_{ij}^{-ll}\right)\right)^2+q_j\max\left[0,S_{ij}^{uu}\left(z_{ij}^{-ll}\right)\right],\\
[r+\delta+q_i]\,S_{ij}^{eu}\left(z_{ij}^{-ll}\right) &= z_{ij}^{-ll}\left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{eu}+\delta\overline{S}_{z_{ij}^{eu}}^{eu}-\Theta_{ij}^{eu}\\
&\quad +q_i\max\left[0,S_{ij}^{uu}\left(z_{ij}^{-ll}\right)\right]+\tfrac{1}{2}\left(\sigma_{j,i}^{u,e}\left(z_{ij}^{-ll}\right)\right)^2,\\
[r+\delta]\,S_{ij}^{uu}\left(z_{ij}^{-ll}\right) &= z_{ij}^{-ll}\left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{uu}+\delta\overline{S}_{z_{ij}^{uu}}^{uu}-\Theta_{ij}^{uu}\\
&\quad +\tfrac{1}{2}\left(\sigma_{i,j}^{u,u}\left(z_{ij}^{-ll}\right)\right)^2+\tfrac{1}{2}\left(\sigma_{j,i}^{u,u}\left(z_{ij}^{-ll}\right)\right)^2.
\end{aligned}
$$

Note with $S_{ij}^{-ll}\left(z_{ij}^{-ll}\right)=0$ this gives five unknows $\left\{z_{ij}^{-ll},S_{ij}^{ee}\left(z_{ij}^{-ll}\right),S_{ij}^{ue}\left(z_{ij}^{-ll}\right),S_{ij}^{eu}\left(z_{ij}^{-ll}\right),S_{ij}^{uu}\left(z_{ij}^{-ll}\right)\right\}$ for five equations. Again the values $S_{ij}^{-l'l}\left(z_{ij}^{-ll}\right)$, $S_{ij}^{-ll'}\left(z_{ij}^{-ll}\right)$, and $S_{ij}^{-l'l'}\left(z_{ij}^{-ll}\right)$ for each $z_{ij}^{-ll}\in\left\{z_{ij}^{ee},z_{ij}^{ue},z_{ij}^{eu},z_{ij}^{uu}\right\}$ are not needed for further analysis.

Iterating the two sub-iterations while updating the (joint) distributions of married individuals as well as singles in every iteration using equations (39) and (40) determines the fixed-point of the system for $\overline{S}_{z_{ij}^{-ll}}^{-ll}$ and z_{ij}^{-ll} and each combination of labor market statuses $-ll\in\{ee,eu,ue,uu\}$.

Since it turned out that enforcing $S_{ij}^{-ll}\left(z_{ij}^{-ll}\right)=0$ might leads to negative z_{ij}^{-ll} in the convergence process, we replaced the equation with $S_{ij}^{-ll}\left(z_{ij}^{-ll}\right)=0$ in the above equation system with,

$$
\begin{aligned}
z_{ij}^{ee} &= \Big\{[r+\delta+q_i+q_j]\,S_{ij}^{ee}\left(z_{ij}^{ee}\right)+\Theta_{ij}^{ee}-\delta\overline{S}_{z_{ij}^{ee}}^{ee}-q_i\max\left[0,S_{ij}^{ue}\left(z_{ij}^{ee}\right)\right]\\
&\quad -q_j\max\left[0,S_{ij}^{eu}\left(z_{ij}^{ee}\right)\right]\Big\}\,/\left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{ee},\\
z_{ij}^{ue} &= \Big\{[r+\delta+q_j]\,S_{ij}^{ue}\left(z_{ij}^{ue}\right)+\Theta_{ij}^{ue}-\delta\overline{S}_{z_{ij}^{ue}}^{ue}-\tfrac{1}{2}\left(\sigma_{i,j}^{u,e}\left(z_{ij}^{ue}\right)\right)^2\\
&\quad -q_j\max\left[0,S_{ij}^{uu}\left(z_{ij}^{ue}\right)\right]\Big\}\,/\left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{ue},\\
z_{ij}^{eu} &= \Big\{[r+\delta+q_i]\,S_{ij}^{eu}\left(z_{ij}^{eu}\right)+\Theta_{ij}^{eu}-\delta\overline{S}_{z_{ij}^{eu}}^{eu}-q_i\max\left[0,S_{ij}^{uu}\left(z_{ij}^{eu}\right)\right]\\
&\quad -\tfrac{1}{2}\left(\sigma_{j,i}^{u,e}\left(z_{ij}^{eu}\right)\right)^2\Big\}\,/\left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{eu},\\
z_{ij}^{uu} &= \Big\{[r+\delta]\,S_{ij}^{uu}\left(z_{ij}^{uu}\right)+\Theta_{ij}^{uu}-\delta\overline{S}_{z_{ij}^{uu}}^{uu}-\tfrac{1}{2}\left(\sigma_{i,j}^{u,u}\left(z_{ij}^{uu}\right)\right)^2\\
&\quad -\tfrac{1}{2}\left(\sigma_{j,i}^{u,u}\left(z_{ij}^{uu}\right)\right)^2\Big\}\,/\left(\xi_{y,x}+\xi_{x,y}\right)X_{ij}^{uu},
\end{aligned}
$$

where we set the initial values to,

$$
\begin{aligned}
S^{uu}_{ij}\left(z^{uu}_{ij}\right) &= \max\left[\frac{\delta\overline{S}^{uu}_{z^{uu}_{ij}} - \Theta^{uu}_{ij} + \frac{1}{2}\left(\sigma^{u,u}_{i,j}\left(z^{uu}_{ij}\right)\right)^2 + \frac{1}{2}\left(\sigma^{u,u}_{j,i}\left(z^{uu}_{ij}\right)\right)^2}{[r+\delta]}, 0\right], \\
S^{eu}_{ij}\left(z^{eu}_{ij}\right) &= \max\left[\frac{\delta\overline{S}^{eu}_{z^{eu}_{ij}} - \Theta^{eu}_{ij} + q_i \max\left[0, S^{uu}_{ij}\left(z^{eu}_{ij}\right)\right] + \frac{1}{2}\left(\sigma^{u,e}_{j,i}\left(z^{eu}_{ij}\right)\right)^2}{[r+\delta+q_i]}, 0\right], \\
S^{ue}_{ij}\left(z^{ue}_{ij}\right) &= \max\left[\frac{\delta\overline{S}^{ue}_{z^{ue}_{ij}} - \Theta^{ue}_{ij} + \frac{1}{2}\left(\sigma^{u,e}_{i,j}\left(z^{ue}_{ij}\right)\right)^2 + q_j \max\left[0, S^{uu}_{ij}\left(z^{ue}_{ij}\right)\right]}{[r+\delta+q_j]}, 0\right], \\
S^{ee}_{ij}\left(z^{ee}_{ij}\right) &= \max\left[\frac{\delta\overline{S}^{ee}_{z^{ee}_{ij}} - \Theta^{ee}_{ij} + q_i \max\left[0, S^{ue}_{ij}\left(z^{ee}_{ij}\right)\right] + q_j \max\left[0, S^{eu}_{ij}\left(z^{ee}_{ij}\right)\right]}{[r+\delta+q_i+q_j]}, 0\right].
\end{aligned}
$$

All others initial surplus values are set to zero, i.e., $S^{ee}_{ij}\left(z^{-ll}_{ij}\right) = 0$, $S^{ue}_{ij}\left(z^{-ll}_{ij}\right) = 0$, $S^{eu}_{ij}\left(z^{-ll}_{ij}\right) = 0$, $S^{uu}_{ij}\left(z^{-ll}_{ij}\right) = 0$.

Now, we have the problem that we have four equations for five unknows $\left\{z^{-ll}_{ij}, S^{ee}_{ij}\left(z^{-ll}_{ij}\right), S^{ue}_{ij}\left(z^{-ll}_{ij}\right), S\right.$ To solve this problem we use the following "complementary slackness condition" $z^{-ll}_{ij} S^{-ll}_{ij}\left(z^{-ll}_{ij}\right) = 0$.

A.2.1 Simple calculation of the z-block

The cutoff $z^{uu}_{ij}\_new$ can be solved independently of the other cutoffs. The cutoff is determined by the following two conditions,

$$
z^{uu}_{ij}\_new = \max\left[\frac{\Theta^{uu}_{ij} - \delta\overline{S}^{uu}_{z^{uu}_{ij}} - \frac{1}{2}\left(\sigma^{u,u}_{i,j}\left(z^{uu}_{ij}\right)\right)^2 - \frac{1}{2}\left(\sigma^{u,u}_{j,i}\left(z^{uu}_{ij}\right)\right)^2}{\left(\xi_{y,x} + \xi_{x,y}\right) X^{uu}_{ij}}, 0\right]
$$

The new cutoff z^{eu}_{ij} can be solved as follows,

$$
S^{uu}_{ij}\left(z^{eu}_{ij}\right)\_new = \frac{z^{eu}_{ij}\left(\xi_{y,x} + \xi_{x,y}\right) X^{uu}_{ij} + \delta\overline{S}^{uu}_{z^{uu}_{ij}} - \Theta^{uu}_{ij} + \frac{1}{2}\left(\sigma^{u,u}_{i,j}\left(z^{eu}_{ij}\right)\right)^2 + \frac{1}{2}\left(\sigma^{u,u}_{j,i}\left(z^{eu}_{ij}\right)\right)^2}{[r+\delta]}.
$$

$$
z^{eu}_{ij}\_new = \max\left[\frac{\Theta^{eu}_{ij} - \delta\overline{S}^{eu}_{z^{eu}_{ij}} - q_i \max\left[0, S^{uu}_{ij}\left(z^{eu}_{ij}\right)\_new\right] - \frac{1}{2}\left(\sigma^{u,e}_{j,i}\left(z^{eu}_{ij}\right)\right)^2}{\left(\xi_{y,x} + \xi_{x,y}\right) X^{eu}_{ij}}, 0\right]
$$

The new cutoff z^{ue}_{ij} can be solved as follows,

$$
S^{uu}_{ij}\left(z^{ue}_{ij}\right)\_new = \frac{z^{ue}_{ij}\left(\xi_{y,x} + \xi_{x,y}\right) X^{uu}_{ij} + \delta\overline{S}^{uu}_{z^{uu}_{ij}} - \Theta^{uu}_{ij} + \frac{1}{2}\left(\sigma^{u,u}_{i,j}\left(z^{ue}_{ij}\right)\right)^2 + \frac{1}{2}\left(\sigma^{u,u}_{j,i}\left(z^{ue}_{ij}\right)\right)^2}{[r+\delta]}.
$$

$$z_{ij}^{ue}\_new = \max\left[\frac{\Theta_{ij}^{ue} - \delta\overline{S}_{z_{ij}^{ue}}^{ue} - \frac{1}{2}\left(\sigma_{i,j}^{u,e}\left(z_{ij}^{ue}\right)\right)^2 - q_j \max\left[0, S_{ij}^{uu}\left(z_{ij}^{ue}\right)\_new\right]}{\left(\xi_{y,x} + \xi_{x,y}\right) X_{ij}^{ue}}, 0\right]$$

The new cutoff z_{ij}^{ee} can be solved as follows,

$$\begin{aligned}
S_{ij}^{uu}\left(z_{ij}^{ee}\right)_new &= \frac{z_{ij}^{ee}\left(\xi_{y,x} + \xi_{x,y}\right) X_{ij}^{uu} + \delta\overline{S}_{z_{ij}^{uu}}^{uu} - \Theta_{ij}^{uu} + \frac{1}{2}\left(\sigma_{i,j}^{u,u}\left(z_{ij}^{ee}\right)\right)^2 + \frac{1}{2}\left(\sigma_{j,i}^{u,u}\left(z_{ij}^{ee}\right)\right)^2}{[r+\delta]}, \\
S_{ij}^{eu}\left(z_{ij}^{ee}\right)_new &= \frac{z_{ij}^{ee}\left(\xi_{y,x} + \xi_{x,y}\right) X_{ij}^{eu} + \delta\overline{S}_{z_{ij}^{eu}}^{eu} - \Theta_{ij}^{eu} + q_i \max\left[0, S_{ij}^{uu}\left(z_{ij}^{ee}\right)_new\right] + \frac{1}{2}\left(\sigma_{j,i}^{u,e}\left(z_{ij}^{ee}\right)\right)^2}{[r+\delta+q_i]} \\
S_{ij}^{ue}\left(z_{ij}^{ee}\right)_new &= \frac{z_{ij}^{ee}\left(\xi_{y,x} + \xi_{x,y}\right) X_{ij}^{ue} + \delta\overline{S}_{z_{ij}^{ue}}^{ue} - \Theta_{ij}^{ue} + \frac{1}{2}\left(\sigma_{i,j}^{u,e}\left(z_{ij}^{ee}\right)\right)^2 + q_j \max\left[0, S_{ij}^{uu}\left(z_{ij}^{ee}\right)_new\right]}{[r+\delta+q_j]}
\end{aligned}$$

$$z_{ij}^{ee}\_new = \max\left[\frac{\Theta_{ij}^{ee} - \delta\overline{S}_{z_{ij}^{ee}}^{ee} - q_i \max\left[0, S_{ij}^{ue}\left(z_{ij}^{ee}\right)\_new\right] - q_j \max\left[0, S_{ij}^{eu}\left(z_{ij}^{ee}\right)\_new\right]}{\left(\xi_{y,x} + \xi_{x,y}\right) X_{ij}^{ee}}, 0\right]$$

A.2.2 Computing the fixed point for single values

Step 1: Compute $\widehat{L}$-values for given single values according to,

$$
\begin{aligned}
\widehat{L}^{uu}_{i=u} &= \lambda^{uu}\alpha^{uu}_{ij}s^{u}_{j}, & \widehat{L}^{eu}_{i=u} &= \lambda^{eu}\alpha^{eu}_{ij}s^{e}_{i}s^{u}_{j}/s^{u}_{i},\\
\widehat{L}^{uu}_{j=u} &= \lambda^{uu}\alpha^{uu}_{ij}s^{u}_{i}, & \widehat{L}^{eu}_{j=u} &= \lambda^{eu}\alpha^{eu}_{ij}s^{e}_{i},\\
\widehat{L}^{uu}_{i=e} &= \lambda^{uu}\alpha^{uu}_{ij}s^{u}_{i}s^{u}_{j}/s^{e}_{i}, & \widehat{L}^{eu}_{i=e} &= \lambda^{eu}\alpha^{eu}_{ij}s^{u}_{j},\\
\widehat{L}^{uu}_{j=e} &= \lambda^{uu}\alpha^{uu}_{ij}s^{u}_{i}s^{u}_{j}/s^{e}_{j}, & \widehat{L}^{eu}_{j=e} &= \lambda^{eu}\alpha^{eu}_{ij}s^{e}_{i}s^{u}_{j}/s^{e}_{j},\\
\widehat{L}^{ue}_{i=u} &= \lambda^{ue}\alpha^{ue}_{ij}s^{e}_{j}, & \widehat{L}^{ee}_{i=u} &= \lambda^{ee}\alpha^{ee}_{ij}s^{e}_{i}s^{e}_{j}/s^{u}_{i},\\
\widehat{L}^{ue}_{j=u} &= \lambda^{ue}\alpha^{ue}_{ij}s^{u}_{i}s^{e}_{j}/s^{u}_{j}, & \widehat{L}^{ee}_{j=u} &= \lambda^{ee}\alpha^{ee}_{ij}s^{e}_{i}s^{e}_{j}/s^{u}_{j},\\
\widehat{L}^{ue}_{i=e} &= \lambda^{ue}\alpha^{ue}_{ij}s^{u}_{i}s^{e}_{j}/s^{e}_{i}, & \widehat{L}^{ee}_{i=e} &= \lambda^{ee}\alpha^{ee}_{ij}s^{e}_{j},\\
\widehat{L}^{ue}_{j=e} &= \lambda^{ue}\alpha^{ue}_{ij}s^{u}_{i}, & \widehat{L}^{ee}_{j=e} &= \lambda^{ee}\alpha^{ee}_{ij}s^{e}_{i}.
\end{aligned}
$$

Step 2: Compute for each male and female type j and labor market combination the $\widehat{m}$-values according to the following recursive system,

$$
\begin{aligned}
\widehat{m}^{ee}_{j=l} &= \frac{B}{C}\widehat{L}^{ee}_{j=l} + \frac{A_i\overline{\tau}^{u,e}_{j,i} + \overline{\tau}^{u,u}_{j,i}\overline{\tau}^{u,e}_{i,j}\overline{\tau}^{e,u}_{i,j}}{C}\left[\widehat{L}^{eu}_{j=l} + \frac{\overline{\tau}^{u,u}_{i,j}}{D^{uu} + \overline{\tau}^{u,u}_{i,j} + \overline{\tau}^{u,u}_{j,i}}\widehat{L}^{uu}_{j=l}\right]\\
&\quad + \frac{A_j\overline{\tau}^{u,e}_{i,j} + \overline{\tau}^{u,u}_{i,j}\overline{\tau}^{u,e}_{j,i}\overline{\tau}^{e,u}_{j,i}}{C}\left[\widehat{L}^{ue}_{j=l} + \frac{\overline{\tau}^{u,u}_{j,i}}{D^{uu} + \overline{\tau}^{u,u}_{i,j} + \overline{\tau}^{u,u}_{j,i}}\widehat{L}^{uu}_{j=l}\right],\\
\widehat{m}^{eu}_{j=l} &= \frac{A_i}{B}\left[\widehat{L}^{eu}_{j=l} + \frac{\overline{\tau}^{u,u}_{i,j}}{D^{uu} + \overline{\tau}^{u,u}_{i,j} + \overline{\tau}^{u,u}_{j,i}}\widehat{L}^{uu}_{j=l}\right] + \frac{A_i\overline{\tau}^{e,e}_{j,i} + \overline{\tau}^{u,u}_{i,j}\overline{\tau}^{e,u}_{j,i}\overline{\tau}^{e,e}_{i,j}}{B}\widehat{m}^{ee}_{j=l}\\
&\quad + \frac{\overline{\tau}^{u,u}_{i,j}\overline{\tau}^{e,u}_{j,i}}{B}\left[\widehat{L}^{ue}_{j=l} + \frac{\overline{\tau}^{u,u}_{j,i}}{D^{uu} + \overline{\tau}^{u,u}_{i,j} + \overline{\tau}^{u,u}_{j,i}}\widehat{L}^{uu}_{j=l}\right],\\
\widehat{m}^{ue}_{j=l} &= \frac{A_j}{B}\left[\widehat{L}^{ue}_{j=l} + \frac{\overline{\tau}^{u,u}_{j,i}}{D^{uu} + \overline{\tau}^{u,u}_{i,j} + \overline{\tau}^{u,u}_{j,i}}\widehat{L}^{uu}_{j=l}\right] + \frac{A_j\overline{\tau}^{e,e}_{i,j} + \overline{\tau}^{u,u}_{j,i}\overline{\tau}^{e,u}_{i,j}\overline{\tau}^{e,e}_{j,i}}{B}\widehat{m}^{ee}_{j=l}\\
&\quad + \frac{\overline{\tau}^{u,u}_{j,i}\overline{\tau}^{e,u}_{i,j}}{B}\left[\widehat{L}^{eu}_{j=l} + \frac{\overline{\tau}^{u,u}_{i,j}}{D^{uu} + \overline{\tau}^{u,u}_{i,j} + \overline{\tau}^{u,u}_{j,i}}\widehat{L}^{uu}_{j=l}\right],\\
\widehat{m}^{uu}_{j=l} &= \frac{\widehat{L}^{uu}_{j=l} + \overline{\tau}^{e,u}_{i,j}\widehat{m}^{eu}_{j=l} + \overline{\tau}^{e,u}_{j,i}\widehat{m}^{ue}_{j=l}}{D^{uu} + \overline{\tau}^{u,u}_{i,j} + \overline{\tau}^{u,u}_{j,i}}.
\end{aligned}
$$

where

$$
\begin{aligned}
A_j &= \left(D^{uu}+\overline{\tau}_{j,i}^{u,u}\right)\left(D^{eu}+\overline{\tau}_{j,i}^{u,e}\right)+\overline{\tau}_{i,j}^{e,u}\left(D^{uu}+\overline{\tau}_{j,i}^{u,u}\right)+\overline{\tau}_{i,j}^{u,u}\left(D^{eu}+\overline{\tau}_{j,i}^{u,e}\right), \\
A_i &= \left(D^{uu}+\overline{\tau}_{i,j}^{u,u}\right)\left(D^{ue}+\overline{\tau}_{i,j}^{u,e}\right)+\overline{\tau}_{j,i}^{e,u}\left(D^{uu}+\overline{\tau}_{i,j}^{u,u}\right)+\overline{\tau}_{j,i}^{u,u}\left(D^{ue}+\overline{\tau}_{i,j}^{u,e}\right), \\
B &= \left(D^{uu}+\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,u}\right)\left(D^{ue}+\overline{\tau}_{i,j}^{u,e}\right)\left(D^{eu}+\overline{\tau}_{j,i}^{u,e}\right)+\left(D^{uu}+\overline{\tau}_{j,i}^{u,u}\right)\left(D^{ue}+\overline{\tau}_{i,j}^{u,e}\right)\overline{\tau}_{i,j}^{e,u} \\
&\quad +\left(D^{uu}+\overline{\tau}_{i,j}^{u,u}\right)\left(D^{eu}+\overline{\tau}_{j,i}^{u,e}\right)\overline{\tau}_{j,i}^{e,u}+D^{uu}\overline{\tau}_{j,i}^{e,u}\overline{\tau}_{i,j}^{e,u}, \\
C &= D^{ee}B+\left[D^{eu}+\overline{\tau}_{i,j}^{e,u}+\overline{\tau}_{j,i}^{u,e}\right]\left[D^{uu}D^{ue}+D^{uu}\overline{\tau}_{j,i}^{e,u}+\overline{\tau}_{j,i}^{u,u}D^{ue}\right]\overline{\tau}_{i,j}^{e,e} \\
&\quad +\left[D^{ue}+\overline{\tau}_{i,j}^{u,e}+\overline{\tau}_{j,i}^{e,u}\right]\left[D^{uu}D^{eu}+D^{uu}\overline{\tau}_{i,j}^{e,u}+\overline{\tau}_{i,j}^{u,u}D^{eu}\right]\overline{\tau}_{j,i}^{e,e} \\
&\quad +\overline{\tau}_{i,j}^{u,u}\left[D^{ue}D^{eu}+D^{ue}\overline{\tau}_{j,i}^{u,e}+\overline{\tau}_{j,i}^{e,u}D^{eu}\right]\overline{\tau}_{i,j}^{e,e}+\overline{\tau}_{j,i}^{u,u}\left[D^{ue}D^{eu}+D^{ue}\overline{\tau}_{i,j}^{e,u}+D^{eu}\overline{\tau}_{i,j}^{u,e}\right]\overline{\tau}_{j,i}^{e,e}, \\
D^{-ll} &= \delta\left(1-\alpha_{ij}^{-ll}\right)+\underline{\tau}_{i,j}^{-l,l}+\underline{\tau}_{j,i}^{l,-l}.
\end{aligned}
$$

Step 3: Compute the new single values,

$$
s_j^u = \frac{\tau_j^e n_j}{\tau_j^e+\tau_j^u+\sum_i\left[\tau_j^e+\underline{\tau}_{j,i}^{u,u}+\overline{\tau}_{j,i}^{u,u}\right]\widehat{m}_{j=u}^{uu}+\sum_i\left[\tau_j^e+\underline{\tau}_{j,i}^{u,e}+\overline{\tau}_{j,i}^{u,e}\right]\widehat{m}_{j=u}^{eu}}
$$

$$
s_j^e = \frac{\tau_j^u n_j}{\begin{array}{c}\tau_j^u+\tau_j^e+\sum_i\left[\tau_j^u+\underline{\tau}_{j,i}^{e,u}+\overline{\tau}_{j,i}^{e,u}\right]\widehat{m}_{j=e}^{ue}+\sum_i\left[\tau_j^u+\underline{\tau}_{j,i}^{e,e}+\overline{\tau}_{j,i}^{e,e}\right]\widehat{m}_{j=e}^{ee} \\ +\sum_i\left[\tau_j^u-\underline{\tau}_{j,i}^{u,u}-\overline{\tau}_{j,i}^{u,u}\right]\widehat{m}_{j=e}^{uu}+\sum_i\left[\tau_j^u-\underline{\tau}_{j,i}^{u,e}-\overline{\tau}_{j,i}^{u,e}\right]\widehat{m}_{j=e}^{eu}\end{array}}
$$

Step 4: Start with step 1 until single values converge.

B Structural Estimation

B.1 Definition of education categories

The five education categories are defined by years of education. Due to 9 years of compulsory schooling, the years of eduction start with 9 years and end at 17 years of eduction for somebody with a university degree or higher. The exact definition is as follows:

Table A.1: Definition of Years of Eduction (YoE)

YoE	highest schooling level	highest prof. education
17	any	university degree or higher
14	any	master craftsman / technician
14	secondary school level 2 or higher[a)]	vocational training completed
12	less than secondary school level 2[b)]	vocational training completed
10	secondary school level 1 and 2 or higher[c)]	no degree
9	less than secondary school level 1 and 2[d)]	no degree

a) Fachabitur or Abitur
b) Mittlere Reife or lower
c) Mittlere Reife, Fachabitur or Abitur
d) with or without Hauptschulabschl.

B.2 Transition probabilities

Since we do not observe the exact date of the transition but only whether a person changed the labor or marriage market status from one year to another, we need to make the following transformation to obtain the empirical counterpart of our continuous time model.

We normalize the duration of a year to unity, i.e., the transition rates are yearly transition rates, which implicitly assumes that labor and marriage market transitions occur only once per year. Given that we assume a Poisson process for the transition rates, the time until an event occurs follows an exponential distribution. Note that not all Poisson transition rates are independent of the marital or labor market status of the person in question. For example the marriage rate depends on the labor market status. How this shows up in the formulas will become clear below.

We start with looking at the labor market transitions a single woman can make.[6] In these cases there is no marriage market transition by assumption. Hence, the failure to marry depends on the aggregate marriage rate, i.e., the sum over the potential partners. To simplify the notation we denote the marriage rate for an employed, single woman by $\lambda_j^e \equiv \sum_i \sum_{-l} \lambda \alpha_{ij}^{-le} s_i^{-l}$, and the marriage rate for an unemployed, single woman by

[6]The formulas are equivalent for single men.

$\lambda_j^u \equiv \sum_i \sum_{-l} \lambda \alpha_{ij}^{-lu} s_i^{-l}$. Consider first the probability of an unemployed single woman to stay unemployed and remain single, i.e., $\Pr\left[s_j^u \to s_j^u\right]$. Since neither a labor nor a marriage market transition occurs, the respective Poisson rates τ_j^u and λ_j^u remain the same during the year under consideration. We can therefore obtain the probability as follows,

C Calculation of transition probabilities for yearly data

Since we do not observe the exact date of the transition but only whether a person changed the labor or marriage market status from one year to another, we need to make the following transformation to obtain the empirical counterpart of our continuous time model.

We normalize the duration of a year to unity, i.e., the transition rates are yearly transition rates, which implicitly assumes that labor and marriage market transitions occur only once per year. Given that we assume a Poisson process for the transition rates, the time until an event occurs follows an exponential distribution. Note that not all Poisson transition rates are independent of the marital or labor market status of the person in question. For example the marriage rate depends on the labor market status. How this shows up in the formulas will become clear below.

C.1 Single

We start with looking at the labor market transitions a single woman can make.[7] In these cases there is no marriage market transition by assumption. Hence, the failure to marry depends on the aggregate marriage rate, i.e., the sum over the potential partners. To simplify the notation we denote the marriage rate for an employed, single woman by $\lambda_j^e \equiv \sum_i \sum_{-l} \lambda \alpha_{ij}^{-le} s_i^{-l}$, and the marriage rate for an unemployed, single woman by $\lambda_j^u \equiv \sum_i \sum_{-l} \lambda \alpha_{ij}^{-lu} s_i^{-l}$. Consider first the probability of an unemployed single woman to stay unemployed and remain single, i.e., $\Pr\left[s_j^u \to s_j^u\right]$. Since neither a labor nor a marriage market transition occurs, the respective Poisson rates τ_j^u and λ_j^u remain the same during the year under consideration. We can therefore obtain the probability as follows,

$$\begin{aligned}
\Pr\left[s_j^u \to s_j^u\right] &= \left(1 - \int_0^1 \lambda_j^u e^{-\lambda_j^u t} dt\right)\left(1 - \int_0^1 \tau_j^u e^{-\tau_j^u t} dt\right) \\
&= e^{-\lambda_j^u} e^{-\tau_j^u}.
\end{aligned}$$

[7] The formulas are equivalent for single men.

If we consider now an unemployed, single woman that finds a job during the year, the respective probability is given by,

$$\begin{aligned}\Pr\left[s_j^u \to s_j^e\right] &= \int_0^1 \tau_j^u e^{-\tau_j^u t}\left(1-\int_0^t \lambda_j^u e^{-\lambda_j^u x}dx - \int_t^1 \lambda_j^e e^{-\lambda_j^e x}dx\right)dt \\ &= \int_0^1 \tau_j^u e^{-\tau_j^u t}\left(1-\left(1-e^{-\lambda_j^u t}\right)-\left(e^{-\lambda_j^e t}-e^{-\lambda_j^e}\right)\right)dt \\ &= \int_0^1 \tau_j^u e^{-\tau_j^u t}\left(e^{-\lambda_j^u t}-e^{-\lambda_j^e t}+e^{-\lambda_j^e}\right)dt \\ &= \left(1-e^{-\tau_j^u}\right)e^{-\lambda_j^e}+\tfrac{\tau_j^u}{\lambda_j^u+\tau_j^u}\left(1-e^{-\left(\lambda_j^u+\tau_j^u\right)}\right)-\tfrac{\tau_j^u}{\lambda_j^e+\tau_j^u}\left(1-e^{-\left(\lambda_j^e+\tau_j^u\right)}\right),\end{aligned}$$

where the marriage rate changes from λ_j^u to λ_j^e after the woman found a job. The probability that an employed, single woman stays employed, remains single, and does not change jobs is equivalently given by,

$$\begin{aligned}\Pr\left[s_j^e \to s_j^e\right] &= \left(1-\int_0^1 \lambda_j^e e^{-\lambda_j^e t}dt\right)\left(1-\int_0^1 q_j e^{-q_j t}dt\right)\left(1-\int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t}dt\right) \\ &= e^{-\lambda_j^e}e^{-q_j}e^{-\tau_j^{ee}}.\end{aligned}$$

The probability that an employed, single woman stays employed, remains single, but change jobs is given by,

$$\begin{aligned}\Pr\left[s_j^e \to s_j^{e'}\right] &= \left(1-\int_0^1 \lambda_j^e e^{-\lambda_j^e t}dt\right)\left(1-\int_0^1 q_j e^{-q_j t}dt\right)\int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t}dt \\ &= e^{-\lambda_j^e}e^{-q_j}\left(1-e^{-\tau_j^{ee}}\right).\end{aligned}$$

The probability that an employed, single woman does not change jobs while being employed, becomes unemployed, and stays single during the whole duration is given by,

$$\begin{aligned}\Pr\left[s_j^e \to s_j^u\right] &= \int_0^1 q_j e^{-q_j t}\left(1-\int_0^t \tau_j^{ee} e^{-\tau_j^{ee} x}dx\right)\left(1-\int_0^t \lambda_j^e e^{-\lambda_j^e x}dx - \int_t^1 \lambda_j^u e^{-\lambda_j^u x}dx\right)dt \\ &= \int_0^1 q_j e^{-q_j t}e^{-\tau_j^{ee} t}\left(e^{-\lambda_j^e t}-e^{-\lambda_j^u t}+e^{-\lambda_j^u}\right)dt \\ &= \tfrac{q_j}{q_j+\tau_j^{ee}+\lambda_j^e}\left(1-e^{-\left(q_j+\tau_j^{ee}+\lambda_j^e\right)}\right)-\tfrac{q_j}{q_j+\tau_j^{ee}+\lambda_j^u}\left(1-e^{-\left(q_j+\tau_j^{ee}+\lambda_j^u\right)}\right) \\ &\quad +\tfrac{q_j}{q_j+\tau_j^{ee}}\left(1-e^{-\left(q_j+\tau_j^{ee}\right)}\right)e^{-\lambda_j^u}.\end{aligned}$$

The assumption that only one labor market transition can happen within a year implies that we can omit the possibility to find a job after the jobloss.

Next, we consider the probability that a single, unemployed woman becomes married. Since the job finding rate of a single woman is different from a married woman, the failure to find a job depends on the job finding rate of single women τ_j^u before the marriage and on the job finding rate of married women $\tau_{j,i}^{u,-l}$ after marriage. Since the marriage observations in the data are scares, we do not differentiate between marriages of different types, i.e., we sum over all partner types, i.e., $\Pr\left[s_j^u \to \sum_i \sum_{-l} m_{ij}^{-lu}\right]$. This implies that we need to take the average job finding rate of married woman (averaged over all potential partners) when we consider the job finding rate, i.e.,

$$\widehat{\tau}_{j,i}^{u,-l} \equiv \frac{\sum_i \sum_{-l} m_{ij}^{-lu} \tau_{j,i}^{u,-l}}{\sum_i \sum_{-l} m_{ij}^{-lu}}.$$

Note, that all marriages that form have by definition a bliss value above the cutoff value. By the assumption that no further marriage market transition occurs within the same year, we can abstract from changes in bliss values that leads to divorces. This allows us to write the transition probability of an unemployed, single woman that marries but stays unemployed as follows,

$$\begin{aligned}
&\Pr\left[s_j^u \to \textstyle\sum_i \sum_{-l} m_{ij}^{-lu}\right] \\
= &\int_0^1 \lambda_j^u e^{-\lambda_j^u t}\left(1 - \int_0^t \tau_j^u e^{-\tau_j^u x} dx - \int_t^1 \widehat{\tau}_{j,i}^{u,-l} e^{-\widehat{\tau}_{j,i}^{u,-l} x} dx\right) dt \\
= &\int_0^1 \lambda_j^u e^{-\lambda_j^u t}\left(e^{-\tau_j^u t} - e^{-\widehat{\tau}_{j,i}^{u,-l} t} + e^{-\widehat{\tau}_{j,i}^{u,-l}}\right) dt \\
= &\left(1 - e^{-\lambda_j^u}\right) e^{-\widehat{\tau}_{j,i}^{u,-l}} + \tfrac{\lambda_j^u}{\lambda_j^u + \tau_j^u}\left(1 - e^{-\left(\lambda_j^u + \tau_j^u\right)}\right) - \tfrac{\lambda_j^u}{\lambda_j^u + \widehat{\tau}_{j,i}^{u,-l}}\left(1 - e^{-\left(\lambda_j^u + \widehat{\tau}_{j,i}^{u,-l}\right)}\right),
\end{aligned}$$

We now consider the probability that an unemployed, single woman marries and finds a job. This can happen via two ways either the woman marries first and finds a job later or visa versa. If the marriage rate and the job finding rate would remain the same even if a marriage or labor market transition occurs, when we would get $\Pr\left[s_j^u \to \sum_i \sum_{-l} m_{ij}^{-le}\right] = \int_0^1 \lambda_j^u e^{-\lambda_j^u t} dt \int_0^1 \tau_j^u e^{-\tau_j^u t} dt$. Since the marriage rate and the job finding rate change with the transition in the other market, we have to correct for these changes. We can do so as follows,

$$\begin{aligned}
\Pr\left[s_j^u \to \textstyle\sum_i \sum_{-l} m_{ij}^{-le}\right] = &\int_0^1 \lambda_j^u e^{-\lambda_j^u t} dt \int_0^1 \tau_j^u e^{-\tau_j^u t} dt \\
&+ \int_0^1 \tau_j^u e^{-\tau_j^u t}\left(\int_t^1 \lambda_j^e e^{-\lambda_j^e x} dx - \int_t^1 \lambda_j^u e^{-\lambda_j^u x} dx\right) dt \\
&+ \int_0^1 \lambda_j^u e^{-\lambda_j^u t}\left(\int_t^1 \widehat{\tau}_{j,i}^{u,-l} e^{-\widehat{\tau}_{j,i}^{u,-l} x} dx - \int_t^1 \tau_j^u e^{-\tau_j^u x} dx\right) dt,
\end{aligned}$$

where the second term corrects for the change in the marriage rate if the labor market transition occurs first and the third term corrects for the change of the job finding rate if the marriage market transition occurs first. Simplifying, gives

$$\begin{aligned}
\Pr\left[s_j^u \to \sum_i \sum_{-l} m_{ij}^{-le}\right] &= \left(1-e^{-\lambda_j^u}\right)\left(1-e^{-\tau_j^u}\right) \\
&\quad + \int_0^1 \tau_j^u e^{-\tau_j^u t}\left(e^{-\lambda_j^e t} - e^{-\lambda_j^e} - e^{-\lambda_j^u t} + e^{-\lambda_j^u}\right) dt \\
&\quad + \int_0^1 \lambda_j^u e^{-\lambda_j^u t}\left(e^{-\widehat{\tau}_{j,i}^{u,-l} t} - e^{-\widehat{\tau}_{j,i}^{u,-l}} - e^{-\tau_j^u t} + e^{-\tau_j^u}\right) dt \\
&= \left(1-e^{-\lambda_j^u}\right)\left(1-e^{-\tau_j^u}\right) + \left(1-e^{-\tau_j^u}\right)\left(e^{-\lambda_j^u} - e^{-\lambda_j^e}\right) \\
&\quad + \left(1-e^{-\lambda_j^u}\right)\left(e^{-\tau_j^u} - e^{-\widehat{\tau}_{j,i}^{u,-l}}\right) \\
&\quad - \tfrac{\tau_j^u}{\lambda_j^u+\tau_j^u}\left(1-e^{-\left(\lambda_j^u+\tau_j^u\right)}\right) + \tfrac{\tau_j^u}{\lambda_j^e+\tau_j^u}\left(1-e^{-\left(\lambda_j^e+\tau_j^u\right)}\right) \\
&\quad - \tfrac{\lambda_j^u}{\lambda_j^u+\tau_j^u}\left(1-e^{-\left(\lambda_j^u+\tau_j^u\right)}\right) + \tfrac{\lambda_j^u}{\lambda_j^u+\widehat{\tau}_{j,i}^{u,-l}}\left(1-e^{-\left(\lambda_j^u+\widehat{\tau}_{j,i}^{u,-l}\right)}\right) \\
&= \tfrac{\tau_j^u}{\lambda_j^e+\tau_j^u}\left(1-e^{-\left(\lambda_j^e+\tau_j^u\right)}\right) - \left(1-e^{-\tau_j^u}\right)e^{-\lambda_j^e} \\
&\quad + \tfrac{\lambda_j^u}{\lambda_j^u+\widehat{\tau}_{j,i}^{u,-l}}\left(1-e^{-\left(\lambda_j^u+\widehat{\tau}_{j,i}^{u,-l}\right)}\right) - \left(1-e^{-\lambda_j^u}\right)e^{-\widehat{\tau}_{j,i}^{u,-l}}.
\end{aligned}$$

One can check that the transition probabilities of a single, unemployed woman add up to unity, i.e.,

$$\begin{aligned}
1 &= \Pr\left[s_j^u \to s_j^u\right] + \Pr\left[s_j^u \to s_j^e\right] \\
&\quad + \Pr\left[s_j^u \to \sum_i \sum_{-l} m_{ij}^{-lu}\right] + \Pr\left[s_j^u \to \sum_i \sum_{-l} m_{ij}^{-le}\right].
\end{aligned}$$

Next, we consider the probability that a single, employed woman gets married and remains employed (at the same employer)

$$\begin{aligned}
&\Pr\left[s_j^e \to \sum_i \sum_{-l} m_{ij}^{-le}\right] \\
&= \int_0^1 \lambda_j^e e^{-\lambda_j^e t} dt \left(1 - \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} dt\right)\left(1 - \int_0^1 q_j e^{-q_j t} dt\right) \\
&= \left(1-e^{-\lambda_j^e}\right) e^{-\tau_j^{ee}} e^{-q_j}.
\end{aligned}$$

Next, we can write the probability that the single woman gets married and changes employer, i.e.,

$$\begin{aligned}
&\Pr\left[s_j^e \to \sum_i \sum_{-l} m_{ij}^{-le'}\right] \\
&= \int_0^1 \lambda_j^e e^{-\lambda_j^e t} dt \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t}\left(1 - \int_0^t q_j e^{-q_j x} dx\right) dt \\
&= \left(1-e^{-\lambda_j^e}\right) \tfrac{\tau_j^{ee}}{q_j+\tau_j^{ee}}\left(1-e^{-\left(q_j+\tau_j^{ee}\right)}\right).
\end{aligned}$$

Note that after finding a new job the woman cannot be laid off in the remaining year due to the assumption that only one labor market transition per year is possible. Finally, we consider the probability that a single, employed woman gets married and looses her job. Marriage can happend before and after the job loss. We therefore get,

$$
\begin{aligned}
& \Pr\left[s_j^e \to \sum_i \sum_{-l} m_{ij}^{-lu}\right] \\
= & \int_0^1 q_j e^{-q_j t}\left(1 - \int_0^t \tau_j^{ee} e^{-\tau_j^{ee} x} dx\right)\left(\int_0^t \lambda_j^e e^{-\lambda_j^e x} dx + \int_t^1 \lambda_j^u e^{-\lambda_j^u x} dx\right) dt \\
= & \int_0^1 q_j e^{-q_j t} e^{-\tau_j^{ee} t}\left(1 - e^{-\lambda_j^e t} + e^{-\lambda_j^u t} - e^{-\lambda_j^u}\right) dt \\
= & \left(1 - e^{-\lambda_j^u}\right) \tfrac{q_j}{q_j + \tau_j^{ee}}\left(1 - e^{-\left(q_j + \tau_j^{ee}\right)}\right) \\
& - \tfrac{q_j}{q_j + \tau_j^{ee} + \lambda_j^e}\left(1 - e^{-\left(q_j + \tau_j^{ee} + \lambda_j^e\right)}\right) + \tfrac{q_j}{q_j + \tau_j^{ee} + \lambda_j^u}\left(1 - e^{-\left(q_j + \tau_j^{ee} \lambda_j^u\right)}\right)
\end{aligned}
$$

It is again easy to check that the probabilities add up to unity, i.e.,

$$
\begin{aligned}
1 = & \Pr\left[s_j^e \to s_j^e\right] + \Pr\left[s_j^e \to \sum_i \sum_{-l} m_{ij}^{-le}\right] \\
& + \Pr\left[s_j^e \to s_j^{e'}\right] + \Pr\left[s_j^e \to \sum_i \sum_{-l} m_{ij}^{-le'}\right] \\
& + \Pr\left[s_j^e \to s_j^u\right] + \Pr\left[s_j^e \to \sum_i \sum_{-l} m_{ij}^{-lu}\right].
\end{aligned}
$$

C.2 Married stay married

Now, let us look at the transition probabilities of married couples. The difference here is that both spouses can change their labor market status within the year and during the same year a love shock δ can occur. We start with those cases where all couples stay married. A married couple where both spouses are initially unemployed and stay unemployed and married has the following probability,

$$
\begin{aligned}
\Pr\left[m_{ij}^{uu} \to m_{ij}^{uu}\right] = & \left(1 - \int_0^1 \tau_{i,j}^{u,u} e^{-\tau_{i,j}^{u,u} t} dt\right)\left(1 - \int_0^1 \tau_{j,i}^{u,u} e^{-\tau_{j,i}^{u,u} t} dt\right) \\
& \times \left(1 - \int_0^1 \delta\left(1 - \alpha_{ij}^{uu}\right) e^{-\delta\left(1 - \alpha_{ij}^{uu}\right) t} dt\right) \\
= & e^{-\tau_{i,j}^{u,u}} e^{-\tau_{j,i}^{u,u}} e^{-\delta\left(1 - \alpha_{ij}^{uu}\right)}.
\end{aligned}
$$

The probabilities for the cases where one spouse becomes employed have to take into account that the job finding rate of the partner and the divorce cutoff in case of a love shock changes. If $\alpha_{ij}^{ue} \geq \alpha_{ij}^{uu}$ ($\alpha_{ij}^{eu} \geq \alpha_{ij}^{uu}$), then all marriages survive the UE-transition of the woman (man). If $\alpha_{ij}^{ue} < \alpha_{ij}^{uu}$ ($\alpha_{ij}^{eu} < \alpha_{ij}^{uu}$), then some marriages are destroyed with the UE-transition. The respective transition probability for the UE-transition are therefore

$\overline{\tau}_{j,i}^{u,u}$ and $\overline{\tau}_{i,j}^{u,u}$. This implies,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{uu} \to m_{ij}^{ue}\right] \\
= \; & \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(1 - \int_0^t \tau_{i,j}^{u,u} e^{-\tau_{i,j}^{u,u} x} dx - \int_t^1 \tau_{i,j}^{u,e} e^{-\tau_{i,j}^{u,e} x} dx\right) \\
& \times \left(1 - \int_0^t \delta\left(1 - \alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} dx - \int_t^1 \delta\left(1 - \alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} dx\right) dt \\
= \; & \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\tau_{i,j}^{u,u} t} - e^{-\tau_{i,j}^{u,e} t} + e^{-\tau_{i,j}^{u,e}}\right) \\
& \times \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dt \\
= \; & e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\tau_{i,j}^{u,u} t} - e^{-\tau_{i,j}^{u,e} t}\right) dt \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\tau_{i,j}^{u,u} t} - e^{-\tau_{i,j}^{u,e} t}\right) \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t}\right) dt \\
& + e^{-\tau_{i,j}^{u,e}} \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t}\right) dt \\
& + e^{-\tau_{i,j}^{u,e}} e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\overline{\tau}_{j,i}^{u,u}}\right) \\
= \; & e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \left(\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,u}} \left(1 - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,u}\right)}\right) - \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,e}} \left(1 - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,e}\right)}\right)\right) \\
& + \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(1 - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \\
& - \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
& - \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(1 - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \\
& + \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \tau_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
& + e^{-\tau_{i,j}^{u,e}} \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(1 - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \\
& - e^{-\tau_{i,j}^{u,e}} \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
& + e^{-\tau_{i,j}^{u,e}} e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\overline{\tau}_{j,i}^{u,u}}\right)
\end{aligned}
$$

and

$$
\begin{aligned}
& \Pr\left[m_{ij}^{uu} \to m_{ij}^{eu}\right] \\
= & \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(1 - \int_0^t \tau_{j,i}^{u,u} e^{-\tau_{j,i}^{u,u} x} dx - \int_t^1 \tau_{j,i}^{u,e} e^{-\tau_{j,i}^{u,e} x} dx\right) \\
& \times \left(1 - \int_0^t \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} dx - \int_t^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} dx\right) dt \\
= & \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\tau_{j,i}^{u,u} t} - e^{-\tau_{j,i}^{u,e} t} + e^{-\tau_{j,i}^{u,e}}\right) \\
& \times \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) dt \\
= & e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\tau_{j,i}^{u,u} t} - e^{-\tau_{j,i}^{u,e} t}\right) dt \\
& + \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\tau_{j,i}^{u,u} t} - e^{-\tau_{j,i}^{u,e} t}\right) \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}\right) dt \\
& + e^{-\tau_{j,i}^{u,e}} \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}\right) dt \\
& + e^{-\tau_{j,i}^{u,e}} e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1 - e^{-\overline{\tau}_{i,j}^{u,u}}\right) \\
= & e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \left(\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,u}} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,u}\right)}\right) - \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,e}} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,e}\right)}\right)\right) \\
& + \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \\
& - \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{eu}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& - \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \\
& + \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{eu}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \tau_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& + e^{-\tau_{j,i}^{u,e}} \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \\
& - e^{-\tau_{j,i}^{u,e}} \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{eu}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& + e^{-\tau_{j,i}^{u,e}} e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1 - e^{-\overline{\tau}_{i,j}^{u,u}}\right)
\end{aligned}
$$

The probability that both unemployed spouses find a job and stay married depends similarly on α_{ij}^{ee} and α_{ij}^{uu} and the respective UE-transition rates. The probability is given by,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{uu} \to m_{ij}^{ee}\right] \\
= & \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(1 - \Delta_{0,t}^{uu \to ue}\right) dt \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(1 - \Delta_{0,t}^{uu \to eu}\right) dt \\
& + \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(1 - \Delta_{0,t}^{uu \to eu}\right) \left(\int_t^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} x} \left(1 - \Delta_{t,x}^{eu \to ee}\right) dx - \int_t^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} x} \left(1 - \Delta_{t,x}^{uu \to ue}\right) dx\right) d \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(1 - \Delta_{0,t}^{uu \to ue}\right) \left(\int_t^1 \overline{\tau}_{i,j}^{u,e} e^{-\overline{\tau}_{i,j}^{u,e} x} \left(1 - \Delta_{t,x}^{ue \to ee}\right) dx - \int_t^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} x} \left(1 - \Delta_{t,x}^{uu \to eu}\right) dx\right) d
\end{aligned}
$$

where

$$\Delta_{s,t}^{eu\to uu} = \int_s^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)y} dy + \int_t^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)y} dy.$$

$$\begin{aligned}
& \Pr\left[m_{ij}^{uu} \to m_{ij}^{ee}\right] \\
= \ & \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dt \\
& \times \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) dt \\
& + \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) \\
& \times \left(\int_t^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) dx\right) dt \\
& - \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) \\
& \times \left(\int_t^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dx\right) dt \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) \\
& \times \left(\int_t^1 \overline{\tau}_{i,j}^{u,e} e^{-\overline{\tau}_{i,j}^{u,e} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) dx\right) dt \\
& - \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) \\
& \times \left(\int_t^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) dx\right) dt
\end{aligned}$$

$$
\begin{aligned}
= \quad & \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) dt \\
& \times \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right) dt \\
& + \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right) \\
& \times \left(\left(e^{-\overline{\tau}_{j,i}^{u,e} t} - e^{-\overline{\tau}_{j,i}^{u,e}} \right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)} \right) \right. \\
& + \frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{eu}\right)} \left(e^{-\left(\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)t} - e^{-\left(\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)} \right) \\
& \left. - \frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)} \left(e^{-\left(\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)t} - e^{-\left(\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)} \right) \right) dt \\
& - \int_0^1 \overline{\tau}_{i,j}^{u,u} e^{-\overline{\tau}_{i,j}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right) \\
& \times \left(\left(e^{-\overline{\tau}_{j,i}^{u,u} t} - e^{-\overline{\tau}_{j,i}^{u,u}} \right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) \right. \\
& + \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)t} - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)} \right) \\
& \left. - \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)t} - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)} \right) \right) dt \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) \\
& \times \left(\left(e^{-\overline{\tau}_{i,j}^{u,e} t} - e^{-\overline{\tau}_{i,j}^{u,e}} \right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)} \right) \right. \\
& + \frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)t} - e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)} \right) \\
& \left. - \frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)} \left(e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)t} - e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)} \right) \right) dt \\
& - \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) \\
& \times \left(\left(e^{-\overline{\tau}_{i,j}^{u,u} t} - e^{-\overline{\tau}_{i,j}^{u,u}} \right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right) \right. \\
& + \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(e^{-\left(\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)t} - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)} \right) \\
& \left. - \frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{eu}\right)} \left(e^{-\left(\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)t} - e^{-\left(\overline{\tau}_{i,j}^{u,u} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)} \right) \right) dt
\end{aligned}
$$

$$
\begin{aligned}
= \quad & \left(\frac{\overline{\tau}_{j,i}^{u,u}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)} - \frac{\overline{\tau}_{j,i}^{u,u}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)} + \left(1 - e^{-\overline{\tau}_{j,i}^{u,u}}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) \\
& \times \left(\frac{\overline{\tau}_{i,j}^{u,u}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)} - \frac{\overline{\tau}_{i,j}^{u,u}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)} + \left(1 - e^{-\overline{\tau}_{i,j}^{u,u}}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right)
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}\right)}\right)\left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&-\left(1-e^{-\overline{\tau}_{i,j}^{u,u}}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\overline{\tau}_{j,i}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,e}}\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,e}}\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\overline{\tau}_{j,i}^{u,e}}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&-\left(1-e^{-\overline{\tau}_{i,j}^{u,u}}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}_{i,j}^{u,u}}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\right)\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\right)\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}\right)}\right)e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\right)\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\bar{\tau}^{u,u}_{j,i}}\left(1+e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\right)\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)e^{-\bar{\tau}^{u,u}_{j,i}}\left(1+e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\right)\\
&+\left(1-e^{-\bar{\tau}^{u,u}_{i,j}}\right)e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\bar{\tau}^{u,u}_{j,i}}\left(1+e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\right)\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\bar{\tau}^{u,u}_{j,i}}\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)e^{-\bar{\tau}^{u,u}_{j,i}}\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\bar{\tau}^{u,u}_{j,i}}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&+\left(1-e^{-\bar{\tau}^{u,u}_{i,j}}\right)e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&-\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&+\frac{\bar{\tau}^{u,u}_{i,j}}{\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\bar{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&-\left(1-e^{-\bar{\tau}^{u,u}_{i,j}}\right)e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\frac{\bar{\tau}^{u,u}_{j,i}}{\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(\bar{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\overline{\tau}^{u,e}_{i,j}}\left(1+e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\overline{\tau}^{u,e}_{i,j}}\left(1+e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\right)\\
&-\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\overline{\tau}^{u,e}_{i,j}}\left(1+e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\overline{\tau}^{u,e}_{i,j}}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\overline{\tau}^{u,e}_{i,j}}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\overline{\tau}^{u,e}_{i,j}}
\end{aligned}
$$

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\begin{aligned}
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&-\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\overline{\tau}^{u,u}_{i,j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\overline{\tau}^{u,u}_{i,j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\overline{\tau}^{u,u}_{i,j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\overline{\tau}^{u,u}_{i,j}}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\overline{\tau}^{u,u}_{i,j}}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\overline{\tau}^{u,u}_{i,j}}
\end{aligned}
$$

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\begin{aligned}
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&-\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}
\end{aligned}
$$

Let us now turn to married couples where the male partner is initially employed and the female partner unemployed. First we investigate the probability that nothing changes, i.e.,

$$
\begin{aligned}
\Pr\left[m_{ij}^{eu} \rightarrow m_{ij}^{eu}\right] &= \left(1-\int_0^1 q_i e^{-q_i t} dt\right)\left(1-\int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} dt\right)\left(1-\int_0^1 \tau_{j,i}^{u,e} e^{-\tau_{j,i}^{u,e} t} dt\right) \\
&\quad \times \left(1-\int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} dt\right) \\
&= e^{-q_i} e^{-\tau_i^{ee}} e^{-\tau_{j,i}^{u,e}} e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}.
\end{aligned}
$$

The probability that the man makes a job-to-job transition and everything else remains unchanged is given by,

$$
\begin{aligned}
\Pr\left[m_{ij}^{eu} \rightarrow m_{ij}^{e'u}\right] &= \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t}\left(1-\int_0^t q_i e^{-q_i x} dx\right) dt \left(1-\int_0^1 \tau_{j,i}^{u,e} e^{-\tau_{j,i}^{u,e} t} dt\right) \\
&\quad \times \left(1-\int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} dt\right) \\
&= \tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right) e^{-\tau_{j,i}^{u,e}} e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}.
\end{aligned}
$$

The probability that the man looses his job and nothing changes depends on α_{ij}^{eu} and α_{ij}^{uu}. If $\alpha_{ij}^{eu} \leq \alpha_{ij}^{uu}$, all marriages survive the job loss of the man. If $\alpha_{ij}^{eu} > \alpha_{ij}^{uu}$, some couples divorce after the job loss of the man. In the later case only the fraction $\alpha_{ij}^{uu}/\alpha_{ij}^{eu}$

of marriages survive. Thus, the quit rate has to be multiplied by $\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]$.

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu} \to m_{ij}^{uu}\right] \\
= & \int_0^1 q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]t} \left(1-\int_0^t \tau_i^{ee} e^{-\tau_i^{ee}x}dx\right) \\
& \times \left(1-\int_0^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x}dx - \int_t^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x}dx\right) \\
& \times \left(1-\int_0^t \tau_{j,i}^{u,e} e^{-\tau_{j,i}^{u,e}x}dx - \int_t^1 \tau_{j,i}^{u,u} e^{-\tau_{j,i}^{u,u}x}dx\right) dt, \\
= & \int_0^1 q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]t} e^{-\tau_i^{ee}t} \\
& \times \left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\left(e^{-\tau_{j,i}^{u,e}t} - e^{-\tau_{j,i}^{u,u}t} + e^{-\tau_{j,i}^{u,u}}\right) dt, \\
= & \tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)}\right) \\
& -\tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,u}} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,u}\right)}\right) \\
& +\tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) e^{-\tau_{j,i}^{u,u}} \\
& -\tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,e}} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,e}\right)}\right) \\
& +\tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}\right)}\right) \\
& -\tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) e^{-\tau_{j,i}^{u,u}} \\
& +\tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\tau_{j,i}^{u,e}} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\tau_{j,i}^{u,e}\right)}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)} \\
& -\tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\tau_{j,i}^{u,u}} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}+\tau_{j,i}^{u,u}\right)}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)} \\
& +\tfrac{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}} \left(1-e^{-\left(q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]+\tau_i^{ee}\right)}\right) e^{-\tau_{j,i}^{u,u}} e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}.
\end{aligned}
$$

if min $\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]=1$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu}\to m_{ij}^{uu}\right] \\
= & \int_0^1 q_i e^{-q_i t}\left(1-\int_0^t \tau_i^{ee}e^{-\tau_i^{ee}x}dx\right)\left(1-\int_0^t \tau_{j,i}^{u,e}e^{-\tau_{j,i}^{u,e}x}dx-\int_t^1 \tau_{j,i}^{u,u}e^{-\tau_{j,i}^{u,u}x}dx\right) \\
& \times\left(1-\int_0^t \delta\left(1-\alpha_{ij}^{eu}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x}dx-\int_t^1 \delta\left(1-\alpha_{ij}^{uu}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x}dx\right)dt \\
= & \int_0^1 q_i e^{-q_i t}e^{-\tau_i^{ee}t}\left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}-e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t}+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\left(e^{-\tau_{j,i}^{u,e}t}-e^{-\tau_{j,i}^{u,u}t}+e^{-\tau_{j,i}^{u,u}}\right)dt \\
= & \tfrac{q_i}{q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\left(1-e^{-\left(q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)}\right) \\
& -\tfrac{q_i}{q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,u}}\left(1-e^{-\left(q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,u}\right)}\right) \\
& +\tfrac{q_i}{q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\tau_{j,i}^{u,u}} \\
& -\tfrac{q_i}{q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,e}}\left(1-e^{-\left(q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,e}\right)}\right) \\
& +\tfrac{q_i}{q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}}\left(1-e^{-\left(q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}\right)}\right) \\
& -\tfrac{q_i}{q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\tau_{j,i}^{u,u}} \\
& +\tfrac{q_i}{q_i+\tau_i^{ee}+\tau_{j,i}^{u,e}}\left(1-e^{-\left(q_i+\tau_i^{ee}+\tau_{j,i}^{u,e}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)} \\
& -\tfrac{q_i}{q_i+\tau_i^{ee}+\tau_{j,i}^{u,u}}\left(1-e^{-\left(q_i+\tau_i^{ee}+\tau_{j,i}^{u,u}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)} \\
& +\tfrac{q_i}{q_i+\tau_i^{ee}}\left(1-e^{-\left(q_i+\tau_i^{ee}\right)}\right)e^{-\tau_{j,i}^{u,u}}e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}.
\end{aligned}
$$

The probability that the woman finds a job and nothing changes depends on α_{ij}^{eu} and α_{ij}^{ee}, which is captured by the job finding probability $\overline{\tau}_{j,i}^{u,e}$. The respective probability is given by

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu}\to m_{ij}^{ee}\right] \\
= & \left(1-\int_0^1 q_i e^{-q_i t}dt\right)\left(1-\int_0^1 \tau_i^{ee}e^{-\tau_i^{ee}t}dt\right) \\
& \times\int_0^1 \overline{\tau}_{j,i}^{u,e}e^{-\overline{\tau}_{j,i}^{u,e}t}\left(1-\int_0^t \delta\left(1-\alpha_{ij}^{eu}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x}-\int_t^1 \delta\left(1-\alpha_{ij}^{ee}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x}dx\right)dt \\
= & e^{-q_i}e^{-\tau_i^{ee}}\int_0^1 \overline{\tau}_{j,i}^{u,e}e^{-\overline{\tau}_{j,i}^{u,e}t}\left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}-e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)dt \\
= & e^{-q_i}e^{-\tau_i^{ee}}\tfrac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& -e^{-q_i}e^{-\tau_i^{ee}}\tfrac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) \\
& +e^{-q_i}e^{-\tau_i^{ee}}\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}.
\end{aligned}
$$

The probability that the man changes jobs and the woman finds a job is given by

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu} \rightarrow m_{ij}^{e'e}\right] \\
= & \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} \left(1 - \int_0^t q_i e^{-q_i x} dx\right) dt \\
& \times \int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t} \left(1 - \int_0^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} - \int_t^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} dx\right) dt \\
= & \tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right) \tfrac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& -\tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right) \tfrac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)} \left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) \\
& +\tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right)\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}.
\end{aligned}
$$

The probability that the man looses his job and the woman finds a job and nothing else happens is given by

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu} \rightarrow m_{ij}^{ue}\right] \\
= & \int_0^1 q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]t} \left(1-\int_0^t \tau_i^{ee} e^{-\tau_i^{ee} x} dx\right)\left(1-\Delta_{0,t}^{eu\rightarrow uu}\right) dt \\
& \times \int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t}\left(1-\Delta_{0,t}^{eu\rightarrow ee}\right) dt \\
& + \int_0^1 q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]t} \left(1-\int_0^t \tau_i^{ee} e^{-\tau_i^{ee} x} dx\right)\left(1-\Delta_{0,t}^{eu\rightarrow uu}\right) \\
& \times \left(\int_t^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} x}\left(1-\Delta_{t,x}^{uu\rightarrow ue}\right) dx - \int_t^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} x}\left(1-\Delta_{t,x}^{eu\rightarrow ee}\right) dx\right) dt \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t}\left(1-\Delta_{0,t}^{eu\rightarrow ee}\right) \\
& \times \left(\int_t^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]x} \left(1-\int_t^x \tau_i^{ee} e^{-\tau_i^{ee} y} dy\right)\left(1-\Delta_{t,x}^{ee\rightarrow ue}\right) dx\right. \\
& \left. - \int_t^1 q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]x} \left(1-\int_t^x \tau_i^{ee} e^{-\tau_i^{ee} y} dy\right)\left(1-\Delta_{t,x}^{eu\rightarrow uu}\right) dx\right) dt
\end{aligned}
$$

To simplify notation, replace

$$
q_i^{-l'l/-ll} = \min\left[\left(\alpha_{ij}^{-l'l}/\alpha_{ij}^{-ll}\right),1\right].
$$

This gives,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu} \to m_{ij}^{ue}\right] \\
= & \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) dt \\
& \times \int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t} \left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) dt \\
& + \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) \\
& \times \left(\int_t^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dx\right. \\
& \left. - \int_t^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) dx\right) dt \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t} \left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) \\
& \times \left(\int_t^1 q_i^{ue/ee} e^{-q_i^{ue/ee} x} \left(1 - e^{-\tau_i^{ee} t} + e^{-\tau_i^{ee} x}\right)\right. \\
& \times \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dx \\
& - \int_t^1 q_i^{uu/eu} e^{-q_i^{uu/eu} x} \left(1 - e^{-\tau_i^{ee} t} + e^{-\tau_i^{ee} x}\right) \\
& \left. \times \left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) dx\right) dt
\end{aligned}
$$

$$
\begin{aligned}
= & \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) dt \\
& \times \int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t} \left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) dt \\
& + \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) \\
& \times \left(\left(e^{-\overline{\tau}_{j,i}^{u,u} t} - e^{-\overline{\tau}_{j,i}^{u,u}}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\right. \\
& + \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)t} - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \\
& - \frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)t} - e^{-\left(\overline{\tau}_{j,i}^{u,u} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
& - \left(e^{-\overline{\tau}_{j,i}^{u,e} t} - e^{-\overline{\tau}_{j,i}^{u,e}}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) \\
& - \frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{eu}\right)} \left(e^{-\left(\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)t} - e^{-\left(\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& \left. + \frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)} \left(e^{-\left(\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)t} - e^{-\left(\overline{\tau}_{j,i}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\right) dt
\end{aligned}
$$

$$
\begin{aligned}
&+\int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t}\left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}-e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&\times\left(\left(e^{-q_i^{ue/ee}t}-e^{-q_i^{ue/ee}}\right)\left(1-e^{-\tau_i^{ee}t}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\right.\\
&+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\left(e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)t}-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)t}-e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1-e^{-\tau_i^{ee}t}\right)\\
&+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)t}-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\\
&-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)t}-e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1-e^{-\tau_i^{ee}t}\right)\\
&-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)t}-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\\
&-\left(e^{-q_i^{uu/eu}t}-e^{-q_i^{uu/eu}}\right)\left(1-e^{-\tau_i^{ee}t}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\left(e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)t}-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)t}-e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1-e^{-\tau_i^{ee}t}\right)\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)t}-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)t}-e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\left(1-e^{-\tau_i^{ee}t}\right)\\
&\left.+\ \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)t}-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\right)dt
\end{aligned}
$$

$$
\begin{aligned}
= \quad &\left(\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\right.\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\\
&\left.+\ \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&\times\left(\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\right.\\
&\left.-\ \frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)+\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)
\end{aligned}
$$

$$+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)$$
$$-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)$$
$$+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)$$
$$-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,u}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)$$
$$+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,u}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)$$
$$-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\overline{\tau}_{j,i}^{u,u}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)$$
$$-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)$$
$$+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)$$
$$-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,u}}$$
$$-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,u}}$$
$$+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\overline{\tau}_{j,i}^{u,u}}$$

$$
\begin{aligned}
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{j,i}^{u,u}}{\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\overline{\tau}_{j,i}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,e}}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\overline{\tau}_{j,i}^{u,e}}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\overline{\tau}_{j,i}^{u,e}}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&+\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&-\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-q_i^{ue/ee}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_i^{ue/ee}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&-\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_i^{ue/ee}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-q_i^{ue/ee}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_i^{ue/ee}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_i^{ue/ee}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{ue/ee}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{ue/ee}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{ue/ee}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{ue/ee}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{ue/ee}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{ue/ee}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q_i^{ue/ee}}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q_i^{ue/ee}}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-q_i^{ue/ee}}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q_i^{ue/ee}}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q_i^{ue/ee}}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-q_i^{ue/ee}}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&-\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}
\end{aligned}
$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$
\begin{aligned}
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{ue/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-q_i^{uu/eu}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_i^{uu/eu}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\left(1-e^{-\overline{\tau}^{u,e}_{j,i}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_i^{uu/eu}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-q_i^{uu/eu}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_i^{uu/eu}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_i^{uu/eu}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-q_i^{uu/eu}}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_i^{uu/eu}}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_i^{uu/eu}}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-q_i^{uu/eu}}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_i^{uu/eu}}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_i^{uu/eu}}
\end{aligned}
$$

$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}$$
$$+\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}^{u,e}_{j,i}}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,e}_{j,i}}{\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{j,i}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}^{u,e}_{j,i}}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}
\end{aligned}
$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$
$$-\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$

$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\tau_i^{ee}+q_i^{uu/eu}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$
$$-\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$
$$+\frac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$
$$-\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}.$$

The corresponding formulas for married couples where in the beginning the woman is employed and the man unemployed are as follows,

$$\begin{aligned}
\Pr\left[m_{ij}^{ue}\rightarrow m_{ij}^{ue}\right] &= \left(1-\int_0^1 \tau_{i,j}^{u,e}e^{-\tau_{i,j}^{u,e}t}dt\right)\left(1-\int_0^1 q_j e^{-q_j t}dt\right)\left(1-\int_0^1 \tau_j^{ee}e^{-\tau_j^{ee}t}dt\right)\\
&\quad\times\left(1-\int_0^1 \delta\left(1-\alpha_{ij}^{ue}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t}dt\right)\\
&= e^{-\tau_{i,j}^{u,e}}e^{-q_j}e^{-\tau_j^{ee}}e^{-\delta\left(1-\alpha_{ij}^{ue}\right)},
\end{aligned}$$

$$\begin{aligned}
\Pr\left[m_{ij}^{ue}\rightarrow m_{ij}^{ue'}\right] &= \left(1-\int_0^1 \tau_{i,j}^{u,e}e^{-\tau_{i,j}^{u,e}t}dt\right)\int_0^1 \tau_j^{ee}e^{-\tau_j^{ee}t}\left(1-\int_0^t q_j e^{-q_j x}dx\right)dt\\
&\quad\times\left(1-\int_0^1 \delta\left(1-\alpha_{ij}^{ue}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t}dt\right)\\
&= \tfrac{\tau_j^{ee}}{\tau_j^{ee}+q_j}\left(1-e^{-\left(\tau_j^{ee}+q_j\right)}\right)e^{-\tau_{i,j}^{u,e}}e^{-\delta\left(1-\alpha_{ij}^{ue}\right)},
\end{aligned}$$

$$\begin{aligned}
&\Pr\left[m_{ij}^{ue}\rightarrow m_{ij}^{uu}\right]\\
=\ &\int_0^1 q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]e^{-q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]t}\left(1-\int_0^t \tau_j^{ee}e^{-\tau_j^{ee}x}dx\right)\\
&\times\left(1-\int_0^t \delta\left(1-\alpha_{ij}^{ue}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x}dx-\int_t^1 \delta\left(1-\alpha_{ij}^{uu}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x}dx\right)\\
&\times\left(1-\int_0^t \tau_{i,j}^{u,e}e^{-\tau_{i,j}^{u,e}x}dx-\int_t^1 \tau_{i,j}^{u,u}e^{-\tau_{i,j}^{u,u}x}dx\right)dt,\\
=\ &\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}\right)}\right)\\
&-\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,u}}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,u}\right)}\right)\\
&+\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\tau_{i,j}^{u,u}}\\
&-\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,e}}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,e}\right)}\right)\\
&+\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}\right)}\right)\\
&-\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\tau_{i,j}^{u,u}}\\
&+\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\tau_{i,j}^{u,e}}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\tau_{i,j}^{u,e}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&-\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\tau_{i,j}^{u,u}}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}+\tau_{i,j}^{u,u}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&+\tfrac{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]}{q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}}\left(1-e^{-\left(q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]+\tau_j^{ee}\right)}\right)e^{-\tau_{i,j}^{u,u}}e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}.
\end{aligned}$$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ue} \to m_{ij}^{ee}\right] \\
= & \int_0^1 \overline{\tau}_{i,j}^{u,e} e^{-\overline{\tau}_{i,j}^{u,e} t} \left(1 - \int_0^t \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} - \int_t^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} dx\right) dt \\
& \times \left(1 - \int_0^1 q_j e^{-q_j t} dt\right)\left(1 - \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} dt\right) \\
= & e^{-q_j} e^{-\tau_j^{ee}} \int_0^1 \overline{\tau}_{i,j}^{u,e} e^{-\overline{\tau}_{i,j}^{u,e} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) dt \\
= & e^{-q_j} e^{-\tau_j^{ee}} \frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
& - e^{-q_j} e^{-\tau_j^{ee}} \frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) \\
& + e^{-q_j} e^{-\tau_j^{ee}} \left(1 - e^{-\overline{\tau}_{i,j}^{u,e}}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}.
\end{aligned}
$$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ue} \to m_{ij}^{ee'}\right] \\
= & \int_0^1 \overline{\tau}_{i,j}^{u,e} e^{-\overline{\tau}_{i,j}^{u,e} t} \left(1 - \int_0^t \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} - \int_t^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} dx\right) dt \\
& \times \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} \left(1 - \int_0^t q_j e^{-q_j x} dx\right) dt \\
= & \frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \frac{\tau_j^{ee}}{\tau_j^{ee} + q_j} \left(1 - e^{-\left(\tau_j^{ee} + q_j\right)}\right) \\
& - \frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) \frac{\tau_j^{ee}}{\tau_j^{ee} + q_j} \left(1 - e^{-\left(\tau_j^{ee} + q_j\right)}\right) \\
& + \left(1 - e^{-\overline{\tau}_{i,j}^{u,e}}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)} \frac{\tau_j^{ee}}{\tau_j^{ee} + q_j} \left(1 - e^{-\left(\tau_j^{ee} + q_j\right)}\right).
\end{aligned}
$$

$$
\begin{aligned}
\Pr\left[m_{ij}^{ue} \to m_{ij}^{eu}\right] = & \left(\frac{q_j^{uu/ue}}{q_j^{uu/ue} + \tau_j^{ee} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(q_j^{uu/ue} + \tau_j^{ee} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\right. \\
& - \frac{q_j^{uu/ue}}{q_j^{uu/ue} + \tau_j^{ee} + \delta\left(1-\alpha_{ij}^{uu}\right)} \left(1 - e^{-\left(q_j^{uu/ue} + \tau_j^{ee} + \delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \\
& \left. + \frac{q_j^{uu/ue}}{q_j^{uu/ue} + \tau_j^{ee}} \left(1 - e^{-\left(q_j^{uu/ue} + \tau_j^{ee}\right)}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) \\
& \times \left(\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\right. \\
& \left. - \frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,e} + \delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) + \left(1 - e^{-\overline{\tau}_{i,j}^{u,e}}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)
\end{aligned}
$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\overline{\tau}_{i,j}^{u,u}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\overline{\tau}_{i,j}^{u,u}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\overline{\tau}_{i,j}^{u,u}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\overline{\tau}_{i,j}^{u,u}}$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\overline{\tau}_{i,j}^{u,u}}$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\overline{\tau}_{i,j}^{u,u}}$$

$$
\begin{aligned}
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\overline{\tau}_{i,j}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\overline{\tau}_{i,j}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\overline{\tau}_{i,j}^{u,e}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\overline{\tau}_{i,j}^{u,e}}\\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\overline{\tau}_{i,j}^{u,e}}\\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\overline{\tau}_{i,j}^{u,e}}
\end{aligned}
$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$
\begin{aligned}
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-q^{eu/ee}_{j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q^{eu/ee}_{j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\left(1-e^{-\overline{\tau}^{u,e}_{i,j}}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-q^{eu/ee}_{j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-q^{eu/ee}_{j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q^{eu/ee}_{j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-q^{eu/ee}_{j}}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q^{eu/ee}_{j}}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q^{eu/ee}_{j}}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-q^{eu/ee}_{j}}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q^{eu/ee}_{j}}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-q^{eu/ee}_{j}}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}e^{-q^{eu/ee}_{j}}
\end{aligned}
$$

$$+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}$$

$$-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}$$

$$+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}$$

$$-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}e^{-\left(q^{eu/ee}_{j}+\tau^{ee}_{j}\right)}$$

$$+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}e^{-\left(q^{eu/ee}_{j}+\tau^{ee}_{j}\right)}$$

$$-\left(1-e^{-\overline{\tau}^{u,e}_{i,j}}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}e^{-\left(q^{eu/ee}_{j}+\tau^{ee}_{j}\right)}$$

$$-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}$$

$$+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}$$

$$-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_{j}+q^{eu/ee}_{j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}$$

$$+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}e^{-\left(q^{eu/ee}_{j}+\tau^{ee}_{j}\right)}$$

$$-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}e^{-\left(q^{eu/ee}_{j}+\tau^{ee}_{j}\right)}$$

$$+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q^{eu/ee}_{j}}{q^{eu/ee}_{j}+\tau^{ee}_{j}}e^{-\left(q^{eu/ee}_{j}+\tau^{ee}_{j}\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\left(1-e^{-\overline{\tau}_{i,j}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\left(1-e^{-\overline{\tau}_{i,j}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$
$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$
$$+\left(1-e^{-\overline{\tau}_{i,j}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$
$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$
$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$
$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$

$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{eu/ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}$$
$$+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$
$$-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$
$$+\left(1-e^{-\overline{\tau}_{i,j}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}$$

$$
\begin{aligned}
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-q_j^{uu/ue}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_j^{uu/ue}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\left(1-e^{-\overline{\tau}_{i,j}^{u,e}}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_j^{uu/ue}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-q_j^{uu/ue}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_j^{uu/ue}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_j^{uu/ue}}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-q_j^{uu/ue}}\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_j^{uu/ue}}\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_j^{uu/ue}}\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-q_j^{uu/ue}}\\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-q_j^{uu/ue}}\\
&-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-q_j^{uu/ue}}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}e^{-\left(q^{uu/ue}_j+\tau^{ee}_j\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}e^{-\left(q^{uu/ue}_j+\tau^{ee}_j\right)}\\
&+\left(1-e^{-\overline{\tau}^{u,e}_{i,j}}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1+e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}e^{-\left(q^{uu/ue}_j+\tau^{ee}_j\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau^{ee}_j+q^{uu/ue}_j+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}e^{-\left(q^{uu/ue}_j+\tau^{ee}_j\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}e^{-\left(q^{uu/ue}_j+\tau^{ee}_j\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q^{uu/ue}_j}{q^{uu/ue}_j+\tau^{ee}_j}e^{-\left(q^{uu/ue}_j+\tau^{ee}_j\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}^{u,e}_{i,j}}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\\
&+\left(1-e^{-\overline{\tau}^{u,e}_{i,j}}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&-\left(1-e^{-\overline{\tau}^{u,e}_{i,j}}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\tau_j^{ee}+q_j^{uu/ue}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)}\\
&-\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&+\frac{\overline{\tau}^{u,e}_{i,j}}{\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,e}_{i,j}+\delta\left(1-\alpha^{ee}_{ij}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\\
&-\left(1-e^{-\overline{\tau}^{u,e}_{i,j}}\right)e^{-\delta\left(1-\alpha^{ee}_{ij}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}.
\end{aligned}
$$

The next set of formulas captures the labor market transitions of married couples where both are spouses are employed,

$$\begin{aligned}
\Pr\left[m_{ij}^{ee}\to m_{ij}^{ee}\right] &= \left(1-\int_0^1 q_i e^{-q_i t}dt\right)\left(1-\int_0^1 \tau_i^{ee}e^{-\tau_i^{ee}t}dt\right)\\
&\quad\times\left(1-\int_0^1 q_j e^{-q_j t}dt\right)\left(1-\int_0^1 \tau_j^{ee}e^{-\tau_j^{ee}t}dt\right)\\
&\quad\times\left(1-\int_0^1 \delta\left(1-\alpha_{ij}^{ee}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}dt\right)\\
&= e^{-q_i}e^{-\tau_i^{ee}}e^{-q_j}e^{-\tau_j^{ee}}e^{-\delta\left(1-\alpha_{ij}^{ee}\right)},
\end{aligned}$$

$$\begin{aligned}
\Pr\left[m_{ij}^{ee}\to m_{ij}^{e'e}\right] &= \int_0^1 \tau_i^{ee}e^{-\tau_i^{ee}t}\left(1-\int_0^t q_i e^{-q_i x}dx\right)dt\\
&\quad\times\left(1-\int_0^1 q_j e^{-q_j t}dt\right)\left(1-\int_0^1 \tau_j^{ee}e^{-\tau_j^{ee}t}dt\right)\\
&\quad\times\left(1-\int_0^1 \delta\left(1-\alpha_{ij}^{ee}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}dt\right)\\
&= \tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right)e^{-q_j}e^{-\tau_j^{ee}}e^{-\delta\left(1-\alpha_{ij}^{ee}\right)},
\end{aligned}$$

$$\begin{aligned}
\Pr\left[m_{ij}^{ee}\to m_{ij}^{ee'}\right] &= \left(1-\int_0^1 q_i e^{-q_i t}dt\right)\left(1-\int_0^1 \tau_i^{ee}e^{-\tau_i^{ee}t}dt\right)\\
&\quad\times\int_0^1 \tau_j^{ee}e^{-\tau_j^{ee}t}\left(1-\int_0^t q_j e^{-q_j x}dx\right)dt\\
&\quad\times\left(1-\int_0^1 \delta\left(1-\alpha_{ij}^{ee}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}dt\right)\\
&= e^{-q_i}e^{-\tau_i^{ee}}\tfrac{\tau_j^{ee}}{\tau_j^{ee}+q_j}\left(1-e^{-\left(\tau_j^{ee}+q_j\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)},
\end{aligned}$$

$$\begin{aligned}
\Pr\left[m_{ij}^{ee}\to m_{ij}^{e'e'}\right] &= \int_0^1 \tau_i^{ee}e^{-\tau_i^{ee}t}\left(1-\int_0^t q_i e^{-q_i x}dx\right)dt\\
&\quad\times\int_0^1 \tau_j^{ee}e^{-\tau_j^{ee}t}\left(1-\int_0^t q_j e^{-q_j x}dx\right)dt\\
&\quad\times\left(1-\int_0^1 \delta\left(1-\alpha_{ij}^{ee}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}dt\right)\\
&= \tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right)\tfrac{\tau_j^{ee}}{\tau_j^{ee}+q_j}\left(1-e^{-\left(\tau_j^{ee}+q_j\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ee}\right)},
\end{aligned}$$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ee} \to m_{ij}^{eu}\right] \\
= & \left(1-\int_0^1 q_i e^{-q_i t} dt\right)\left(1-\int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} dt\right)\int_0^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] \\
& \times e^{-q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_j^{ee} e^{-\tau_j^{ee} x} dx\right)\left(1-\Delta_{0,t}^{ee\to eu}\right) dt, \\
= & e^{-q_i} e^{-\tau_i^{ee}} \int_0^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] e^{-q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]t} e^{-\tau_j^{ee} t} \\
& \times\left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) dt, \\
= & e^{-q_i} e^{-\tau_i^{ee}}\left[\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\right. \\
& -\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& \left.+\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}\left(1-e^{-\left(\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right)}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right],
\end{aligned}
$$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ee} \to m_{ij}^{e'u}\right] \\
= & \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t}\left(1-\int_0^t q_i e^{-q_i x} dx\right) dt \int_0^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] \\
& \times e^{-q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_j^{ee} e^{-\tau_j^{ee} x} dx\right)\left(1-\Delta_{0,t}^{ee\to eu}\right) dt, \\
= & \frac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right)\int_0^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] e^{-q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]t} e^{-\tau_j^{ee} t} \\
& \times\left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t}-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) dt, \\
= & \frac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right) \\
& \times\left[\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\right. \\
& -\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& \left.+\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}\left(1-e^{-\left(\tau_j^{ee}+q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right)}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right],
\end{aligned}
$$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ee} \to m_{ij}^{ue}\right] \\
= & \int_0^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_i^{ee} e^{-\tau_i^{ee} x} dx\right)\left(1-\Delta_{0,t}^{ee\to ue}\right) dt \\
& \times\left(1-\int_0^1 q_j e^{-q_j t} dt\right)\left(1-\int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} dt\right), \\
= & \left[\frac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{\tau_i^{ee}+q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\tau_i^{ee}+q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\right. \\
& -\frac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{\tau_i^{ee}+q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\tau_i^{ee}+q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
& \left.+\frac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{\tau_i^{ee}+q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}\left(1-e^{-\left(\tau_i^{ee}+q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right] e^{-q_j} e^{-\tau_j^{ee}},
\end{aligned}
$$

$$
\begin{aligned}
&\Pr\left[m_{ij}^{ee}\to m_{ij}^{ue'}\right]\\
=\;& \int_0^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right] e^{-q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_i^{ee}e^{-\tau_i^{ee}x}dx\right)\left(1-\Delta_{0,t}^{ee\to ue}\right)dt\\
&\times\int_0^1 \tau_j^{ee}e^{-\tau_j^{ee}t}\left(1-\int_0^t q_j e^{-q_j x}dx\right)dt,\\
=\;& \Bigg[\frac{q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{\tau_i^{ee}+q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\tau_i^{ee}+q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\\
&-\frac{q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{\tau_i^{ee}+q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\tau_i^{ee}+q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\\
&+\frac{q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{\tau_i^{ee}+q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}\left(1-e^{-\left(\tau_i^{ee}+q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\Bigg]\\
&\times\frac{\tau_j^{ee}}{\tau_j^{ee}+q_j}\left(1-e^{-\left(\tau_j^{ee}+q_j\right)}\right),
\end{aligned}
$$

$$
\begin{aligned}
&\Pr\left[m_{ij}^{ee}\to m_{ij}^{uu}\right]\\
=\;& \int_0^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right] e^{-q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_i^{ee}e^{-\tau_i^{ee}x}dx\right)\left(1-\Delta_{0,t}^{ee\to ue}\right)dt\\
&\times\int_0^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] e^{-q_j\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_j^{ee}e^{-\tau_j^{ee}x}dx\right)\left(1-\Delta_{0,t}^{ee\to eu}\right)dt\\
&+\int_0^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] e^{-q_j\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_j^{ee}e^{-\tau_j^{ee}x}dx\right)\left(1-\Delta_{0,t}^{ee\to eu}\right)\\
&\times\left(\int_t^1 q_i \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right] e^{-q_i\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{eu}\right),1\right]x}\left(1-\int_0^x \tau_i^{ee}e^{-\tau_i^{ee}y}dy\right)\left(1-\Delta_{t,x}^{eu\to uu}\right)dx\right)dt\\
&-\int_0^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] e^{-q_j\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_j^{ee}e^{-\tau_j^{ee}x}dx\right)\left(1-\Delta_{0,t}^{ee\to eu}\right)\\
&\times\left(\int_t^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right] e^{-q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]x}\left(1-\int_0^x \tau_i^{ee}e^{-\tau_i^{ee}y}dy\right)\left(1-\Delta_{t,x}^{ee\to ue}\right)dx\right)dt\\
&+\int_0^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right] e^{-q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_i^{ee}e^{-\tau_i^{ee}x}dx\right)\left(1-\Delta_{0,t}^{ee\to ue}\right)\\
&\times\left(\int_t^1 q_j \min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right] e^{-q_j\min\left[\left(\alpha_{ij}^{uu}/\alpha_{ij}^{ue}\right),1\right]x}\left(1-\int_0^x \tau_j^{ee}e^{-\tau_j^{ee}y}dy\right)\left(1-\Delta_{t,x}^{ue\to uu}\right)dx\right)dt\\
&-\int_0^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right] e^{-q_i\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]t}\left(1-\int_0^t \tau_i^{ee}e^{-\tau_i^{ee}x}dx\right)\left(1-\Delta_{0,t}^{ee\to ue}\right)\\
&\times\left(\int_t^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] e^{-q_j\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]x}\left(1-\int_0^x \tau_j^{ee}e^{-\tau_j^{ee}y}dy\right)\left(1-\Delta_{t,x}^{ee\to eu}\right)dx\right)dt
\end{aligned}
$$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ee} \to m_{ij}^{uu}\right] \\
= \; & \int_0^1 q_i^{ue/ee} e^{-q_i^{ue/ee} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dt \\
& \times \int_0^1 q_j^{eu/ee} e^{-q_j^{eu/ee} t} e^{-\tau_j^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) dt \\
& + \int_0^1 q_j^{eu/ee} e^{-q_j^{eu/ee} t} e^{-\tau_j^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) \\
& \times \int_t^1 q_i^{uu/eu} e^{-q_i^{uu/eu} x} e^{-\tau_i^{ee} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) dxdt \\
& - \int_0^1 q_j^{eu/ee} e^{-q_j^{eu/ee} t} e^{-\tau_j^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) \\
& \times \int_t^1 q_i^{ue/ee} e^{-q_i^{ue/ee} x} e^{-\tau_i^{ee} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dxdt \\
& + \int_0^1 q_i^{ue/ee} e^{-q_i^{ue/ee} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) \\
& \times \int_t^1 q_j^{uu/ue} e^{-q_j^{uu/ue} x} e^{-\tau_j^{ee} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) dxdt \\
& - \int_0^1 q_i^{ue/ee} e^{-q_i^{ue/ee} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) \\
& \times \int_t^1 q_j^{eu/ee} e^{-q_j^{eu/ee} x} e^{-\tau_j^{ee} x} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) dxdt
\end{aligned}
$$

$$
\begin{aligned}
&\Pr\left[m_{ij}^{ee} \to m_{ij}^{uu}\right] \\
= \ & \int_0^1 q_i^{ue/ee} e^{-q_i^{ue/ee} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) dt \\
& \times \int_0^1 q_j^{eu/ee} e^{-q_j^{eu/ee} t} e^{-\tau_j^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right) dt \\
& + \int_0^1 q_j^{eu/ee} e^{-q_j^{eu/ee} t} e^{-\tau_j^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right) \\
& \times \left(\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}} \left(e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)t} - e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)} \right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)} \right) \right. \\
& + \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)t} - e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)} \right) \\
& \left. - \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)} \left(e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)t} - e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)} \right) \right) dt \\
& - \int_0^1 q_j^{eu/ee} e^{-q_j^{eu/ee} t} e^{-\tau_j^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right) \\
& \times \left(\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}} \left(e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)t} - e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)} \right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) \right. \\
& + \frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)} \left(e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)t} - e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)} \right) \\
& \left. - \frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)} \left(e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)t} - e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)} \right) \right) dt
\end{aligned}
$$

$$
\begin{aligned}
& + \int_0^1 q_i^{ue/ee} e^{-q_i^{ue/ee} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) \\
& \times \left(\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}} \left(e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)t} - e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)} \right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)} \right) \right. \\
& + \frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)} \left(e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)t} - e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)} \right) \\
& \left. - \frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)} \left(e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)t} - e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)} \right) \right) dt \\
& - \int_0^1 q_i^{ue/ee} e^{-q_i^{ue/ee} t} e^{-\tau_i^{ee} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} \right) \\
& \times \left(\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}} \left(e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)t} - e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)} \right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{eu}\right)} \right) \right. \\
& + \frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)} \left(e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)t} - e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)} \right) \\
& \left. - \frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)t} - e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)} \right) \right) dt
\end{aligned}
$$

$$
\begin{aligned}
\Pr\left[m_{ij}^{ee}\to m_{ij}^{uu}\right] \;=\; & \left(\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\right.\\
& -\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\\
& \left.+\;\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\\
& \times\left(\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\right.\\
& -\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\\
& \left.+\;\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{q_j^{eu/ee}}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\\
&-\frac{q_j^{eu/ee}}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\\
&+\frac{q_j^{eu/ee}}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\\
&-\frac{q_j^{eu/ee}}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\\
&+\frac{q_j^{eu/ee}}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\\
&-\frac{q_j^{eu/ee}}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&-\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&+\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&-\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&+\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&-\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)}{q_i^{uu/eu}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{q_j^{eu/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&+\frac{q_j^{eu/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&-\frac{q_j^{eu/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&+\frac{q_j^{eu/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&-\frac{q_j^{eu/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&+\frac{q_j^{eu/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}
\end{aligned}
$$

$$
\begin{aligned}
&-\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&-\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&+\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&-\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&+\frac{q_j^{eu/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&+\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\\
&-\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}
\end{aligned}
$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}$$

$$+\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}$$

$$-\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}$$

$$+\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}$$

$$-\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$

$$+\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)+\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$

$$-\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{uu/ue}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1+e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}$$

$$+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}$$

$$-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}\right)}$$

$$
\begin{aligned}
&-\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&-\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\\
&+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\\
&+\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\delta\left(1-\alpha_{ij}^{ee}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&-\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\delta\left(1-\alpha_{ij}^{eu}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&+\frac{q_i^{ue/ee}\left(1-e^{-\left(q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)}{q_i^{ue/ee}+q_j^{eu/ee}+\tau_i^{ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\\
&-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&+\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\\
&-\frac{q_i^{ue/ee}}{q_i^{ue/ee}+\tau_i^{ee}}\left(1-e^{-\left(q_i^{ue/ee}+\tau_i^{ee}\right)}\right)e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\frac{q_j^{eu/ee}}{q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}e^{-\left(q_j^{eu/ee}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}.
\end{aligned}
$$

C.3 Married couples divorce

Let us finally turn to the divorce transition rates of married couples. We start again with a married couple where both spouses are unemployed and consider first the probability that they divorce without finding a job. The divorce is therefore solely driven by an adverse love shock, i.e.,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{uu} \rightarrow s_i^u, s_j^u\right] \\
= \; & \int_0^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} \left(1-\int_0^t \tau_{i,j}^{u,u} e^{-\tau_{i,j}^{u,u}x} dx - \int_t^1 \tau_i^u e^{-\tau_i^u x} dx\right) \\
& \times \left(1-\int_0^t \tau_{j,i}^{u,u} e^{-\tau_{j,i}^{u,u}x} dx - \int_t^1 \tau_j^u e^{-\tau_j^u x} dx\right) dt \\
= \; & \int_0^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} \left(e^{-\tau_{i,j}^{u,u}t} - e^{-\tau_i^u t} + e^{-\tau_i^u}\right) \left(e^{-\tau_{j,i}^{u,u}t} - e^{-\tau_j^u t} + e^{-\tau_j^u}\right) dt \\
= \; & \tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}+\tau_{j,i}^{u,u}} \left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}+\tau_{j,i}^{u,u}\right)}\right) - \tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}+\tau_j^u} \left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}+\tau_j^u\right)}\right) \\
& -\tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u+\tau_{j,i}^{u,u}} \left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u+\tau_{j,i}^{u,u}\right)}\right) + \tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u+\tau_j^{u,u}} \left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u+\tau_j^u\right)}\right) \\
& +\tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}} \left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}\right)}\right) e^{-\tau_j^u} - \tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u} \left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u\right)}\right) e^{-\tau_j^u} \\
& +\tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}} \left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}\right)}\right) e^{-\tau_i^u} - \tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_j^u} \left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_j^u\right)}\right) e^{-\tau_i^u} \\
& +\left(1-e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) e^{-\tau_i^u} e^{-\tau_j^u}
\end{aligned}
$$

The probabilities for the cases where either the woman or the man becomes employed have to take into account that at rate $\underline{\tau}_{j,i}^{u,u}$ $\left(\overline{\tau}_{j,i}^{u,u}\right)$ the labor market transition of the woman leads (does not lead) to a divorce. In case the labor market transition is not the cause for the divorce the divorce has to be triggered by the love shock. When calculating the respective transition probabilites we have to take into account that the job finding rate of the partner and the divorce cutoff in case of a love shock changes with the labor market transition. Formally,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{uu} \rightarrow s_i^u, s_j^e\right] \\
= \; & \int_0^1 \underline{\tau}_{j,i}^{u,u} e^{-\underline{\tau}_{j,i}^{u,u}t} \left(1-\int_0^t \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} dx\right) \left(1-\int_0^t \tau_{i,j}^{u,u} e^{-\tau_{i,j}^{u,u}x} dx - \int_t^1 \tau_i^u e^{-\tau_i^u x} dx\right) dt \\
& +\int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u}t} dt \int_0^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} dt \left(1-\int_0^1 \tau_i^u e^{-\tau_i^u t} dt\right) \\
& +\int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u}t} \int_0^t \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} \left(\int_0^x \tau_i^u e^{-\tau_i^u y} dy - \int_0^x \tau_{i,j}^{u,u} e^{-\tau_{i,j}^{u,u}y} dy\right) dx dt \\
& +\int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u}t} \left(\int_t^1 \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} dx - \int_t^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} dx\right) dt \left(1-\int_0^1 \tau_i^u e^{-\tau_i^u t}\right. \\
& +\int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u}t} \int_t^1 \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} \left(\int_t^x \tau_i^u e^{-\tau_i^u y} dy - \int_t^x \tau_{i,j}^{u,e} e^{-\tau_{i,j}^{u,e}y} dy\right) dx dt \\
& +\int_0^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} \left(\int_t^1 \tau_j^u e^{-\tau_j^u x} dx - \int_t^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u}x} dx\right) dt \left(1-\int_0^1 \tau_i^u e^{-\tau_i^u t} dt\right)
\end{aligned}
$$

$$
\begin{aligned}
= \quad & \int_0^1 \underline{\tau}_{j,i}^{u,u} e^{-\underline{\tau}_{j,i}^{u,u} t} e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} \left(e^{-\tau_{i,j}^{u,u} t} - e^{-\tau_i^u t} + e^{-\tau_i^u}\right) dt \\
& + \left(1 - e^{-\overline{\tau}_{j,i}^{u,u}}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) e^{-\tau_i^u} \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(1 - e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}\right)t}\right) dt \tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}} \\
& - \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(1 - e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u\right)t}\right) dt \tfrac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u} \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dt e^{-\tau_i^u} \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) \left(e^{-\tau_i^u t} - e^{-\tau_{i,j}^{u,e} t}\right) dt \\
& + \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}\right)t} - e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}\right)}\right) dt \tfrac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}} \\
& - \int_0^1 \overline{\tau}_{j,i}^{u,u} e^{-\overline{\tau}_{j,i}^{u,u} t} \left(e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u\right)t} - e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u\right)}\right) dt \tfrac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u} \\
& + \int_0^1 \delta\left(1 - \alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} \left(e^{-\tau_j^u t} - e^{-\overline{\tau}_{j,i}^{u,u} t} + e^{-\overline{\tau}_{j,i}^{u,u}} - e^{-\tau_j^u}\right) dt e^{-\tau_i^u}
\end{aligned}
$$

$$
\begin{aligned}
= \quad & \frac{\underline{\tau}^{u,u}_{j,i}}{\underline{\tau}^{u,u}_{j,i}+\tau^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\underline{\tau}^{u,u}_{j,i}+\tau^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) \\
& -\frac{\underline{\tau}^{u,u}_{j,i}}{\underline{\tau}^{u,u}_{j,i}+\tau^{u}_{i}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\underline{\tau}^{u,u}_{j,i}+\tau^{u}_{i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) \\
& +\frac{\underline{\tau}^{u,u}_{j,i}}{\underline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\underline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) e^{-\tau^{u}_{i}} \\
& +\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)\left(1-e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right) e^{-\tau^{u}_{i}} \\
& +\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)\frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\delta\left(1-\alpha^{uu}_{ij}\right)+\tau^{u,u}_{i,j}} \\
& -\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\tau^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\tau^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) \frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\delta\left(1-\alpha^{uu}_{ij}\right)+\tau^{u,u}_{i,j}} \\
& -\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)\frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\delta\left(1-\alpha^{uu}_{ij}\right)+\tau^{u}_{i}} \\
& +\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\tau^{u}_{i}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\tau^{u}_{i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) \frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\delta\left(1-\alpha^{uu}_{ij}\right)+\tau^{u}_{i}} \\
& +\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right) e^{-\tau^{u}_{i}} \\
& -\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) e^{-\tau^{u}_{i}} \\
& +\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)\left(e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}-e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}\right) e^{-\tau^{u}_{i}} \\
& +\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\tau^{u}_{i}+\delta\left(1-\alpha^{ue}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\tau^{u}_{i}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right) \\
& -\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\tau^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\tau^{u,e}_{i,j}+\delta\left(1-\alpha^{ue}_{ij}\right)\right)}\right) \\
& -\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\tau^{u}_{i}} \left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\tau^{u}_{i}\right)}\right) e^{-\delta\left(1-\alpha^{ue}_{ij}\right)} \\
& +\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\tau^{u,e}_{i,j}} \left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\tau^{u,e}_{i,j}\right)}\right) e^{-\delta\left(1-\alpha^{ue}_{ij}\right)}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}\right)}\right)\frac{\delta\left(1-\alpha^{ue}_{ij}\right)}{\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}}\\
&-\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\left(\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}\right)}\frac{\delta\left(1-\alpha^{ue}_{ij}\right)}{\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}\right)}\right)\frac{\delta\left(1-\alpha^{ue}_{ij}\right)}{\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}}\\
&+\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\left(\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}\right)}\frac{\delta\left(1-\alpha^{ue}_{ij}\right)}{\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u,e}_{i,j}}\\
&-\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}\right)}\right)\frac{\delta\left(1-\alpha^{ue}_{ij}\right)}{\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}}\\
&+\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\left(\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}\right)}\frac{\delta\left(1-\alpha^{ue}_{ij}\right)}{\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}}\\
&+\frac{\overline{\tau}^{u,u}_{j,i}}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}\right)}\right)\frac{\delta\left(1-\alpha^{ue}_{ij}\right)}{\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}}\\
&-\left(1-e^{-\overline{\tau}^{u,u}_{j,i}}\right)e^{-\left(\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}\right)}\frac{\delta\left(1-\alpha^{ue}_{ij}\right)}{\delta\left(1-\alpha^{ue}_{ij}\right)+\tau^{u}_{i}}\\
&+\frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\tau^{u}_{j}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\tau^{u}_{j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\tau^{u}_{i}}\\
&-\frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)}\left(1-e^{-\left(\overline{\tau}^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right)e^{-\tau^{u}_{i}}\\
&+\left(1-e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right)\left(e^{-\overline{\tau}^{u,u}_{j,i}}-e^{-\tau^{u}_{j}}\right)e^{-\tau^{u}_{i}}
\end{aligned}
$$

and

$$
\begin{aligned}
& \Pr\left[m^{uu}_{ij} \to s^{e}_{i}, s^{u}_{j}\right] \\
= \; & \frac{\underline{\tau}^{u,u}_{i,j}}{\underline{\tau}^{u,u}_{i,j}+\tau^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\underline{\tau}^{u,u}_{i,j}+\tau^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) \\
& -\frac{\underline{\tau}^{u,u}_{i,j}}{\underline{\tau}^{u,u}_{i,j}+\tau^{u}_{j}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\underline{\tau}^{u,u}_{i,j}+\tau^{u}_{j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) \\
& +\frac{\underline{\tau}^{u,u}_{i,j}}{\underline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\underline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) e^{-\tau^{u}_{j}} \\
& +\left(1-e^{-\overline{\tau}^{u,u}_{i,j}}\right)\left(1-e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}\right) e^{-\tau^{u}_{j}} \\
& +\left(1-e^{-\overline{\tau}^{u,u}_{i,j}}\right) \frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\delta\left(1-\alpha^{uu}_{ij}\right)+\tau^{u,u}_{j,i}} \\
& -\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\tau^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{i,j}+\tau^{u,u}_{j,i}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) \frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\delta\left(1-\alpha^{uu}_{ij}\right)+\tau^{u,u}_{j,i}} \\
& -\left(1-e^{-\overline{\tau}^{u,u}_{i,j}}\right) \frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\delta\left(1-\alpha^{uu}_{ij}\right)+\tau^{u}_{j}} \\
& +\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\tau^{u}_{j}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{i,j}+\tau^{u}_{j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) \frac{\delta\left(1-\alpha^{uu}_{ij}\right)}{\delta\left(1-\alpha^{uu}_{ij}\right)+\tau^{u}_{j}} \\
& +\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right) e^{-\tau^{u}_{j}} \\
& -\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{i,j}+\delta\left(1-\alpha^{uu}_{ij}\right)\right)}\right) e^{-\tau^{u}_{j}} \\
& +\left(1-e^{-\overline{\tau}^{u,u}_{i,j}}\right)\left(e^{-\delta\left(1-\alpha^{uu}_{ij}\right)}-e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}\right) e^{-\tau^{u}_{j}} \\
& +\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\tau^{u}_{j}+\delta\left(1-\alpha^{eu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{i,j}+\tau^{u}_{j}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right) \\
& -\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\tau^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)} \left(1-e^{-\left(\overline{\tau}^{u,u}_{i,j}+\tau^{u,e}_{j,i}+\delta\left(1-\alpha^{eu}_{ij}\right)\right)}\right) \\
& -\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\tau^{u}_{j}} \left(1-e^{-\left(\overline{\tau}^{u,u}_{i,j}+\tau^{u}_{j}\right)}\right) e^{-\delta\left(1-\alpha^{eu}_{ij}\right)} \\
& +\frac{\overline{\tau}^{u,u}_{i,j}}{\overline{\tau}^{u,u}_{i,j}+\tau^{u,e}_{j,i}} \left(1-e^{-\left(\overline{\tau}^{u,u}_{i,j}+\tau^{u,e}_{j,i}\right)}\right) e^{-\delta\left(1-\alpha^{eu}_{ij}\right)}
\end{aligned}
$$

$$
\begin{aligned}
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\\
&-\left(1-e^{-\overline{\tau}_{i,j}^{u,u}}\right)e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)}\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\\
&+\left(1-e^{-\overline{\tau}_{i,j}^{u,u}}\right)e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)}\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\\
&-\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}}\\
&+\left(1-e^{-\overline{\tau}_{i,j}^{u,u}}\right)e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}\right)}\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}}\\
&+\frac{\overline{\tau}_{i,j}^{u,u}}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}}\\
&-\left(1-e^{-\overline{\tau}_{i,j}^{u,u}}\right)e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}\right)}\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j}^{u}}\\
&+\frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\tau_{i}^{u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\tau_{i}^{u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\tau_{j}^{u}}\\
&-\frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\tau_{j}^{u}}\\
&+\left(1-e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)\left(e^{-\overline{\tau}_{i,j}^{u,u}}-e^{-\tau_{i}^{u}}\right)e^{-\tau_{j}^{u}}
\end{aligned}
$$

Since we do not observe a $m_{ij}^{uu} \to s_i^e, s_j^e$ transition in our data, we do not calculate $\Pr\left[m_{ij}^{uu} \to s_i^e, s_j^e\right]$. If we need it for the decomposition, we might use the fact that all proabilities out of one status must add up to unity.

Let us now consider couples where the man is employed and the female unemployed and a divorce happens, i.e.,

$$
\begin{aligned}
\Pr\left[m_{ij}^{eu} \to s_i^e, s_j^u\right] &= \left(1-\int_0^1 q_i e^{-q_i t}dt\right)\left(1-\int_0^1 \tau_i^{ee}e^{-\tau_i^{ee}t}dt\right)\\
&\quad\times\int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}\left(1-\int_0^t \tau_{j,i}^{u,e}e^{-\tau_{j,i}^{u,e}x}dx-\int_t^1 \tau_j^u e^{-\tau_j^u x}dx\right)dt\\
&= e^{-q_i}e^{-\tau_i^{ee}}\int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right)e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}\left(e^{-\tau_{j,i}^{u,e}t}-e^{-\tau_j^u t}+e^{-\tau_j^u}\right)dt\\
&= e^{-q_i}e^{-\tau_i^{ee}}e^{-\tau_j^u}\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\\
&\quad+e^{-q_i}e^{-\tau_i^{ee}}\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)}\right)\\
&\quad-e^{-q_i}e^{-\tau_i^{ee}}\frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u\right)}\right).
\end{aligned}
$$

The probability that the man makes a job-to-job transition and a divorce happens,

$$
\begin{aligned}
\Pr\left[m_{ij}^{eu} \to s_i^{e'}, s_j^{u}\right] &= \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t}\left(1-\int_0^t q_i e^{-q_i x} dx\right) dt \\
&\quad \times \int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t}\left(1-\int_0^t \tau_{j,i}^{u,e} e^{-\tau_{j,i}^{u,e} x} dx - \int_t^1 \tau_j^{u} e^{-\tau_j^{u} x} dx\right) dt \\
&= \tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right) e^{-\tau_j^{u}}\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right) \\
&\quad + \tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right) \tfrac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)}\right) \\
&\quad - \tfrac{\tau_i^{ee}}{\tau_i^{ee}+q_i}\left(1-e^{-\left(\tau_i^{ee}+q_i\right)}\right) \tfrac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^{u}}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^{u}\right)}\right).
\end{aligned}
$$

The probability that the man looses his job and a divorce happens depends on α_{ij}^{eu} and α_{ij}^{uu}. If $\alpha_{ij}^{eu} \leq \alpha_{ij}^{uu}$, all marriages survive the job loss of the man and the divorce must be triggered by an adverse love shock. If $\alpha_{ij}^{eu} > \alpha_{ij}^{uu}$, the fraction $1-\alpha_{ij}^{uu}/\alpha_{ij}^{eu}$ of marriages divorce directly due to the man's job loss.

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu} \to s_i^u, s_j^u\right] \\
= \;& \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu} t} \left(1 - \int_0^t \tau_i^{ee} e^{-\tau_i^{ee} x} dx\right) \\
& \times \Bigg[\left(\left(\int_0^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} dx + \int_t^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} dx\right)\left(1 - \int_0^1 \tau_j^u e^{-\tau_j^u y} dy\right)\right. \\
& + \int_0^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} \left(\int_0^x \tau_j^u e^{-\tau_j^u y} dy - \int_0^x \tau_{j,i}^{u,e} e^{-\tau_{j,i}^{u,e} y} dy\right) dx \\
& + \int_t^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} \left(\int_t^x \tau_j^u e^{-\tau_j^u y} dy - \int_t^x \tau_{j,i}^{u,u} e^{-\tau_{j,i}^{u,u} y} dy\right) dx\Bigg] dt \\
& + \int_0^1 \left(q_i - q_i^{uu/eu}\right) e^{-\left(q_i - q_i^{uu/eu}\right)t} \left(1 - \int_0^t \tau_i^{ee} e^{-\tau_i^{ee} x} dx\right)\left(1 - \int_0^t \tau_{j,i}^{u,e} e^{-\tau_{j,i}^{u,e} x} dx - \int_t^1 \tau_j^u e^{-\tau_j^u x} dx\right) \\
& \times \left(1 - \int_0^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} dx\right) dt \\
= \;& \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu} t} e^{-\tau_i^{ee} t} \Bigg[\left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) e^{-\tau_j^u} \\
& + \int_0^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)x} \left(e^{-\tau_{j,i}^{u,e} x} - e^{-\tau_j^u x}\right) dx \\
& + \int_t^1 \delta\left(1-\alpha_{ij}^{uu}\right) e^{-\delta\left(1-\alpha_{ij}^{uu}\right)x} \left(e^{-\tau_{j,i}^{u,u} x} - e^{-\tau_j^u x}\right) dx\Bigg] dt \\
& + \int_0^1 \left(q_i - q_i^{uu/eu}\right) e^{-\left(q_i - q_i^{uu/eu}\right)t} e^{-\tau_i^{ee} t} \left(e^{-\tau_{j,i}^{u,e} t} - e^{-\tau_j^u t} + e^{-\tau_j^u}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} dt \\
= \;& \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu} t} e^{-\tau_i^{ee} t} \Bigg[\left(1 - e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) e^{-\tau_j^u} \\
& + \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right) + \tau_{j,i}^{u,e}} \left(1 - e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right) + \tau_{j,i}^{u,e}\right)t}\right) - \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right) + \tau_j^u} \left(1 - e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right) + \tau_j^u\right)t}\right) \\
& + \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right) + \tau_{j,i}^{u,u}} \left(1 - e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right) + \tau_{j,i}^{u,u}\right)t}\right) - \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right) + \tau_j^u} \left(1 - e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right) + \tau_j^u\right)t}\right)\Bigg] dt \\
& + \int_0^1 \left(q_i - q_i^{uu/eu}\right) e^{-\left(q_i - q_i^{uu/eu}\right)t} e^{-\tau_i^{ee} t} \left(e^{-\tau_{j,i}^{u,e} t} - e^{-\tau_j^u t} + e^{-\tau_j^u}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} dt
\end{aligned}
$$

where

$$q_i^{-l'l/-ll} = q_i \min\left[\left(\alpha_{ij}^{-l'l} / \alpha_{ij}^{-ll}\right), 1\right].$$

$$
\begin{aligned}
\Pr\left[m_{ij}^{eu} \to s_i^u, s_j^u\right] \;=\; & \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} e^{-\delta\left(1-\alpha_{ij}^{uu}\right)t} dt e^{-\tau_j^u} \\
& - \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} dt e^{-\tau_j^u} \\
& + \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} dt \left(1 - e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) e^{-\tau_j^u} \\
& + \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} dt \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}} \\
& - \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}\right)t} dt \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}} \\
& - \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} dt \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u} \\
& + \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u\right)t} dt \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u} \\
& + \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} dt \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}} \\
& - \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}\right)t} dt \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}} \\
& - \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} dt \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_j^u} \\
& + \int_0^1 q_i^{uu/eu} e^{-q_i^{uu/eu}t} e^{-\tau_i^{ee}t} e^{-\left(\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_j^u\right)t} dt \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_j^u} \\
& + \int_0^1 \left(q_i - q_i^{uu/eu}\right) e^{-\left(q_i-q_i^{uu/eu}\right)t} e^{-\tau_i^{ee}t} e^{-\tau_{j,i}^{u,e}t} e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} dt \\
& - \int_0^1 \left(q_i - q_i^{uu/eu}\right) e^{-\left(q_i-q_i^{uu/eu}\right)t} e^{-\tau_i^{ee}t} e^{-\tau_j^u t} e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} dt \\
& + \int_0^1 \left(q_i - q_i^{uu/eu}\right) e^{-\left(q_i-q_i^{uu/eu}\right)t} e^{-\tau_i^{ee}t} e^{-\delta\left(1-\alpha_{ij}^{eu}\right)t} dt e^{-\tau_j^u}
\end{aligned}
$$

$$
\begin{aligned}
= \; & \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) e^{-\tau_j^u} \\
& - \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) e^{-\tau_j^u} \\
& + \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right) \left(1-e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right) e^{-\tau_j^u} \\
& + \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right) \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}} \\
& - \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\tau_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\tau_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_{j,i}^{u,e}} \\
& - \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right) \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u} \\
& + \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u\right)}\right) \frac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u} \\
& + \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right) \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}} \\
& - \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\tau_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\tau_{j,i}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{j,i}^{u,u}} \\
& - \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}\right)}\right) \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_j^u} \\
& + \frac{q_i^{uu/eu}}{q_i^{uu/eu}+\tau_i^{ee}+\tau_j^u+\delta\left(1-\alpha_{ij}^{uu}\right)} \left(1-e^{-\left(q_i^{uu/eu}+\tau_i^{ee}+\tau_j^u+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right) \frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_j^u} \\
& + \frac{\left(q_i-q_i^{uu/eu}\right)}{q_i-q_i^{uu/eu}+\tau_i^{ee}+\tau_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1-e^{-\left(q_i-q_i^{uu/eu}+\tau_i^{ee}+\tau_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& - \frac{\left(q_i-q_i^{uu/eu}\right)}{q_i-q_i^{uu/eu}+\tau_i^{ee}+\tau_j^u+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1-e^{-\left(q_i-q_i^{uu/eu}+\tau_i^{ee}+\tau_j^u+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& + \frac{\left(q_i-q_i^{uu/eu}\right)}{q_i-q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)} \left(1-e^{-\left(q_i-q_i^{uu/eu}+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) e^{-\tau_j^u}.
\end{aligned}
$$

Next, we consider the probability that the woman finds a job and the couple divorces, i.e.,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu} \to s_i^e, s_j^e\right] \\
= & \left(1-\int_0^1 q_i e^{-q_i t} dt\right)\left(1-\int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} dt\right) \\
& \times \int_0^1 \underline{\tau}_{j,i}^{u,e} e^{-\underline{\tau}_{j,i}^{u,e} t}\left(1-\int_0^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) x} dx\right) dt \\
& +\left(1-\int_0^1 q_i e^{-q_i t} dt\right)\left(1-\int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} dt\right) \\
& \times\left[\int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t} dt \int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) t} dt\right. \\
& +\int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t}\left(\int_t^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right) x} dx-\int_t^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) x} dx\right) dt \\
& \left.+\int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) t}\left(\int_t^1 \tau_j^u e^{-\tau_j^u x} dx-\int_t^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} x} dx\right) dt\right] \\
= & e^{-q_i} e^{-\tau_i^{ee}}\left[\tfrac{\underline{\tau}_{j,i}^{u,e}}{\underline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\underline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)+\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\right. \\
& +\tfrac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)-\tfrac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& +\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)\left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}-e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)+\tfrac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u\right)}\right) \\
& \left.-\tfrac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\overline{\tau}_{j,i}^{u,e}}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\overline{\tau}_{j,i}^{u,e}\right)}\right)+\left(e^{-\overline{\tau}_{j,i}^{u,e}}-e^{-\tau_j^u}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\right].
\end{aligned}
$$

The probability that the woman finds a job and the man changes jobs is similarly given by,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{eu} \to s_i^{e'}, s_j^e\right] \\
= & \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t}\left(1-\int_0^t q_i e^{-q_i x} dx\right) dt \int_0^1 \underline{\tau}_{j,i}^{u,e} e^{-\underline{\tau}_{j,i}^{u,e} t}\left(1-\int_0^t \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) x} dx\right) dt \\
& +\int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t}\left(1-\int_0^t q_i e^{-q_i x} dx\right) dt\left[\int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) t} dt \int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t} dt\right. \\
& +\int_0^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} t}\left(\int_t^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right) x} dx-\int_t^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) x} dx\right) dt \\
& \left.+\int_0^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) t}\left(\int_t^1 \tau_j^u e^{-\tau_j^u x} dx-\int_t^1 \overline{\tau}_{j,i}^{u,e} e^{-\overline{\tau}_{j,i}^{u,e} x} dx\right) dt\right] \\
= & \tfrac{\tau_i^{ee}}{q_i+\tau_i^{ee}}\left(1-e^{-\left(q_i+\tau_i^{ee}\right)}\right)\left[\tfrac{\underline{\tau}_{j,i}^{u,e}}{\underline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\underline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right)+\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\right. \\
& +\tfrac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)-\tfrac{\overline{\tau}_{j,i}^{u,e}}{\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(\overline{\tau}_{j,i}^{u,e}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& +\left(1-e^{-\overline{\tau}_{j,i}^{u,e}}\right)\left(e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}-e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)+\tfrac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\tau_j^u\right)}\right) \\
& \left.-\tfrac{\delta\left(1-\alpha_{ij}^{eu}\right)}{\delta\left(1-\alpha_{ij}^{eu}\right)+\overline{\tau}_{j,i}^{u,e}}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{eu}\right)+\overline{\tau}_{j,i}^{u,e}\right)}\right)+\left(e^{-\overline{\tau}_{j,i}^{u,e}}-e^{-\tau_j^u}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\right].
\end{aligned}
$$

Since we do not observe a $m_{ij}^{eu} \to s_i^u, s_j^e$ transition in our data, we do not calculate $\Pr\left[m_{ij}^{eu} \to s_i^u, s_j^e\right]$. If we need it for the decomposition, we might use the fact that all probabilities out of one status must add up to unity.

Let us now consider couples where the woman is employed and the man unemployed and a divorce happens, i.e.,

$$
\begin{aligned}
\Pr\left[m_{ij}^{ue} \to s_i^u, s_j^e\right] &= \int_0^1 \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t}\left(1-\int_0^t \tau_{i,j}^{u,e} e^{-\tau_{i,j}^{u,e}x}dx - \int_t^1 \tau_i^u e^{-\tau_i^u x}dx\right)dt \\
&\quad \times\left(1-\int_0^1 q_j e^{-q_j t}dt\right)\left(1-\int_0^1 \tau_j^{ee} e^{-\tau_j^{ee}t}dt\right) \\
&= \int_0^1 \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t}\left(e^{-\tau_{i,j}^{u,e}t} - e^{-\tau_i^u t} + e^{-\tau_i^u}\right)dt e^{-q_j} e^{-\tau_j^{ee}} \\
&= e^{-\tau_i^u}\left(1-e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)e^{-q_j}e^{-\tau_j^{ee}} \\
&\quad +\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}\right)}\right)e^{-q_j}e^{-\tau_j^{ee}} \\
&\quad -\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u\right)}\right)e^{-q_j}e^{-\tau_j^{ee}}.
\end{aligned}
$$

$$
\begin{aligned}
\Pr\left[m_{ij}^{ue} \to s_i^u, s_j^{e'}\right] &= \int_0^1 \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t}\left(1-\int_0^t \tau_{i,j}^{u,e} e^{-\tau_{i,j}^{u,e}x}dx - \int_t^1 \tau_i^u e^{-\tau_i^u x}dx\right)dt \\
&\quad \times\int_0^1 \tau_j^{ee} e^{-\tau_j^{ee}t}\left(1-\int_0^t q_j e^{-q_j x}dx\right)dt \\
&= \int_0^1 \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t}\left(e^{-\tau_{i,j}^{u,e}t} - e^{-\tau_i^u t} + e^{-\tau_i^u}\right)dt \frac{\tau_j^{ee}}{\tau_j^{ee}+q_j}\left(1-e^{-\left(\tau_j^{ee}+q_j\right)}\right) \\
&= e^{-\tau_i^u}\left(1-e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\frac{\tau_j^{ee}}{\tau_j^{ee}+q_j}\left(1-e^{-\left(\tau_j^{ee}+q_j\right)}\right) \\
&\quad +\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}\right)}\right)\frac{\tau_j^{ee}}{\tau_j^{ee}+q_j}\left(1-e^{-\left(\tau_j^{ee}+q_j\right)}\right) \\
&\quad -\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u\right)}\right)\frac{\tau_j^{ee}}{\tau_j^{ee}+q_j}\left(1-e^{-\left(\tau_j^{ee}+q_j\right)}\right).
\end{aligned}
$$

$$
\begin{aligned}
&\Pr\left[m_{ij}^{ue} \to s_i^u, s_j^u\right] \\
=\;& \frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)e^{-\tau_i^u} \\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\tau_i^u} \\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{uu}\right)}\right)e^{-\tau_i^u} \\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}} \\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\tau_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\tau_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_{i,j}^{u,e}} \\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u} \\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u} \\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}} \\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\tau_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\tau_{i,j}^{u,u}+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_{i,j}^{u,u}} \\
&-\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u} \\
&+\frac{q_j^{uu/ue}}{q_j^{uu/ue}+\tau_j^{ee}+\tau_i^u+\delta\left(1-\alpha_{ij}^{uu}\right)}\left(1-e^{-\left(q_j^{uu/ue}+\tau_j^{ee}+\tau_i^u+\delta\left(1-\alpha_{ij}^{uu}\right)\right)}\right)\frac{\delta\left(1-\alpha_{ij}^{uu}\right)}{\delta\left(1-\alpha_{ij}^{uu}\right)+\tau_i^u} \\
&+\frac{q_j-q_j^{uu/ue}}{q_j-q_j^{uu/ue}+\tau_j^{ee}+\tau_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j-q_j^{uu/ue}+\tau_j^{ee}+\tau_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
&-\frac{q_j-q_j^{uu/ue}}{q_j-q_j^{uu/ue}+\tau_j^{ee}+\tau_i^u+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j-q_j^{uu/ue}+\tau_j^{ee}+\tau_i^u+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
&+\frac{q_j-q_j^{uu/ue}}{q_j-q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(q_j-q_j^{uu/ue}+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)e^{-\tau_i^u}.
\end{aligned}
$$

$$
\begin{aligned}
&\Pr\left[m_{ij}^{ue} \to s_i^e, s_j^e\right] \\
=\;& e^{-q_j}e^{-\tau_j^{ee}}\left[\frac{\underline{\tau}_{i,j}^{u,e}}{\underline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\underline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right)+\left(1-e^{-\overline{\tau}_{i,j}^{u,e}}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\right. \\
&+\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right)-\frac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)}\left(1-e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
&+\left(1-e^{-\overline{\tau}_{i,j}^{u,e}}\right)\left(e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}-e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right)+\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^u\right)}\right) \\
&\left.-\frac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\overline{\tau}_{i,j}^{u,e}}\left(1-e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\overline{\tau}_{i,j}^{u,e}\right)}\right)+\left(e^{-\overline{\tau}_{i,j}^{u,e}}-e^{-\tau_i^u}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\right].
\end{aligned}
$$

$$
\begin{aligned}
&\Pr\left[m_{ij}^{ue} \to s_i^{e}, s_j^{e'}\right] \\
= \;& \tfrac{\tau_j^{ee}}{q_j+\tau_j^{ee}} \left(1 - e^{-\left(q_j+\tau_j^{ee}\right)}\right) \left[\tfrac{\underline{\tau}_{i,j}^{u,e}}{\underline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(\underline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) + \left(1 - e^{-\overline{\tau}_{i,j}^{u,e}}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\right. \\
&+ \tfrac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) - \tfrac{\overline{\tau}_{i,j}^{u,e}}{\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(\overline{\tau}_{i,j}^{u,e}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
&+ \left(1 - e^{-\overline{\tau}_{i,j}^{u,e}}\right) \left(e^{-\delta\left(1-\alpha_{ij}^{ue}\right)} - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) + \tfrac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^{u}} \left(1 - e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\tau_i^{u}\right)}\right) \\
&\left.- \tfrac{\delta\left(1-\alpha_{ij}^{ue}\right)}{\delta\left(1-\alpha_{ij}^{ue}\right)+\overline{\tau}_{i,j}^{u,e}} \left(1 - e^{-\left(\delta\left(1-\alpha_{ij}^{ue}\right)+\overline{\tau}_{i,j}^{u,e}\right)}\right) + \left(e^{-\overline{\tau}_{i,j}^{u,e}} - e^{-\tau_i^{u}}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\right].
\end{aligned}
$$

Finally, let us now consider couples where both are employed and a divorce happens, i.e.,

$$
\begin{aligned}
\Pr\left[m_{ij}^{ee} \to s_i^{e}, s_j^{e}\right] &= \left(1 - \int_0^1 q_i e^{-q_i t} dt\right) \left(1 - \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} dt\right) \int_0^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} dt \\
&\quad \times \left(1 - \int_0^1 q_j e^{-q_j t} dt\right) \left(1 - \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} dt\right) \\
&= e^{-q_i} e^{-\tau_i^{ee}} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) e^{-q_j} e^{-\tau_j^{ee}}.
\end{aligned}
$$

$$
\begin{aligned}
\Pr\left[m_{ij}^{ee} \to s_i^{e'}, s_j^{e}\right] &= \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} \left(1 - \int_0^t q_i e^{-q_i x} dx\right) dt \int_0^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} dt \\
&\quad \times \left(1 - \int_0^1 q_j e^{-q_j t} dt\right) \left(1 - \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} dt\right) \\
&= \tfrac{\tau_i^{ee}}{q_i+\tau_i^{ee}} \left(1 - e^{-\left(q_i+\tau_i^{ee}\right)}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) e^{-q_j} e^{-\tau_j^{ee}}.
\end{aligned}
$$

$$
\begin{aligned}
\Pr\left[m_{ij}^{ee} \to s_i^{e}, s_j^{e'}\right] &= \left(1 - \int_0^1 q_i e^{-q_i t} dt\right) \left(1 - \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} dt\right) \int_0^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} dt \\
&\quad \times \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} \left(1 - \int_0^t q_j e^{-q_j x} dx\right) dt \\
&= e^{-q_i} e^{-\tau_i^{ee}} \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) \tfrac{\tau_j^{ee}}{q_j+\tau_j^{ee}} \left(1 - e^{-\left(q_j+\tau_j^{ee}\right)}\right).
\end{aligned}
$$

$$
\begin{aligned}
\Pr\left[m_{ij}^{ee} \to s_i^{e'}, s_j^{e'}\right] &= \int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} \left(1 - \int_0^t q_i e^{-q_i x} dx\right) dt \int_0^1 \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} dt \\
&\quad \times \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} \left(1 - \int_0^t q_j e^{-q_j x} dx\right) dt \\
&= \tfrac{\tau_i^{ee}}{q_i+\tau_i^{ee}} \left(1 - e^{-\left(q_i+\tau_i^{ee}\right)}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)}\right) \tfrac{\tau_j^{ee}}{q_j+\tau_j^{ee}} \left(1 - e^{-\left(q_j+\tau_j^{ee}\right)}\right).
\end{aligned}
$$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ee} \to s_i^u, s_j^e\right] \\
= & \left[\int_0^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right), 1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]t} \left(1 - \int_0^t \tau_i^{ee} e^{-\tau_i^{ee} x} dx\right)\right. \\
& \times \left(\int_0^t \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right)x} dx + \int_t^1 \delta\left(1-\alpha_{ij}^{ue}\right) e^{-\delta\left(1-\alpha_{ij}^{ue}\right)x} dx\right) dt \\
& \left. + \int_0^1 q_i \left(1 - \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right), 1\right]\right) e^{-q_i\left(1-\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)t} \left(1 - \int_0^t \tau_i^{ee} e^{-\tau_i^{ee} x} dx\right) dt\right] \\
& \times \left(1 - \int_0^1 q_j e^{-q_j t} dt\right) \left(1 - \int_0^1 \tau_j^{ee} e^{-\tau_j^{ee} t} dt\right) \\
= & \left[\int_0^1 q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right), 1\right] e^{-q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]t} e^{-\tau_i^{ee} t}\right. \\
& \times \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ee}\right)t} + e^{-\delta\left(1-\alpha_{ij}^{ue}\right)t} - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right) dt \\
& \left. + \int_0^1 q_i \left(1 - \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right), 1\right]\right) e^{-q_i\left(1-\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)t} e^{-\tau_i^{ee} t}\right] e^{-q_j} e^{-\tau_j^{ee}} \\
= & \left[\tfrac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}} \left(1 - e^{-\left(q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}\right)}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\right. \\
& - \tfrac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)} \left(1 - e^{-\left(q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) \\
& + \tfrac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
& \left. + \tfrac{q_i\left(1-\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)}{q_i\left(1-\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)+\tau_i^{ee}} \left(1 - e^{-\left(q_i\left(1-\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)+\tau_i^{ee}\right)}\right)\right] e^{-q_j} e^{-\tau_j^{ee}}.
\end{aligned}
$$

For the case that the woman makes a job to job transition we have to replace $e^{-q_j} e^{-\tau_j^{ee}}$ by $\frac{\tau_j^{ee}}{q_j+\tau_j^{ee}} \left(1 - e^{-\left(q_j+\tau_j^{ee}\right)}\right)$, i.e.,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ee} \to s_i^u, s_j^{e'}\right] \\
= & \left[\tfrac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}} \left(1 - e^{-\left(q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}\right)}\right) \left(1 - e^{-\delta\left(1-\alpha_{ij}^{ue}\right)}\right)\right. \\
& - \tfrac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)} \left(1 - e^{-\left(q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) \\
& + \tfrac{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]}{q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)} \left(1 - e^{-\left(q_i \min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]+\tau_i^{ee}+\delta\left(1-\alpha_{ij}^{ue}\right)\right)}\right) \\
& \left. + \tfrac{q_i\left(1-\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)}{q_i\left(1-\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)+\tau_i^{ee}} \left(1 - e^{-\left(q_i\left(1-\min\left[\left(\alpha_{ij}^{ue}/\alpha_{ij}^{ee}\right),1\right]\right)+\tau_i^{ee}\right)}\right)\right] \tfrac{\tau_j^{ee}}{q_j+\tau_j^{ee}} \left(1 - e^{-\left(q_j+\tau_j^{ee}\right)}\right).
\end{aligned}
$$

Similarly, if the man becomes unemployed, i.e.,

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ee} \rightarrow s_i^{e}, s_j^{u}\right] \\
= & \left(1-\int_0^1 q_i e^{-q_i t} dt\right)\left(1-\int_0^1 \tau_i^{ee} e^{-\tau_i^{ee} t} dt\right) \\
& \times\left[\int_0^1 q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] e^{-q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right] t}\left(1-\int_0^t \tau_j^{ee} e^{-\tau_j^{ee} x} dx\right)\right. \\
& \times\left(\int_0^t \delta\left(1-\alpha_{ij}^{ee}\right) e^{-\delta\left(1-\alpha_{ij}^{ee}\right) x} dx+\int_t^1 \delta\left(1-\alpha_{ij}^{eu}\right) e^{-\delta\left(1-\alpha_{ij}^{eu}\right) x} dx\right) dt \\
& \left.+\int_0^1 q_j\left(1-\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right) e^{-q_j\left(1-\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right) t}\left(1-\int_0^t \tau_j^{ee} e^{-\tau_j^{ee} x} dx\right)\right] \\
= & e^{-q_i} e^{-\tau_i^{ee}}\left[\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}}\left(1-e^{-\left(q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}\right)}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\right. \\
& -\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) \\
& +\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& \left.+\frac{q_j\left(1-\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right)}{q_j\left(1-\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right)+\tau_j^{ee}}\left(1-e^{-\left(q_j\left(1-\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right)+\tau_j^{ee}\right)}\right)\right],
\end{aligned}
$$

$$
\begin{aligned}
& \Pr\left[m_{ij}^{ee} \rightarrow s_i^{e'}, s_j^{u}\right] \\
= & \frac{\tau_i^{ee}}{q_i+\tau_i^{ee}}\left(1-e^{-\left(q_i+\tau_i^{ee}\right)}\right)\left[\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}}\left(1-e^{-\left(q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}\right)}\right)\left(1-e^{-\delta\left(1-\alpha_{ij}^{eu}\right)}\right)\right. \\
& -\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)}\left(1-e^{-\left(q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{ee}\right)\right)}\right) \\
& +\frac{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]}{q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)}\left(1-e^{-\left(q_j \min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]+\tau_j^{ee}+\delta\left(1-\alpha_{ij}^{eu}\right)\right)}\right) \\
& \left.+\frac{q_j\left(1-\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right)}{q_j\left(1-\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right)+\tau_j^{ee}}\left(1-e^{-\left(q_j\left(1-\min\left[\left(\alpha_{ij}^{eu}/\alpha_{ij}^{ee}\right),1\right]\right)+\tau_j^{ee}\right)}\right)\right],
\end{aligned}
$$

We do not consider the case where both spouses become unemployed and divorce.