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HOUSEHOLDS, FRICTIONS, AND GENDER GAP: A SEARCH MODEL OF LABOUR FORCE PARTICIPATION IN INDIA

NCAER Working Paper

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Abstract

Why do nearly half of working-age adults in India, and three-quarters of women, remain outside the labour force? We address this question using a continuous-time joint household search model calibrated to Indian data. Households pool resources and make employment decisions under gender-asymmetric labour market frictions and unequal home-production responsibilities. Estimated transition rates from the Consumer Pyramids Household Survey reveal a labour market characterised by low job-finding and job-loss rates. We find that women's reservation wages substantially exceed men's. Counterfactual decompositions show that household responsibilities explain 45 percent of the gender gap, labour market frictions 35 percent, and interaction effects 20 percent. Reducing uncertainty and women's household burdens significantly increases labour force participation.

JEL codes: J21, J22, J23, J31, J63, J64, J81, E24

Keywords: Macroeconomic job search model; Household joint decision; Gender gap decomposition; labour force participation; Reservation wage; Home production; labour market dynamism

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1 Introduction

Why do people choose not to work? This question is particularly important - and even perplexing - in emerging economies where unemployment and social security benefits are limited. Understanding what keeps people out of the labour force can help improve welfare and boost economic growth. In India, a large and populous economy, the question assumes urgency: almost half of the working-age population is outside the labour force. The gender dimension compounds the puzzle. Disproportionately more women are out of the labour force than men, with female non-participation running at nearly 75 percent. Substantial literature investigates the causes of low participation and gender disparity in India. We complement that literature by combining two factors - the macroeconomic environment and a household-level factor, the allocation of time to unpaid home production - and showing formally how their interaction generates both aggregate low participation and the gender gap.

A central premise of this paper is that labour force participation decisions are made at the household level, not by atomistic individuals. This matters for three reasons. First, the employment status of one spouse affects the reservation wage of the other through income pooling and changes in the value of home production. Second, the gender asymmetry in household responsibilities - women in India devote on average more than six hours daily to unpaid domestic work, compared to under three hours for men - directly raises the opportunity cost of labour market entry for wives. Third, and most importantly, these household-level factors interact with the macroeconomic environment in ways that neither channel alone can generate. A household search model is therefore the appropriate framework.

We develop a continuous-time joint decision household search model for a two-member household (husband and wife), calibrate it to Indian data, and derive equilibrium reservation wages for both spouses under all four household states (worker-worker, searcher-worker, worker-searcher, searcher-searcher). The model incorporates utility from both market consumption and home production, and allows for gender-asymmetric labour market frictions - captured by gender-specific job-finding and job-loss probabilities estimated from the CPHS transition matrices - and differential time requirements for household responsibilities drawn from official time-use data. We find that women exhibit substantially higher equilibrium reservation wages than men. This gap in reservation wages is the proximate mechanism behind the gap in labour force participation rates.

Our key empirical contribution is a novel decomposition of the gender gap in reservation wages. The baseline model generates a gap of Rs. 2,195 per month between women's and men's reservation wages (in the searcher-searcher household state). We implement a counterfactual decomposition that isolates the contribution of three channels. First, we equalise labour market frictions across genders - setting women's job-finding and job-loss rates equal to men's - and find that this reduces the gap by approximately Rs. 770, accounting for 35 percent of the total gap. Second, we equalise home production timeshares and time spent on household work across genders, and find that this reduces the gap by Rs. 1005, accounting for approximately 45 percent of the total gap. The remaining approximately 20 percent reflects interaction effects and nonlinearities between the two channels. The decomposition thus establishes household factors as the dominant driver of gender differences in reservation wages, while confirming that labour market frictions play a quantitatively substantial secondary role.

In India, 49% of the working-age population is outside the labour force, and 75% of women choose not to work. Given the size of the economy and the population, this attracts a great deal of attention from researchers. Substantial literature has studied the low participation of women, citing both demand and supply-side factors. On the demand side, there are limited employment opportunities for women. Deshpande and Singh, 2021 explores the volatility in Indian women's labour market engagement as they exit and re-enter the labour force multiple times over short periods due to a lack of gainful employment opportunities. Mehrotra and Parida, 2017 point to greater mechanisation and a shift from farm to non-farm employment as reasons for falling demand for female workers. Supply-side constraints include marriage, childbirth, and social and cultural norms (Deshpande and Kabeer, 2021). Several other gender-related factors - workplace safety, law and order - have been pointed out to explain the low presence of women in the labour pool (Sarkar et al., 2019, Singh and Das, 2015). Bhalla and Kaur, 2011 emphasise the poor sex ratio in LFPR due to high fertility rates and other socioeconomic belief systems. Using the NSSO 68th round Employment-Unemployment Survey for 2011-12, Sanghi et al., 2015 estimates female LFPR at 22.5 percent. Chatterjee and Dev, 2023 track labour flow movements to comment on the riskiness of the Indian labour market. Verick, 2018 investigates the urban-rural divide for the gender composition of LFPR. Agnihotri et al., 2011 examines migration-related concerns and other obstacles to women's labour force participation.

This paper studies the dynamics of labour supply choices that involve time allocation decisions within households by developing a job search model that also includes home production. We add to the literature on search models in macroeconomics by developing a joint household model in which each member faces asymmetric risk and spends a different amount of time in household production. We extend this to understand the role of uncertainty and dynamism in the labour market in influencing labour force participation decisions. labour market search theory gained traction following McCall, 1970 and Mortensen, 1970's seminal work for the single-agent economy. Burdett, 1978 expanded the search model by allowing for on-the-job search. Subsequent work has identified other determinants of reservation wages, such as job search costs and risk aversion (Mortensen and Pissarides, 2011, Adams-Prassl et al., 2023). Researchers have also explored location frictions, matching frictions, and others (Mortensen and Pissarides, 1994, Diamond and Maskin, 1979, Pissarides, 1984a, Pissarides, 1984b). Our framework is also related to equilibrium search models that incorporate household formation and intra-household bargaining, such as Goussé et al., 2017, which highlight how wage-setting and labour market frictions interact with matching and partnership decisions. A household search model was developed by Dey and Flinn, 2008 and Guler et al., 2012. Albrecht et al., 2010 and Compte and Jehiel, 2010 model the search decision of a committee. Berton and Garibaldi, 2012 and Tejada, 2017 extend the model with temporary and permanent contracts. Intra-household disparities in home production have been studied by Salazar-Saenz, 2022, Li et al., 2020, and Goussé et al., 2017. Topel and Ward, 1992 and Hahn et al., 2021 discuss the implications of more frequent job transitions for labour market outcomes. Decomposition methods in the spirit of Goldin and Polachek, 1987 have been used to attribute wage and participation gaps to observable characteristics; our contribution is to embed such a decomposition within a structural equilibrium model.

We use the CPHS panel data to develop labour flow charts and estimate gender-specific transition probabilities - the first such systematic analysis for India. We introduce within-household disparities in time use, drawing on the official Time Use in India Report (2019). The model generates four equilibrium reservation wages (for each spouse, conditional on the other's employment status). Women's reservation wages exceed men's in all states. The decomposition reveals that household factors are the dominant channel, accounting for 45 percent of the gender gap in reservation wages, with labour market frictions contributing 35 percent and residual interaction effects the remaining 20 percent. In counterfactual exercises, a favorable shift to a low-uncertainty, high-dynamism labour market lowers reservation wages and raises overall participation. Equalizing home production time between men and women virtually eliminates the gender participation gap. This paper is among the first attempts to estimate a household search model for a developing country, and the first to formally decompose the gender gap in reservation wages within such a model.

The rest of the paper is structured as follows. Section 2 presents the data and the methodology for estimating the transition probabilities and generating labour flow charts. Section 3 sets up the household job search model and defines the equilibrium. Section 4 calibrates the model with Indian data. Section 5 presents the results and sensitivity analysis. Section 6 decomposes the gender gap in reservation wages. Section 7 summarises the findings and concludes.

2 labour market dynamics in India

2.1 Data

Accurate high-frequency data are essential for capturing labour market dynamics. In the context of the Indian economy, the Periodic labour Force Survey (PLFS) is the official data source for labour market statistics. The 2017 PLFS replaced the previous quinquennial Employment and Unemployment Surveys (EUS), with the first PLFS report published in June 2019 for 2017-18. Since 2017, further rounds have been conducted: 2018-19, 2019-20, 2020-21, 2021-22, and 2022-23. However, PLFS lacks the frequency and longitudinal structure required to analyze labour flow dynamics and calculate transition probabilities at short intervals. To address these limitations, we utilise the Consumer Pyramids Household Survey (CPHS) from the Centre for Monitoring Indian Economy (CMIE), which offers higher-frequency data and a longitudinal panel structure. CPHS is administered on a panel of more than 170,000 households in India three times a year. The entire sample is surveyed over four months, constituting a wave. We use twenty-four consecutive CPHS waves for our analysis, spanning Wave 7 (January-April 2016) through Wave 30 (September-December 2023).

To construct our charts and matrices, we create a panel of 8,16,549 individuals and track them across all subsequent waves over 96 months from January 2016 to December 2023. The COVID-19 pandemic prompted a nationwide lockdown in March 2020, corresponding to CPHS Wave 19 (January-April 2020), with restrictions persisting through May 2020. The pandemic caused a significant GDP contraction in FY21, followed by recovery in FY22 (Economic Survey, 2022-23, GOI). We exclude four COVID-19-disturbed waves from the calibration analysis: Wave 19 (January-April 2020), Wave 20 (May-August 2020), Wave 21 (September-December 2020), and Wave 22 (January-April 2021), focusing on periods of economic normality. Table 1 summarises the study period.

Description	CPHS waves	Year
Normalcy period	Wave 7 - Wave 18	Jan'16 - Dec'19
COVID-19 GDP contraction	Wave 19 - Wave 22	Jan'20 - Apr'21
Normalcy restored	Wave 23 - Wave 30	May'21 - Dec'23

Table 1: Study time frame

We use individual-level responses on the *Employment Status* variable of the *People of India* database of CPHS to classify respondents into three categories: Out of labour Force, Employed, and Unemployed. Following the CMIE framework, an unemployed worker is either *Unemployed, willing, and looking for a job* or *Unemployed, willing, but not looking for a job.* A respondent who is *Unemployed, not willing, and not looking for a job* is classified as Out of the labour Force. Figure 1 plots the share of the three employment categories for the working-age population. The top panel shows that the out-of-labour-force share has consistently exceeded 50% throughout the eight-year study period. The gender-disaggregated bottom panels reveal a strikingly low female labour force participation rate, below 10% throughout. This underscores the severity of India's female participation deficit.

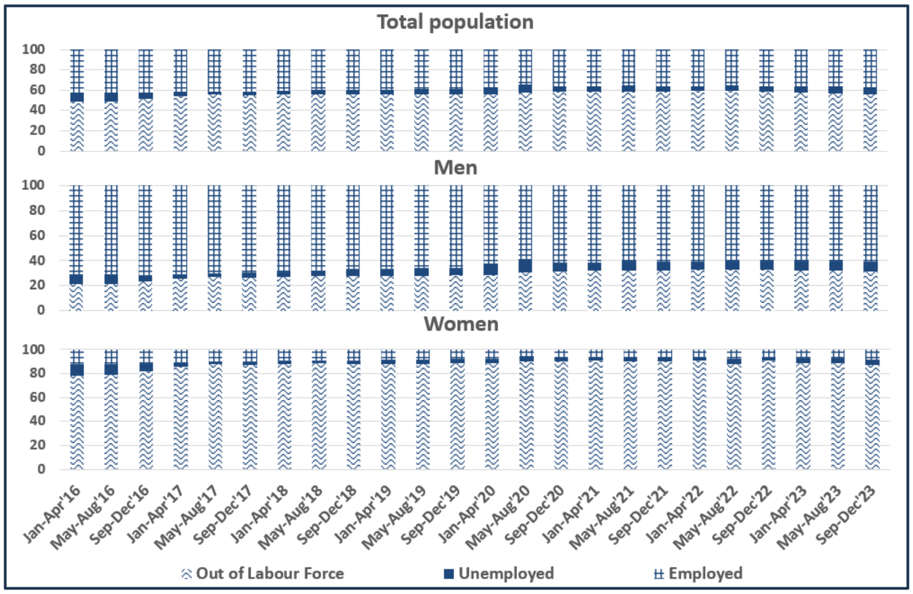

Figure 1: Employment share, India: CMIE CPHS

The share of unemployed workers has remained negligible throughout the study period. The official PLFS data reinforce the CPHS observation: the share of the out-of-labour-force population in the usual status (ps+ss) category for those 15 years and above has remained above 45% throughout. Figure 2 shows this.

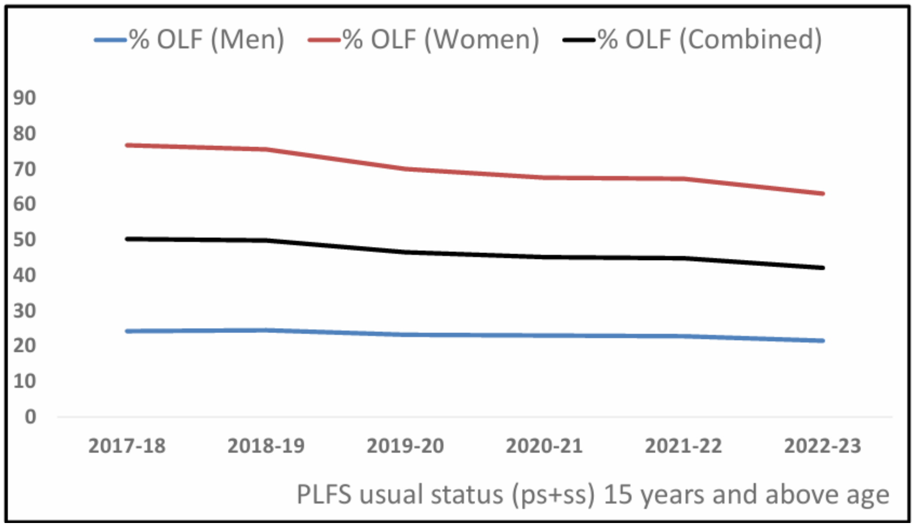

Figure 2: Out of labour Force Population, India: PLFS

Significant gender disparities exist in time-use patterns within Indian households (Deshpande, 2020, Quisumbing et al., 2022). The official Time Use in India Report (2019) documents these disparities: working-age women spend on average more than six hours daily on unpaid domestic work, compared to under three hours for men. This gendered allocation of time to household responsibilities significantly influences labour market participation decisions, as captured in our model. We use the NSS Time Use Report (2019) to calibrate the time-use parameters measuring the time husbands and wives devote to unpaid home production.

2.2 labour flow charts and transition matrices

labour flow charts and transition matrices are standard tools for analyzing labour market dynamics. They track the movement of individuals across employment states over time and estimate transition probabilities. The Bureau of labour Statistics in the United States publishes monthly labour flow charts to monitor workforce transitions. The transition matrix represents the probabilities of moving from one state to another across a time period, with each row summing to unity (Bronson and Costa, 2008).

If there are n states, an individual occupying state $s(t)$ at time t may transition to any of the n states in the subsequent period $(t+1)$. Between any two periods, n^2 transitions are possible. The transition probability is:

$$P(ss') = \frac{s(t) * s'(t+1)}{s(t)} \tag{1}$$

We use Equation 1 to calculate transition probabilities across the three states—*employed*, *unemployed*, and *out of labour force*. These probabilities encapsulate the macroeconomic environment and provide insight into labour market uncertainty and dynamism. Figure 3 shows the associated labour flow charts. The top panel depicts two-way transitions between employment and unemployment; the bottom panel depicts transitions between employment and out-of-labour-force, and the reverse. Given the minimal share of unemployed workers in India, we combine the unemployed with the out-of-labour-force population (Song and Wei, 2019). In the model below, only two employment states exist: employed, and unemployed and seeking employment. An agent who voluntarily declines a job offer is considered to have exited the labour force.

Figure 3: labour flow chart, India

3 Model

We present a joint search model for household decision-making. The primary model environment draws motivation from the McCall-Mortensen model (McCall, 1970, Mortensen, 1970). By allowing for home production in the household's employment decision-making, our model fits into the family of recent work by Salazar-Saenz, 2022 and Flabbi et al., 2016.

Environment: The continuous-time household search model considers a two-agent household—a husband (h) and a wife (w). They behave as a single unit, pooling resources, and derive total household utility $u_{h,w}$ from consumption $C_{h,w}$ and home production $H_{h,w}$. Home production provides a fixed marginal utility per unit of time; its utility is linearly separable and depends solely on the time each spouse devotes to non-market household responsibilities. This is a choice model: upon receiving a job offer, each agent either accepts and becomes employed or declines and exits the labour force voluntarily. The model environment is characterised by: (i) an exogenous wage offer distribution $F(w)$; (ii) a discount rate ρ; (iii) job-offer arrival rates λ_h and λ_w; (iv) job-loss rates η_h and η_w for husband and wife; and (v) per-unit utility from home production x and y for husband and wife. For given home production time (t_h) and (t_w), the household derives home production utility $H_{h,w} = xt_h + yt_w$. Non-working spouses receive non-wage income b_h and b_w. Spouses devote timeshares τ_h and τ_w to home production, determined exogenously; $1-\tau_h$ and $1-\tau_w$ give the time available for employment-related activities. Non-leisure hours are normalised to unity. There are no job offer recalls. The household lives hand-to-mouth, neither saving nor borrowing. There is no flow cost of search. Under this setup, there are four possible household states: *Worker-Worker*, *Searcher-Worker*, *Worker-Searcher*, and *Searcher-Searcher*. Table 2 presents these states.

S.No	Description	Value Function
1.	Worker-Worker Couple	$V^1(w_h, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y)$
2.	Searcher-Worker Couple	$V^2(0, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y)$
3.	Worker-Searcher Couple	$V^3(w_h, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y)$
4.	Searcher-Searcher Couple	$V^4(0, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y)$

Table 2: Household states and value functions

Value functions: The stationarity assumption allows the model to be written recursively. When both spouses are employed (*worker-worker couple*), the household is subject to independent job-loss shocks. Because time is continuous, simultaneous shocks to both spouses are negligible and ignored. A shock to the husband moves the household to state V^2; a shock to the wife moves it to V^3. Equation 2 captures this:

$$\begin{aligned}(\rho + \eta_h + \eta_w)\, V^1\left(w_h, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) = \\ u\left(w_h, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) + \\ \eta_h V^2\left(0, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) + \eta_w V^3\left(w_h, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right)\end{aligned} \tag{2}$$

When the wife is unemployed (*worker-searcher couple*), the household faces job offers to the wife and job-loss risk to the husband. A job-loss shock to the husband moves the household to the searcher-searcher state V^4; a job offer to the wife leads the household to choose between the status quo and the wife accepting wage w, reaching the worker-worker state V^1. Equation 3 describes this:

$$\begin{aligned}(\rho + \eta_h + \lambda_w)\; V^3\left(w_h, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) = \\ u\left(w_h, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) + \eta_h\, V^4\left(0, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) + \\ \lambda_w \int \max\big(V^3\left(w_h, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right), \\ V^1\left(w_h, w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right)\big)\, dF(w)\end{aligned} \tag{3}$$

Symmetrically, when the husband is unemployed (*searcher-worker couple*), the household derives V^2, subject to job offers to the husband and job-loss risk to the wife. Equation 4 captures this:

$$
\begin{aligned}
(\rho + \eta_w + \lambda_h)\, V^2\left(0, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) = \\
u\left(0, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) + \eta_w\, V^4\left(0, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) + \\
\lambda_h \int \max\big(V^2\left(0, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right), \\
V^1\left(w, w_w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right)\big)\; dF(w)
\end{aligned} \tag{4}
$$

When both spouses are unemployed (*searcher-searcher couple*), the household faces two independent job-offer processes. Equation 5 expands V^4:

$$
\begin{aligned}
(\rho + \lambda_h + \lambda_w)\, V^4\left(0, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) = \\
u\left(0, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right) + \lambda_h \int \max\big(V^4\left(0, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right), \\
V^3\left(w, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right)\big)\; dF(w) \\
+\lambda_w \int \max\big(V^4\left(0, 0; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right), \\
V^2\left(0, w; b_h, b_w, \tau_h, \tau_w, t_h, t_w, x, y\right)\big)\; dF(w)
\end{aligned} \tag{5}
$$

Equilibrium: The optimal decision rules are defined by the reservation wages of the two spouses. In labour economics, the reservation wage is the lowest wage at which a job seeker accepts an incoming offer. The reservation wage of one spouse is influenced by the employment status of the other. We have four reservation wages: w_h^{*1} and w_w^{*1} for the searcher-searcher household (where both continue searching after one acceptance), and w_h^{*2} and w_w^{*2} when the other spouse is already employed. These satisfy:

$$
\begin{aligned}
w_h^{*1} &: V^4(0,0;\cdot) = V^3(w_h^{*1}, 0; \cdot) \\
w_w^{*1} &: V^4(0,0;\cdot) = V^2(0, w_w^{*1}; \cdot) \\
w_h^{*2} &: V^2(0, w_w;\cdot) = V^1(w_h^{*2}, w_w; \cdot) \\
w_w^{*2} &: V^3(w_h, 0;\cdot) = V^1(w_h, w_w^{*2}; \cdot)
\end{aligned}
$$

For each spouse in every household state, the value of employment is continuous and monotonically increasing in wages, while the value of unemployment does not depend on a specific wage offer. Substituting the above indifference conditions into the Bellman equations generates a 4×4 system of nonlinear equations. We solve this system for the four equilibrium reservation wages. Equations 6–9 present the expanded value functions:

$$
\begin{aligned}
\rho\, V^1\left(w_h, w_w; \cdot\right) = u\left(w_h, w_w; \cdot\right) + \\
\eta_h \left[V^1\left(w_h^{*2}, w_w; \cdot\right) - V^1\left(w_h, w_w; \cdot\right)\right] + \\
\eta_w \left[V^1\left(w_h, w_w^{*2}; \cdot\right) - V^1\left(w_h, w_w; \cdot\right)\right]
\end{aligned} \tag{6}
$$

$$\rho\ V^2(0,w_w;\cdot) = u(0,w_w;\cdot) + \eta_w\left[V^4(0,0;\cdot) - V^2(0,w_w;\cdot)\right] + \lambda_h \int_{w_h^{*2}}^{w^{max}} \left[V^1(w,w_w;\cdot) - V^1\left(w_h^{*2},w_w;\cdot\right)\right]\ dF(w) \tag{7}$$

$$\rho\ V^3(w_h,0;\cdot) = u(w_h,0;\cdot) + \eta_h\left[V^4(0,0;\cdot) - V^3(w_h,0;\cdot)\right] + \lambda_w \int_{w_w^{*2}}^{w^{max}} \left[V^1(w_h,w;\cdot) - V^1\left(w_h,w_w^{*2};\cdot\right)\right]\ dF(w) \tag{8}$$

$$\rho\ V^4(0,0;\cdot) = u(0,0;\cdot) + \lambda_h \int_{w_h^{*1}}^{w^{max}} \left[V^3(w,0;\cdot) - V^3\left(w_h^{*1},0;\cdot\right)\right]\ dF(w) + \lambda_w \int_{w_w^{*1}}^{w^{max}} \left[V^2(0,w;\cdot) - V^2\left(0,w_w^{*1};\cdot\right)\right]\ dF(w) \tag{9}$$

Definition: Given (λ_h, λ_w, η_h, η_w, ρ, b_h, b_w, $F(w)$, τ_h, τ_w, t_h, t_w, x, y) and a continuous utility function, the **Household Search Model Equilibrium** is the set of reservation wages (w_h^{*1}, w_w^{*1}, w_h^{*2}, w_w^{*2}) solving Equations (6)–(9).

4 Calibrating the model parameters

Solving the equilibrium system of nonlinear equations requires specifying a functional form for household utility. The household comprises a husband (h) and a wife (w), who pool resources and derive utility from joint consumption $C_{h,w}$ and home production $H_{h,w}$. We adopt a concave utility environment to incorporate risk aversion, using an isoelastic (CRRA) utility function with risk aversion parameter θ:

$$U\ (C_{h,w}, H_{h,w})\ =\ \frac{C_{h,w}^{1-\theta}}{1-\theta}\ + (x \cdot t_h + y \cdot t_w), \quad \theta \geq 0,\ \theta \neq 1 \tag{10}$$

Joint consumption $C_{h,w}$ is the sum of each spouse's wage if employed or non-wage income if out of the labour force. The home production timeshares τ_h and τ_w reduce time available for work. The per-unit utility of home production (x for husbands, y for wives) is inferred as the opportunity cost of not participating in the labour market. The reduced-form CRRA utility function is:

$$u(w_h, w_w;\cdot) = \frac{(b_h + b_w + (1-\tau_h)w_h + (1-\tau_w)w_w)^{1-\theta}}{1-\theta} + (x \cdot t_h + y \cdot t_w), \quad \theta \geq 0,\ \theta \neq 1 \tag{11}$$

We assume that the exogenous wage offer distribution follows a lognormal distribution with parameters $\mu = 0$ and $\sigma = 1$, with homogeneous job offers across genders in the baseline (we relax this in Section 5.3). Gender-specific transition probabilities λ_h, λ_w, η_h, η_w are estimated from the CPHS transition matrices, excluding COVID-19-disturbed waves. Time discount parameters are derived from India's annual nominal interest rate. Non-wage income is drawn from the CPHS Income Pyramids database. We set the coefficient of relative risk aversion to $\theta = 2$, consistent with standard values used in the macroeconomics and labour search literature (e.g., Chetty, 2006; Shimer, 2005). We assess robustness by considering alternative values $\theta \in \{1.5, 2, 2.5, 3\}$ and find that the main results are unchanged. Time-use parameters are drawn from the official Time Use in India Report (2019, GOI): women spend on average twice as much time in home production as men. Normalizing non-leisure hours to unity, $\tau_h = 0.37$ and $\tau_w = 0.62$. Figure 4 shows these official time-use data.

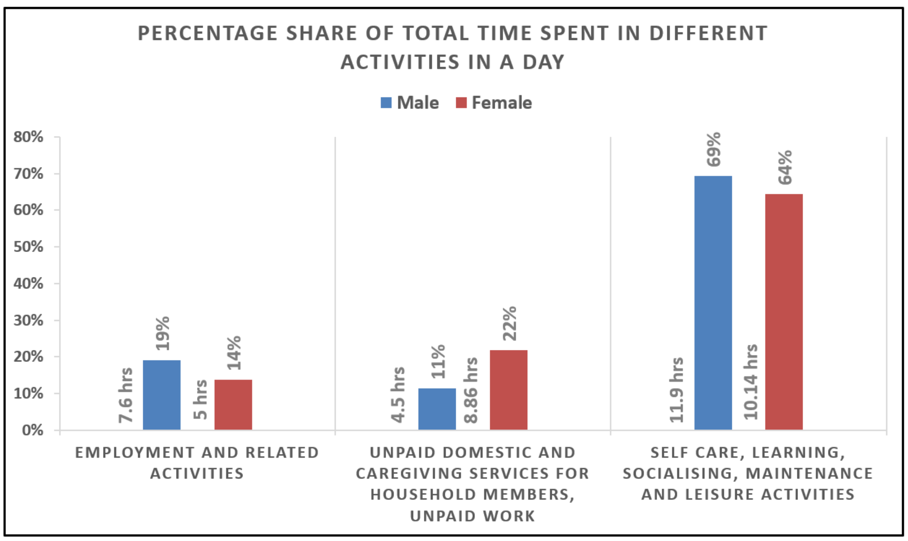

Figure 4: Time use survey - 2019, GOI

We adopt an indirect calibration approach to estimate the utility from home production, employing the opportunity cost method:

$$\text{Utility}^i_{\text{Care}} \approx w^i \tag{12}$$

The utility value of one hour of unpaid care work is approximated by the wage forgone by not entering the labour market. We use gender-disaggregated wage data from the PLFS (Government of India) over the period 2017–2023. Table 3 presents the computed wage losses by gender and the calibrated home production utility parameters.

Years	Wage loss for Husbands ($x \cdot t_h$)	Wage loss for Wives ($y \cdot t_w$)
2017	84×4.5	73×8.86
2018	94×4.5	81×8.86
2019	105×4.5	89×8.86
2020	114×4.5	101×8.86
2021	122×4.5	105×8.86
2022	129×4.5	108×8.86
2023	134×4.5	112×8.86
Average	502.71	846.76

Table 3: Home production utility

Table 4 summarises all calibrated parameter values used in solving the reduced-form nonlinear system.

Parameter	Description	Value
β	4-monthly time discount rate	0.9734
ρ	4-monthly time discount factor	0.027
λ_h	4-monthly job arrival rate, husbands	0.23765
λ_w	4-monthly job arrival rate, wives	0.06934
η_h	4-monthly job loss rate, husbands	0.01004
η_w	4-monthly job loss rate, wives	0.0174
θ	Coefficient of risk aversion	2
b_h	Monthly non-wage income, husbands (Rs.)	845
b_w	Monthly non-wage income, wives (Rs.)	845
τ_h	Husband's home production timeshare	0.37
τ_w	Wife's home production timeshare	0.62
t_h	Husband's home production time (hrs)	4.5
t_w	Wife's home production time (hrs)	8.86

Table 4: Calibrated parameter values

5 Equilibrium

5.1 Calculated reservation wages

We solve the household search model using the calibrated parameters to derive equilibrium reservation wages. The 4×4 nonlinear system yields four equilibrium values: w_h^{*1}, w_w^{*1}, w_h^{*2}, w_w^{*2}. Table 5 presents the results.

Reservation Wage	Calculated Value (Rs./month)
w_h^{*1}	2781.43
w_w^{*1}	4976.33
w_h^{*2}	2698.21
w_w^{*2}	4788.31

Table 5: Equilibrium reservation wages

Women's equilibrium reservation wages substantially exceed men's, in all household states. In households where both spouses are searching, women require Rs. 4,976 to accept a job versus Rs. 2,781 for men - a gap of approximately Rs. 2,195. A similar pattern holds when one spouse is employed. This gender gap in reservation wages is the proximate mechanism behind the gender gap in labour force participation: higher reservation wages imply that a smaller fraction of wage offers clear the acceptance threshold, resulting in lower participation rates. The gap is attributable to the combination of two forces: women face worse labour market conditions ($\lambda_w < \lambda_h$, $\eta_w > \eta_h$) and devote substantially more time to home production ($\tau_w = 0.62$ versus $\tau_h = 0.37$), raising their opportunity cost of market work.

We validate the equilibrium against actual wage data. Using CPHS wage data for January 2020, Figure 5 shows that approximately 99% of households earn a total monthly wage exceeding the maximum model-calculated household reservation wage. This finding is robust across four non-COVID years of data, confirming that the model-implied reservation wages are consistent with the data. At first glance, the finding that a large majority of observed wages exceed the model-implied reservation wage may appear inconsistent with low aggregate participation. However, this reflects the distinction between two separate mechanisms in the model. Aggregate non-participation is primarily driven by low job-finding probabilities (λ_i), which limit the arrival of job offers. Conditional on receiving an offer, reservation wages determine acceptance decisions. Thus, while reservation wages explain the gender gap in participation, low job arrival rates explain the overall low level of participation in the economy. The two mechanisms operate jointly but at different margins.

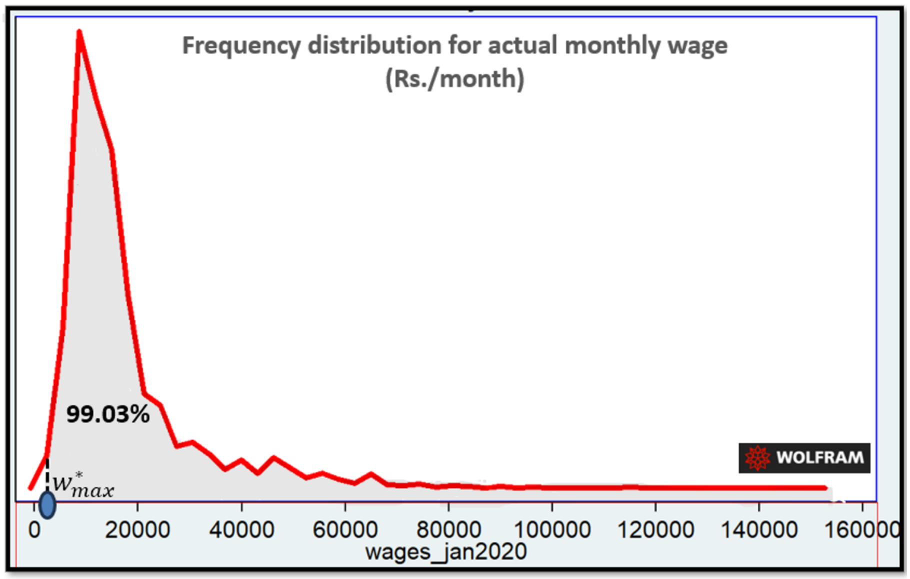

Figure 5: Actual monthly wages, January 2020

5.2 Sensitivity analysis

To evaluate robustness, we conduct counterfactual simulations varying key model parameters: job arrival and loss probabilities, time-use patterns, and non-wage income. Figure 6 presents the results. The top panel plots the trajectory of w_h^{*1} against changing job-finding probabilities; the bottom panel does the same for w_w^{*1}.

Figure 6: Understanding labour market dynamics

Reservation wages rise monotonically with the probability of finding a job λ_i: better job prospects strengthen workers' bargaining power. The probability of job loss η_i acts in the opposite direction: a higher job-loss probability shortens expected employment duration and lowers the reservation wage. Figure 7 shows the scalar field of reservation wages over the grid of λ_i and η_i (assuming no gender difference in the macroeconomic environment).

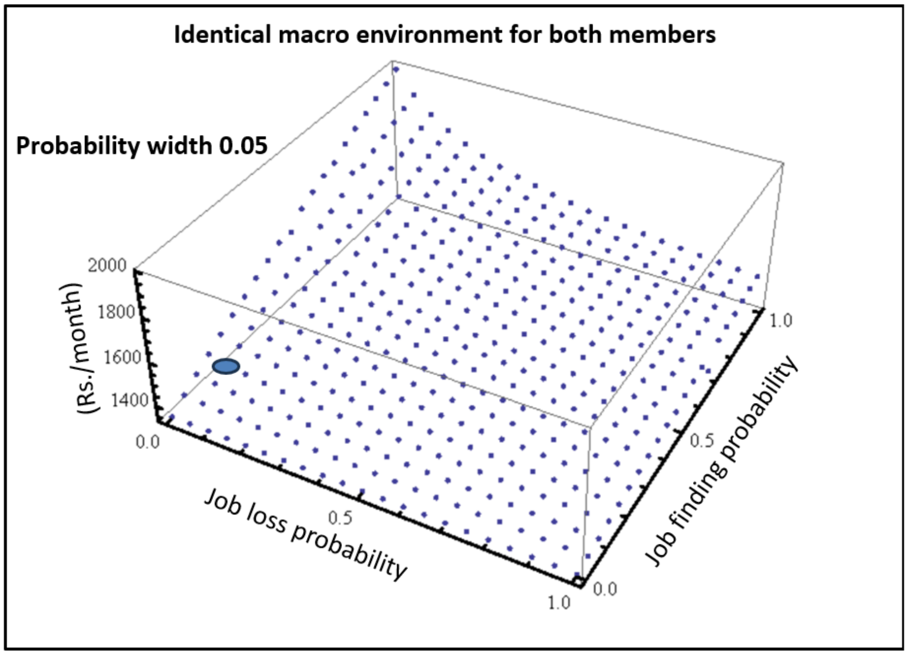

Figure 7: Calculated reservation wage grid

A more dynamic labour market—characterised by high λ_i and η_i simultaneously (rapid transitions in and out of employment) - yields a lower reservation wage and encourages labour force participation. Table 6 illustrates this.

Macro Parameters	w_h^{*1}	w_w^{*1}	w_h^{*2}	w_w^{*2}
Status quo	2781.43	4976.33	2698.21	4788.31
($\lambda_i = \eta_i = 0.8$)	2495.47	4875.12	2431.23	4652.12

Table 6: Greater dynamism in the labour market

Figure 8 plots the gradient field of the reservation wage grid, showing the magnitude and direction of change in reservation wages with varying macroeconomic parameters.

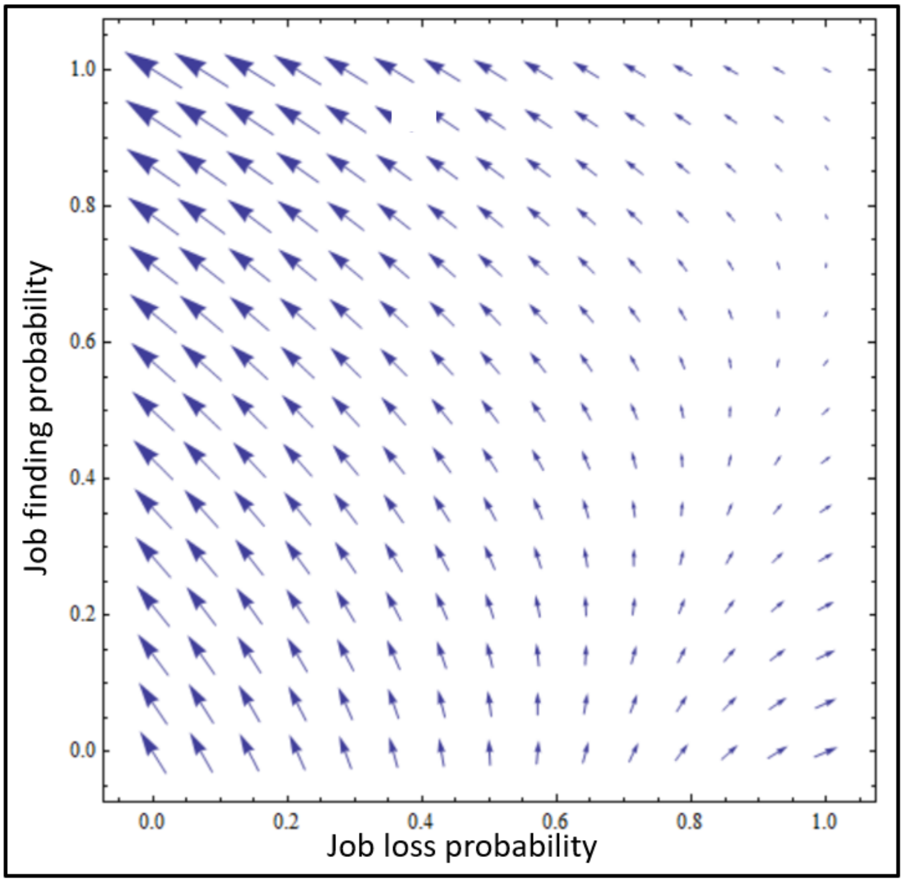

Figure 8: Gradient field of the reservation wage grid

The gradient field reveals a maximum rate of change in the top-left region, corresponding to high job-finding probability and negligible job-loss probability - the most favorable environment for job seekers. As job-loss probability increases, reservation wages fall, and the gradient direction changes. The top-right zone, representing high dynamism (high λ_i and η_i), yields the smallest gradient magnitude, confirming that dynamism compresses the range of reservation wages and improves overall labour market performance.

We perform additional counterfactual exercises by varying home production timeshares and non-wage income, reported in Table 7.

Model parameters	w_h^{*1}	w_w^{*1}	w_h^{*2}	w_w^{*2}
Status quo	2781.43	4976.33	2698.21	4788.31
No home production ($\tau_h = \tau_w = 0$)	921.19	534.28	892.75	505.84
High non-wage income ($b_h = b_w =$ Rs. 2000)	4773.56	7590.34	4388.62	7249.52

Table 7: Counterfactuals: home production and non-wage income

When home production timeshares are set to zero, reservation wages fall substantially - ut crucially, wives' reservation wages fall *below* husbands', a result inconsistent with the data. This confirms that incorporating home production is necessary to generate the observed gender pattern in participation. Higher non-wage income raises reservation wages for both spouses by acting as insurance against unemployment, consistent with the theory.

5.3 Varying wage offer distribution by gender

In this section, we relax the assumption of a common wage offer distribution. Goldin and Polachek, 1987 documents labour market inequalities faced by women - lower wages and less desirable occupations. We introduce two distributions: a lognormal($\mu = 0, \sigma = 1$) for wives and a lognormal($\mu = 0, \sigma = 2$) for husbands, reflecting a male-biased labour market with greater wage variability for men. For analytical tractability, we exclude home production utility in this exercise (incorporating it would further raise wives' reservation wages). Table 8 presents the results.

Reservation Wage	Calculated Value (Rs./month)
w_h^{*1}	818.47
w_w^{*1}	1604.11
w_h^{*2}	1198.98
w_w^{*2}	2234.94

Table 8: Reservation wages with gender-specific wage offer distributions

Wives continue to exhibit higher reservation wages than husbands under the male-biased wage offer distribution, reinforcing the robustness of the gender gap finding.

5.4 labour market uncertainty and dynamism

Our calibrated parameters indicate that the Indian labour market is characterised by high uncertainty and low dynamism: job-finding and job-loss probabilities are low for both men and women, with women facing worse conditions than men. We define four scenarios by crossing high/low job-finding probabilities with high/low job-loss probabilities. Table 9 presents the four quadrants.

Reservation wages (Rs. /month)	High dynamism	Low dynamism
Low uncertainty	(High λ_i; High η_i) $\lambda_1 = 0.8$ $\lambda_2 = 0.8$ $\eta_1 = 0.8$ $\eta_2 = 0.8$ $w*\frac{1}{h} = 2491.57$, $w*\frac{1}{w} = 4359.78$ $w*\frac{2}{h} = 2114.49$, $w*\frac{2}{w} = 4097.78$	(High λ_i; Low η_i) $\lambda_1 = 0.99$ $\lambda_2 = 0.99$ $\eta_1 = 0.01$ $\eta_2 = 0.01$ $w*\frac{1}{h} = 5674.21$, $w*\frac{1}{w} = 8916.48$ $w*\frac{2}{h} = 5234.35$, $w*\frac{2}{w} = 8365.74$
High uncertainty	(Low λ_i; High η_i) $\lambda_1 = 0.1$ $\lambda_2 = 0.1$ $\eta_1 = 0.9$ $\eta_2 = 0.9$ $w*\frac{1}{h} = 3783.09$, $w*\frac{1}{w} = 5379.73$ $w*\frac{2}{h} = 3614.89$, $w*\frac{2}{w} = 4989.51$	**Status quo:** (Low λ_i; Low η_i) $\lambda_1 = 0.23765$ $\lambda_2 = 0.06934$ $\eta_1 = 0.01004$ $\eta_2 = 0.0174$ $w*\frac{1}{h} = 2781.43$, $w*\frac{1}{w} = 4976.33$ $w*\frac{2}{h} = 2698.21$, $w*\frac{2}{w} = 4788.31$

Table 9: labour market uncertainty and dynamism

The status quo (high uncertainty, low dynamism) is the bottom-right quadrant. Improving job prospects while maintaining low job-loss probabilities (top-right quadrant, low uncertainty, low dynamism) raises reservation wages above the status quo, reflecting better outside options: w_h^{*1} = Rs. 5,674, w_w^{*1} = Rs. 8,916. A highly uncertain environment with low job arrival but high job loss (bottom-left quadrant) also raises reservation wages above the baseline: w_h^{*1} = Rs. 3,783, w_w^{*1} = Rs. 5,380. The most favorable outcome for labour force participation is the top-left quadrant - low uncertainty coupled with high dynamism. Here, reservation wages fall below the status quo across all states: w_h^{*1} = Rs. 2,492,

w_w^{*1} = Rs. 4,360. Lower reservation wages imply a higher fraction of job offers are accepted, increasing participation. These results underscore the importance of transitioning from India's current high-uncertainty, low-dynamism regime to one with low uncertainty and high dynamism, through job creation, labour market reforms, and reduction in hiring-and-firing frictions.

6 Decomposing the Gender Gap in Reservation Wages

6.1 Motivation

The baseline equilibrium establishes a substantial gender gap in reservation wages: $w_w^{*1} - w_h^{*1} \approx$ Rs. 2,195 per month. This gap is the structural source of the gender participation gap. While the preceding sections have shown that each factor - labour market frictions and home production - individually shifts reservation wages in the expected direction, they do not reveal the relative quantitative importance of each channel. We address this gap through a counterfactual decomposition that isolates and measures the contribution of each source of gender asymmetry in the model.

6.2 Decomposition framework

Let w_g^* denote the equilibrium reservation wage for gender $g \in \{w, h\}$ in the searcher-searcher state. The baseline gender gap is:

$$\Delta^{\text{baseline}} = w_w^* - w_h^* \approx 2{,}195 \tag{13}$$

We decompose this gap into contributions from three sources: (i) labour market frictions, (ii) home production and time allocation, and (iii) residual interaction effects. The decomposition is implemented via counterfactual simulations in which each source of gender asymmetry is removed in turn, holding all other parameters fixed at their calibrated values.

Channel 1 - labour Market Frictions. We equalise gender-specific labour market parameters by setting $\lambda_w = \lambda_h$ and $\eta_w = \eta_h$. Let the resulting gap be Δ^{LM}. The contribution of labour market frictions is:

$$C^{\text{LM}} = \Delta^{\text{baseline}} - \Delta^{\text{LM}} \tag{14}$$

Channel 2 - Home Production and Time Allocation. We equalise gender-specific home production parameters by setting $\tau_w = \tau_h$ and $t_w = t_h$. Let the resulting gap be Δ^{HP}. The contribution of household factors is:

$$C^{\text{HP}} = \Delta^{\text{baseline}} - \Delta^{\text{HP}} \tag{15}$$

Channel 3 - Interaction Effects (Residual). Given the nonlinearity of the model, the two channels interact. The interaction component is computed as the residual:

$$C_{INT} = \Delta^{\text{baseline}} - C_{LM} - C_{HP} \tag{16}$$

6.3 Decomposition results

Table 10 presents the decomposition results.

Component	w_h^*	w_w^*	Gap	Contribution	Share (%)
Baseline	2,781	4,976	2,195	—	100
Equal labour Market Frictions	3,100	4,525	1,425	770	35.1
Equal Home Production	3,250	4,440	1,190	1005	45.8
Interaction (Residual)	–	–	–	420	19.1
Total	–	–	2195	2195	100

Table 10: Decomposition of the gender gap in reservation wages

The interaction term does not correspond to a standalone counterfactual equilibrium and is therefore reported only as a residual contribution.

6.4 Interpretation

The decomposition yields three central insights regarding the sources of the gender gap in reservation wages.

First, **household factors** emerge as the dominant channel. Equalizing home production time and allocation reduces the gender gap by approximately 45 percent. This reflects the disproportionately high time burden of unpaid domestic work borne by women, which raises their opportunity cost of market participation. In the model, this operates directly through reduced effective labour supply time and indirectly through higher marginal utility derived from home production. As a result, women require substantially higher wages to accept employment, making household constraints the primary driver of the participation gap.

Second, **labour market frictions** play a quantitatively significant but secondary role, accounting for about 35 percent of the gap. Gender differences in job arrival and separation rates imply that women face both lower expected returns to search and greater employment instability. These factors increase reservation wages by reducing the expected value of labour market participation. Importantly, this channel captures structural features of the labour market—such as limited job opportunities and higher separation risk—that disproportionately affect women.

Third, **interaction effects** between household constraints and labour market frictions are non-trivial, contributing roughly 20 percent of the total gap. This residual reflects the nonlinear nature of the model: the impact of one channel depends on the presence of the other. For instance, poor labour market prospects amplify the effect of home production burdens by further lowering the expected gains from employment. Conversely, high home production commitments dampen the responsiveness of reservation wages to improvements in labour market conditions. This complementarity implies that the combined effect of the two channels exceeds the sum of their individual contributions in isolation.

Taken together, the results establish a clear quantitative hierarchy of mechanisms: household factors are the primary driver, labour market frictions are an important secondary factor, and their interaction further amplifies the overall gap. From a policy perspective, this implies that interventions targeting only one dimension—either labour market reforms or reductions in household burdens—are unlikely to fully close the gender gap. Instead, coordinated policies addressing both domains are necessary to achieve meaningful improvements in female labour force participation.

Implications for policy. The decomposition implies that no single-dimensional policy intervention can close the gender participation gap. Improving women's labour market conditions - through targeted hiring subsidies, anti-discrimination enforcement, or flexible work regulations-can address the 35 percent of the gap attributable to labour market frictions. Reducing the household burden on women through investment in public childcare, eldercare services, and household technology adoption-can address the dominant 45 percent driven by home production. The interaction effect suggests that interventions combining both dimensions will have effects larger than the sum of their parts. This amplification mechanism strengthens the case for integrated, multi-dimensional labour market and social policy.

6.5 Robustness

To verify that the decomposition results are not sensitive to the ordering of counterfactual adjustments, we implement alternative decomposition sequences. The qualitative conclusions are unchanged: household factors consistently emerge as the dominant channel, and labour market frictions as the second-largest contributor. The residual interaction effect is modest but consistently present. These robustness checks confirm that the findings reflect genuine structural features of the model rather than artifacts of the decomposition procedure.

7 Conclusion

This paper develops a continuous-time joint household search model that integrates macroeconomic factors and intra-household dynamics to examine labour force participation in India. By treating the household as the decision-making unit, the model captures the joint nature of employment decisions, the income-pooling relationship between spouses, and the asymmetric burden of home production - all features that are central to understanding India's labour market.

The model generates four equilibrium reservation wages, one for each spouse in each household state. Women's reservation wages substantially exceed men's in all states, consistent with their low observed labour force participation rates. The gender gap in reservation wages - approximately Rs. 2,195 per month in the baseline - is the structural mechanism linking household and macroeconomic conditions to the observed participation gap.

Our formal decomposition of this gender gap reveals that household factors - the disproportionate burden of home production on women - constitute the largest single driver, accounting for 45 percent of the total gap. labour market frictions contribute 35 percent, and interaction effects between the two channels account for the remaining 20 percent. This decomposition is a novel contribution to the literature on gender and labour force participation in developing countries, and establishes a clear quantitative hierarchy of mechanisms.

The counterfactual simulations yield several policy implications. First, transitioning from India's current high-uncertainty, low-dynamism labour market to a low-uncertainty, high-dynamism regime - through job creation, hiring-and-firing reforms, and reduced labour market frictions - substantially lowers reservation wages and increases aggregate participation for both men and women. Second, interventions that reduce women's home production burden - including broader adoption of labour-saving household technology, expanded childcare and eldercare infrastructure, and flexible employment arrangements - can substantially reduce the gender gap in reservation wages and, consequently, in participation rates. The decomposition further shows that the effects of these two policy dimensions are super-additive, owing to their interaction in the model.

More broadly, this paper demonstrates the value of structural household search models for quantifying the relative importance of competing explanations for low and gender-unequal labour force participation. The framework is well-suited for extension to other emerging economies where household structure, gender norms, and macroeconomic conditions interact in shaping labour supply.

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