

# First International Workshop on Labor Market Studies



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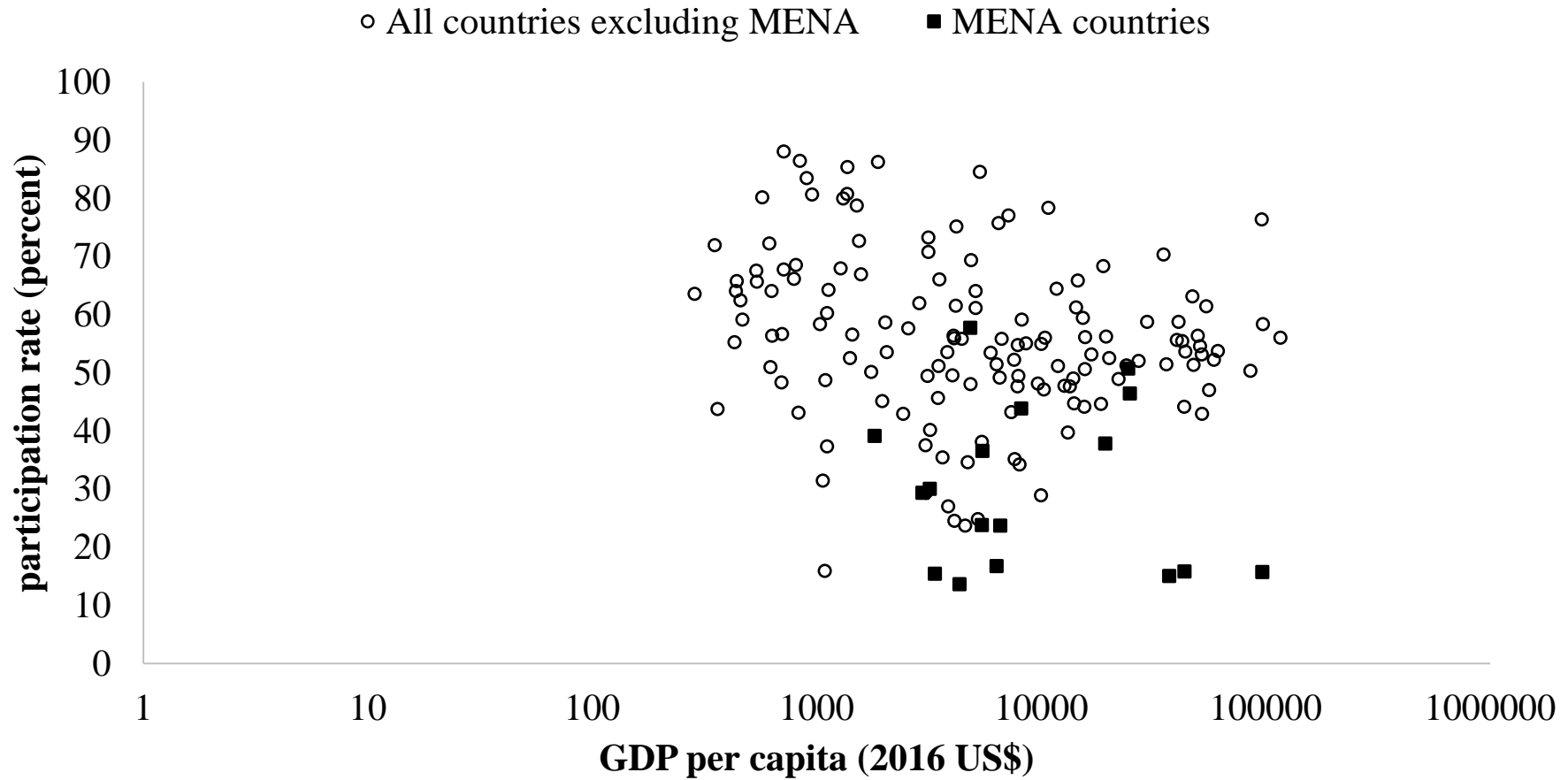


# Female Labor Participation in Iran: A Structural Model Estimation

Mohammad H. Rahmati

Shadi Farahzadi

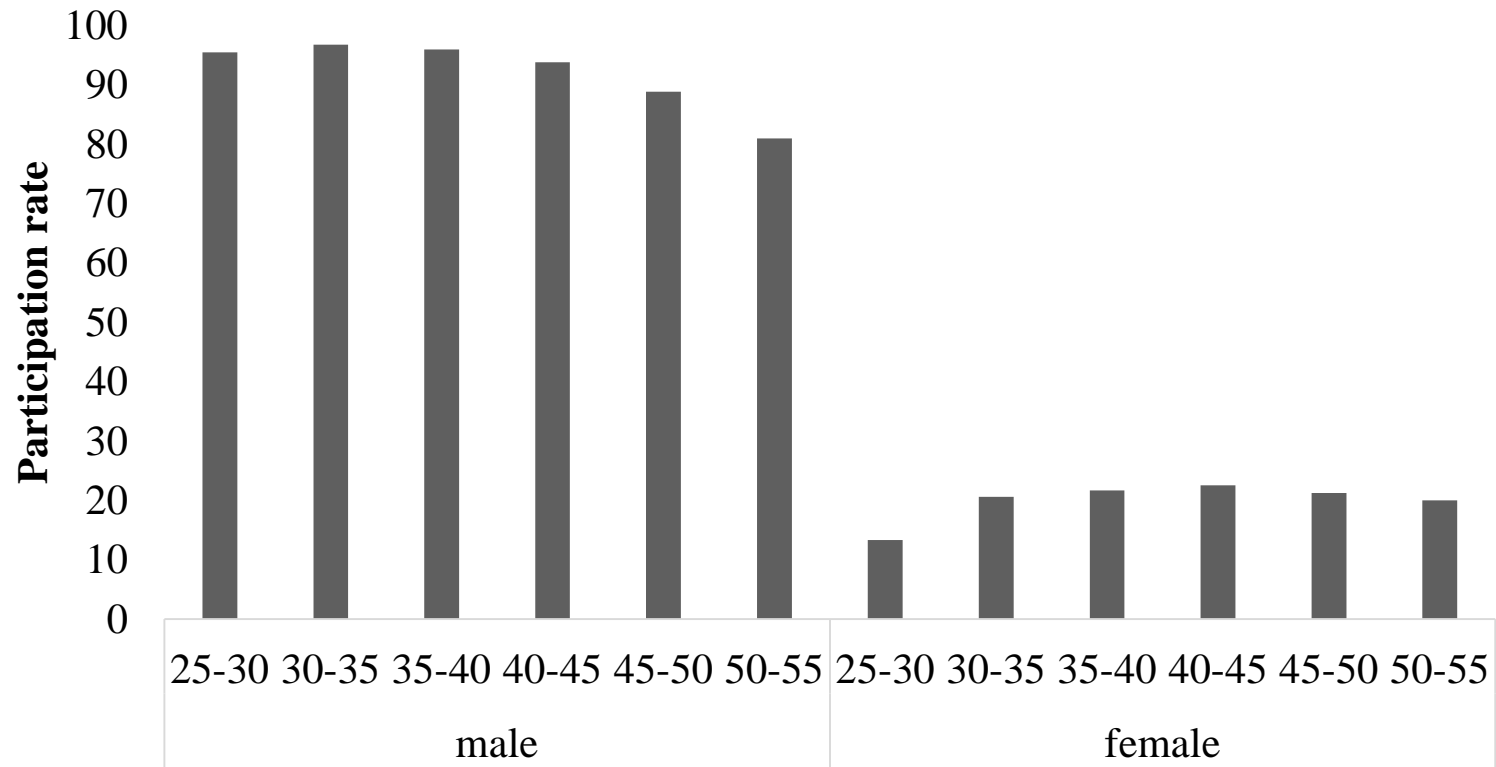
# Why do we care?



# Is there a variation by age?



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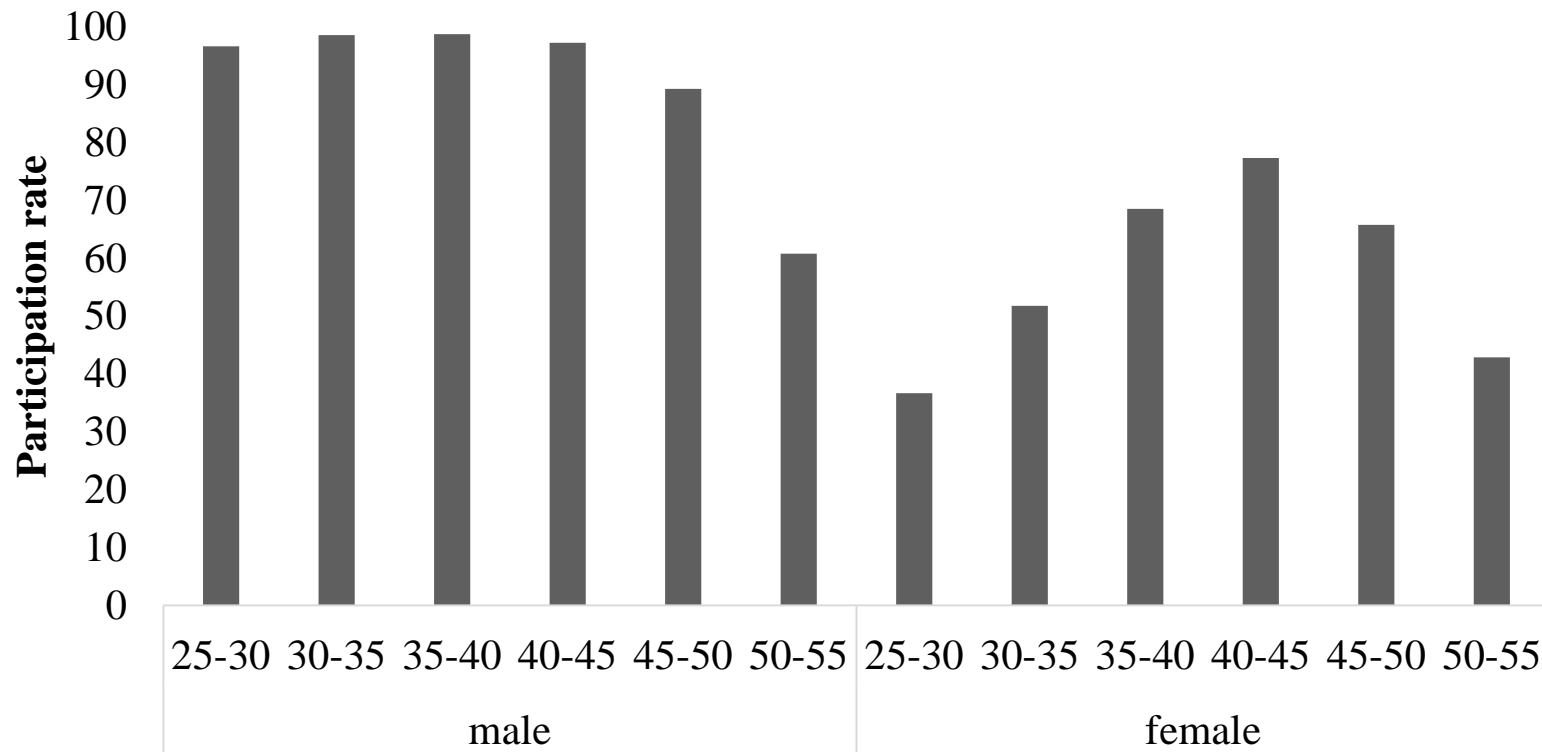
Participation rate of people with **no child** by age (married; aged 25-55)



# Is there a variation by age/education?



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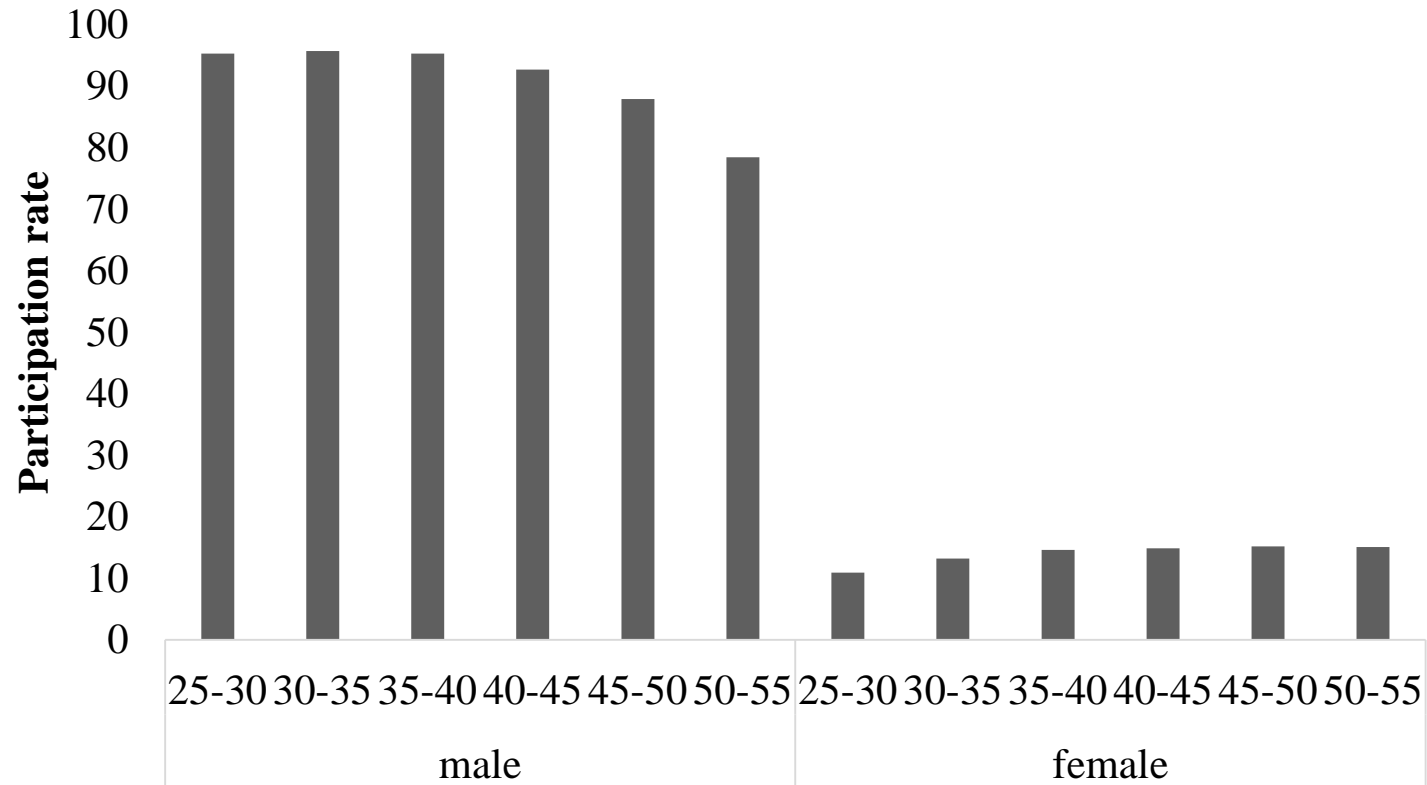
Participation rate of **high-educated** (university degree) people by age (married; aged 25-55)



# Is there a variation by age/education?



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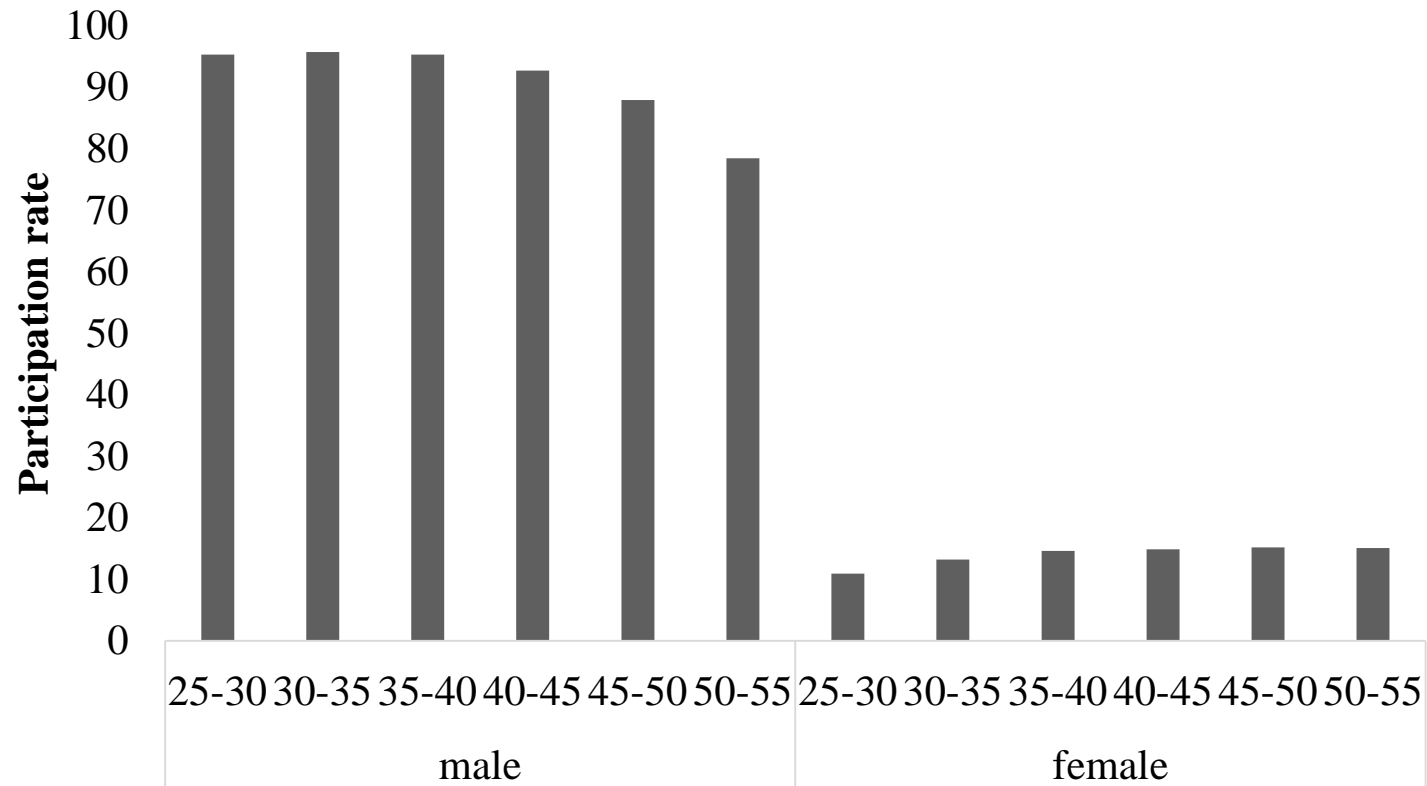
Participation rate of **low-educated** people by age (married; aged 25-55)



# Is there a variation by age/education?



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Participation rate of **low-educated** people by age (married; aged 25-55)



# What we do?



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- We need a structural model to conduct a counterfactual
  - Stablished method for the same question
  - Eckstein& Lifshitz "Dynamic female labor supply." *Econometrica*, (2011)
  - ----- "HH interaction and the labor supply of married women", IER, (2015)
- We have rich individual level dataset with enough variation in moments
  - Simulated method of moments (Why: income from separate sources)
  - Discrete modeling (convenient numerical estimation)
  - Two tier estimation of deep parameters (consistent Hotz-Miller 1993)
- Our contribution:
  - First estimate of (search and match )structural model in a developing country.
  - Add discrimination to the literature in this framework



## Model (set up)



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- HH: man, women, children (two age group: 0-5, 6-24)
- Age group: 25-55
- Family decide on participation (of man & women) ([estimates](#))

$$U_t(c_t, l_t^m, l_t^f, S^m, S^f, N_t^y, N_t^o) = c_t + \sum_{i=m,f} (\alpha_1^i + \alpha_2^i S^i) l_t^i + \sum_{j=y,o} f(N_t^j)$$

- Utility from child:

$$f(N_t^j) = \gamma_0 N_t^j + \gamma_1 N_t^{j^2}$$

- Budget constrain:

$$\sum_{i=m,f} y_t^i(S^i, A_t^i, N_t^y, N_t^o, \varepsilon_t^i) l_t^i = c_t + \sum_{j=y,o} (b_1^j + b_2^j l_t^f) N_t^j$$



# Model (dynamic)



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- HH optimization:

$$\max_{p_t^m=\{0,1\}, p_t^f=\{0,1\}} E_t \left[ \sum_{k=0}^T \beta^k U(l_t^m, l_t^f, y_t^m, y_t^f, S^m, S^f, N_t^y, N_t^o) \right]$$

- Dynamic programming:

$$V_t(l_{t-1}^m, l_{t-1}^f, \varepsilon_t^m, \varepsilon_t^f, \Omega_t) = \max \left\{ \begin{array}{l} V_t^{1,1}(l_{t-1}^m, l_{t-1}^f, \varepsilon_t^m, \varepsilon_t^f, \Omega_t), V_t^{1,0}(l_{t-1}^m, l_{t-1}^f, \varepsilon_t^m, \Omega_t) \\ , V_t^{0,1}(l_{t-1}^m, l_{t-1}^f, \varepsilon_t^f, \Omega_t), V_t^{0,0}(l_{t-1}^m, l_{t-1}^f, \Omega_t) \end{array} \right\}$$

- Where:  $\Omega_t = \{S^m, S^f, A_t^m, A_t^f, N_t^y, N_t^o\}$

- Timing:

- Exog. State: # child,  $\varepsilon_t^m, \varepsilon_t^f$
- Participation decision
- Employment status



## Model (dynamic) (II)



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- If both participate:

$$\begin{aligned}
 & V_t^{1,1}(l_{t-1}^m, l_{t-1}^f, \varepsilon_t^m, \varepsilon_t^f, \Omega_t) \\
 &= (\lambda^m(1 - l_{t-1}^m) + (1 - \delta_i^m)l_{t-1}^m)(\lambda^f(1 - l_{t-1}^f) + (1 - \delta_i^f)l_{t-1}^f)(U_t(1,1, \Omega_t) \\
 &+ \beta E_t[V_{t+1}(1,1, \Omega_{t+1})]) \\
 &+ (\lambda^m(1 - l_{t-1}^m) + (1 - \delta_i^m)l_{t-1}^m)((1 - \lambda^f)(1 - l_{t-1}^f) + \delta_i^f l_{t-1}^f)(U_t(1,0, \Omega_t) \\
 &+ \beta E_t[V_{t+1}(1,0, \Omega_{t+1})]) \\
 &+ ((1 - \lambda^m)(1 - l_{t-1}^m) + \delta_i^m l_{t-1}^m)(\lambda^f(1 - l_{t-1}^f) + (1 - \delta_i^f)l_{t-1}^f)(U_t(0,1, \Omega_t) \\
 &+ \beta E_t[V_{t+1}(0,1, \Omega_{t+1})]) \\
 &+ ((1 - \lambda^m)(1 - l_{t-1}^m) + \delta_i^m l_{t-1}^m)((1 - \lambda^f)(1 - l_{t-1}^f) + \delta_i^f l_{t-1}^f)(U_t(0,0, \Omega_t) \\
 &+ \beta E_t[V_{t+1}(0,0, \Omega_{t+1})]) - s_i^m(1 - l_t^m) - s_i^f(1 - l_t^f), \quad i = l, h
 \end{aligned}$$

# Data (I)



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- Two individual level survey dataset:
  - Labor Force Survey (LFS) (2005-15, quarterly , 50k HH in each survey)
  - Household Income and Expenditure Survey (HIES)

		No. Observations (million)		Participation Rate (%)		Unemployment Rate (%)	
		male	female	male	female	male	female
all data		3.06	3.07	52.2	12.4	9.5	15.8
aged 25-55		1.21	1.29	89.2	20.2	7.5	12.5
married		1.44	1.48	80.3	15.6	4.7	7.2
aged 25-55 and married		1.01	1.05	91.5	17.6	4.9	6.1
our sample	All	0.14	0.14	91.9	18.3	4.3	5.6
	Urban	0.06	0.06	93.1	22.8	4.3	2.3
	Rural	0.08	0.08	91.1	15.2	4.3	8.9



## Data (II)



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- Nice variation across stats variables:

age	Male	Female
25-30	95.4	13.4
30-35	96.0	17.1
35-40	95.7	18.8
40-45	93.2	18.8
45-50	88.0	17.6
50-55	76.5	16.1

education	male	female
elementary	91.0	12.6
high Sch.	90.5	10.2
Bachelor	91.7	58.1
Master	94.9	76.4
Doctoral	99.6	91.3

family income	Male	Female
Q1	89.9	10.8
Q2	98.9	17.5
Q3	100.0	55.2
Q4	100.0	42.3
Q5	100.0	25.0

no. child	male	female
0	84.1	18.2
1	89.4	17.3
2	91.5	17.2
3	90.9	16.4
4+	89.9	18.3



## Data (III)



- Male/female “differences”, “discrimination”
- Job destruction:

	Male	Female
College degree (high educ)	5.5%	11.4%
Low education	7.72%	46.2%

- Job finding rates: (after one year)

	Male	Female
Job finding rates	66.1%	11.2%



- First Stage: Reduced Form Parameters
  - income functions ( $y^m$  and  $y^f$ ) and its transition function ( $\varepsilon^m, \varepsilon^f$ )
  - probability functions of finding jobs ( $\lambda^m$  and  $\lambda^f$ )
  - job destruction rate ( $\delta_h^m, \delta_l^m, \delta_h^f$  and  $\delta_l^f$ )
  - probability of change in numbers of children in each age
- Structural Parameters
  - Simulated Method of Moments:  $(m_S - m_D) \cdot \mathbf{w} (m_S - m_D)$
  - 20 moments
  - 14 parameters (6 utility parameters, 4 budget constrain parameters, and 4 search costs)

# Results



- Structural parameters:

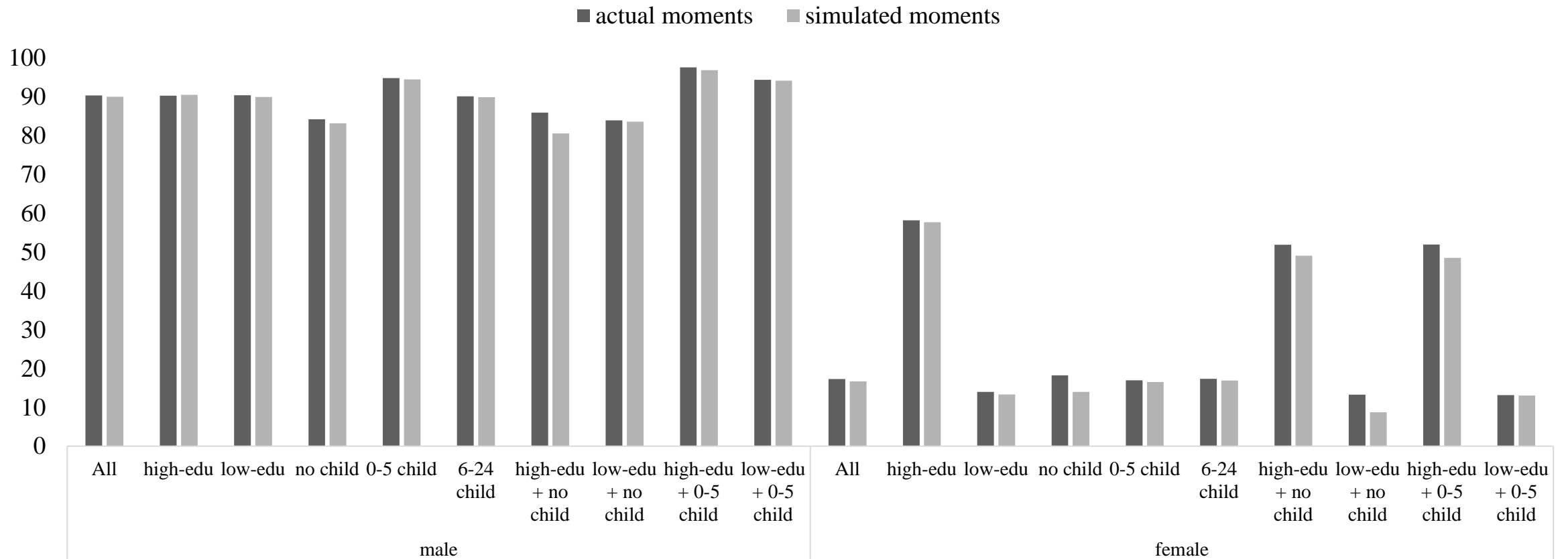
<u>Utility</u>				<u>Budget Constraint</u>		Search	
parameter	value	parameter	value	parameter	value	parameter	value
$\alpha_1^m$	-0.01 (0.00000003)	$\gamma_0$	3.18 (0.0010)	$b_1^1$	2.58 (0.0014)	$s_h^m$	3.01 (0.0037)
$\alpha_2^m$	-0.48 (0.000079)	$\gamma_1$	-1.94 (0.00023)	$b_2^1$	2.29 (0.0017)	$s_l^m$	2.19 (0.00027)
$\alpha_1^f$	-1.01 (0.00048)			$b_1^2$	1.74 (0.00021)	$s_h^f$	3.29 (0.0068)
$\alpha_2^f$	3.02 (0.00030)			$b_2^2$	1.48 (0.00023)	$s_l^f$	1.55 (0.00045)

# Results -goodness of fit



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## Fitness of model to estimated moments:

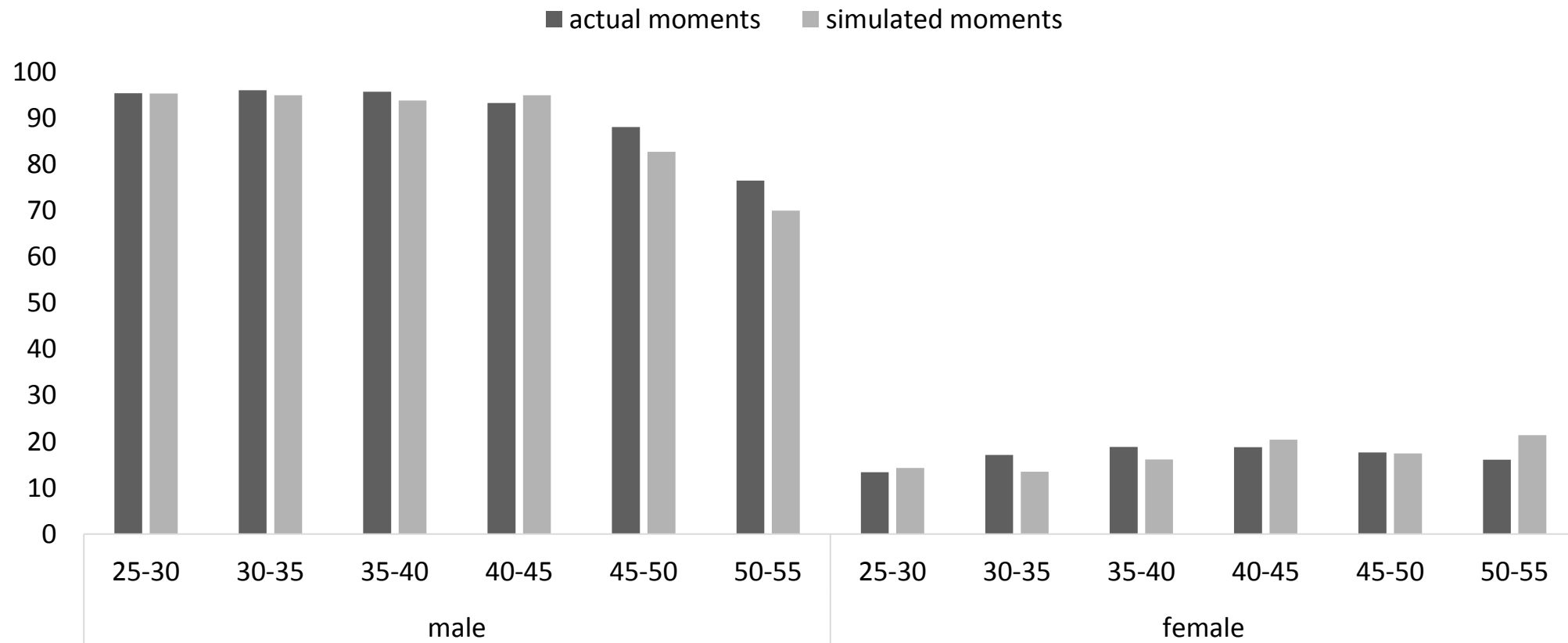


# Results -validation (I)



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## Fitness of model to moments not used for estimation:

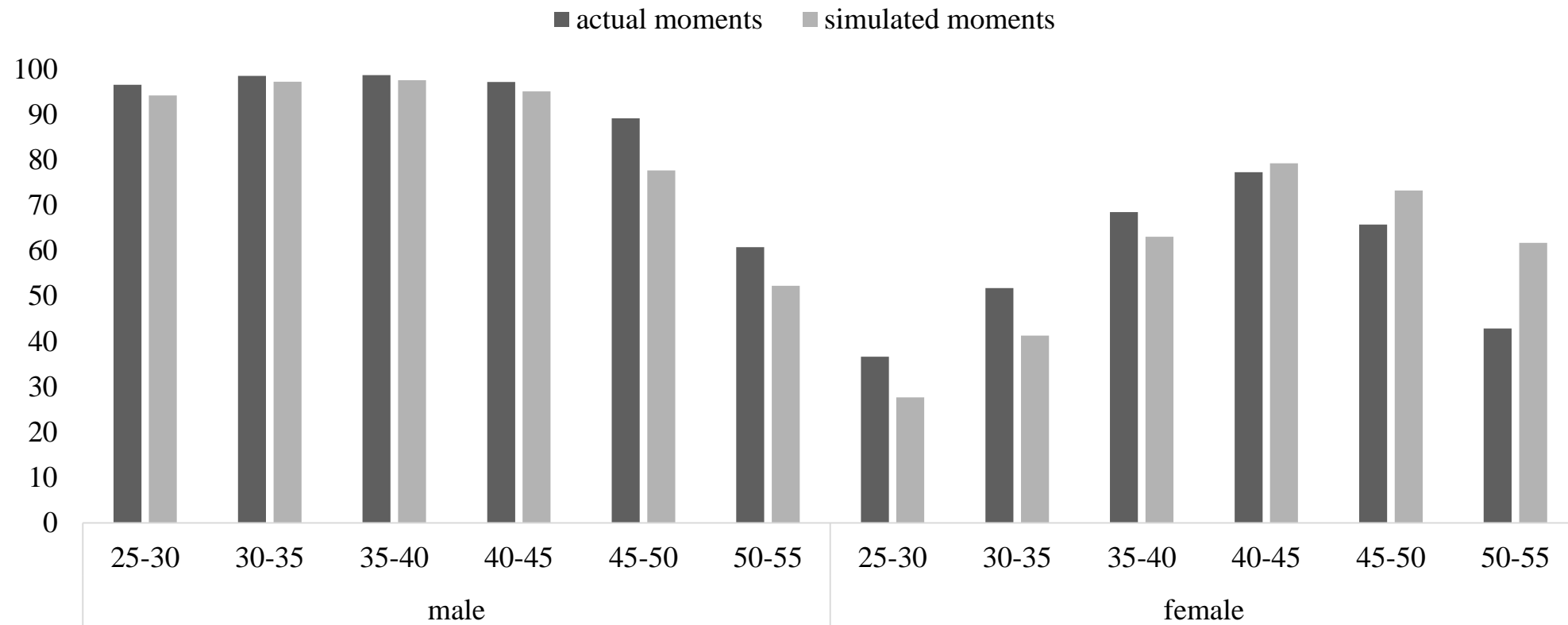


# Results -validation (II)



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## Fitness of model to moments not used for estimation:

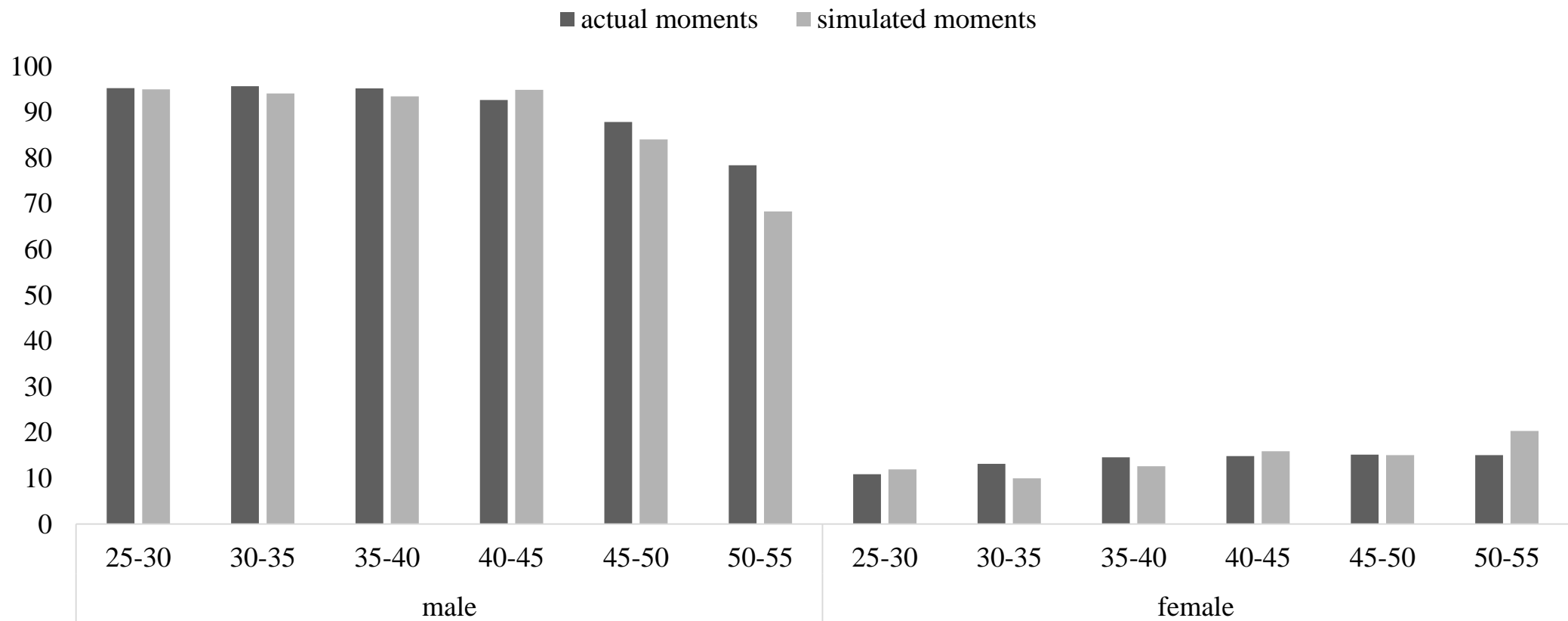


# Results -validation (III)



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## Fitness of model to moments not used for estimation:

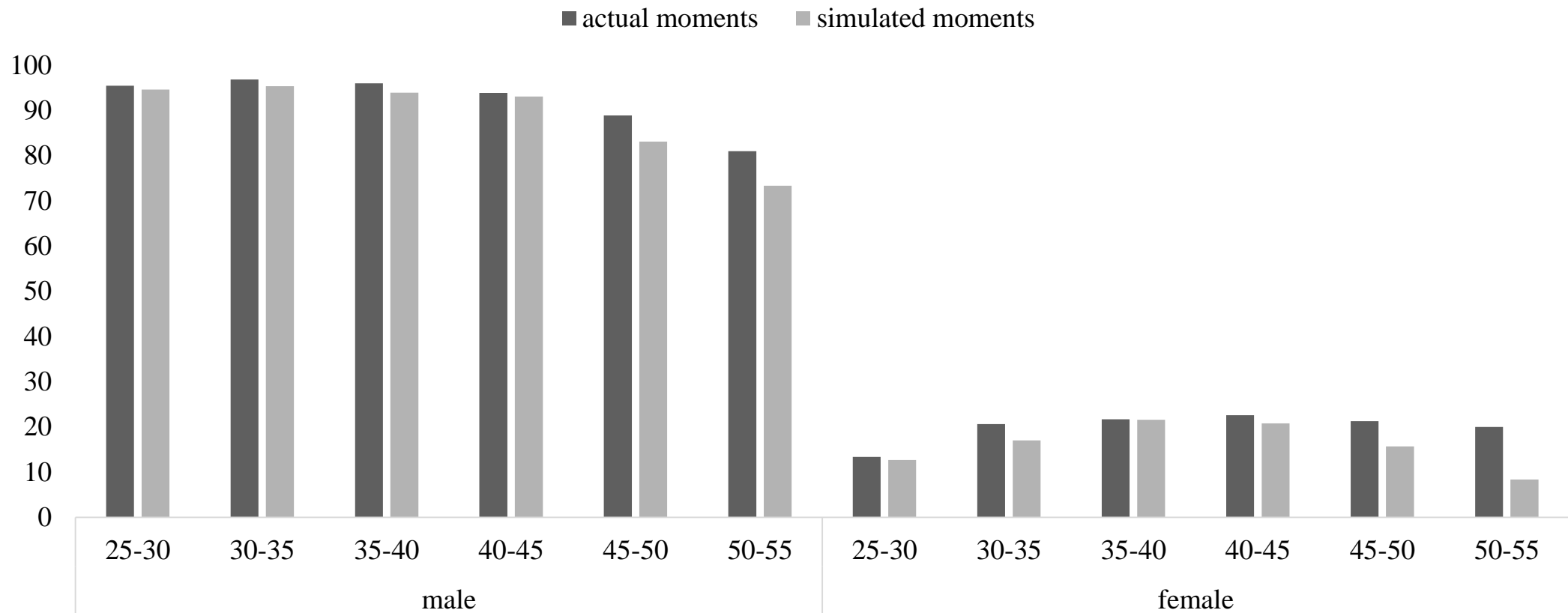


# Results -validation (IV)



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## Fitness of model to moments not used for estimation:



# Counterfactual



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What if we equalize parameters of women to men:

	all	high- education	low- education	no child	only 0-5 aged children
Data	17.28	58.11	13.92	18.21	16.93
Model	16.65	57.61	13.28	13.95	16.46
<b>Job security</b>	18.49	73.51	13.95	13.84	20.07
<b>Job finding</b>	<b>20.91</b>	<b>99.62</b>	14.42	20.24	21.61
<b>Wage discrimination</b>	18.24	<b>57.39</b>	15.01	14.70	16.96
<b>High educated search cost</b>	17.77	58.84	14.38	14.60	16.14
<b>Low educated search cost</b>	17.52	57.24	14.24	14.23	16.13
<b>Education</b>	16.45	15.12	14.22	57.63	17.53
<b>No Labor Market Differences</b>	28.75	19.05	19.32	99.75	25.45

Urban, rural



# Conclusion



- Risk of finding job has biggest effect on lowering participation rate of married woman
- Next, job destruction and wage discrimination
- If all differences disappears, female participation rate increase by 12 percent point to almost 30 percent
- Other factors outside our model have more effect on labor force participation of married woman

# Estimation-income



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$$y^m = 16.25 + .585 S^m + .0626 A^m - .000665 (A^m)^2$$

(.144) (.0120) (.00756) (.0000940)

$$- .0437 N^y - .0206 N^o + \varepsilon^m$$

(.00837) (.00767)

$n = 21307, R^2 = .092$

$$y^f = 13.17 + 1.378 S^f + .148 A^f - .00145 (A^f)^2$$

(.811) (.0495) (.0435) (.000557)

$$+ .0431 N^y - .0682 N^o + \varepsilon^f$$

(.0464) (.0401)

$n = 1433, R^2 = .390$

estimates



# Estimation-income transition



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$$\varepsilon_t^m = - .0328 + .522 \varepsilon_{t-1}^m + \zeta_t^m$$

(.00542)    (.0128)  
 $n = 10600, R^2 = .289$

$$\varepsilon_t^f = .0230 + .664 \varepsilon_{t-1}^f + \zeta_t^f$$

(.0228)    (.0324)  
 $n = 666, R^2 = .518$

$$\varepsilon^m = \begin{bmatrix} -0.524 \\ 0.524 \end{bmatrix}, \quad T^m = \begin{bmatrix} 0.68 & 0.32 \\ 0.32 & 0.68 \end{bmatrix}$$

$$\varepsilon^f = \begin{bmatrix} -0.639 \\ 0.639 \end{bmatrix}, \quad T^f = \begin{bmatrix} 0.749 & 0.251 \\ 0.251 & 0.749 \end{bmatrix}$$

[estimates](#)



# Estimation- job finding



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$$\lambda^m = 1 / (1 + \exp(- ( 1.965 - .442 S^m - .0381 A^m + .0969 N^y + .145 N^o ) ) )$$

(.197)    (.124)            (.00503)            (.0510)            (.0430)

$$\lambda^f = 1 / (1 + \exp(- ( -2.243 + .00933 S^f + .00590 A^f - .0691 N^y + .113 N^o ) ) )$$

(.541)    (.185)            (.0169)            (.143)            (.136)

[estimates](#)



# Estimation-child transition



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VARIABLES	$p^0$	$p^1$	$p^2$
$A^m$	-0.0609*** (0.00376)	0.0164*** (0.00255)	0.0212*** (0.00252)
$A^f$	-0.113*** (0.00408)	-0.000926 (0.00268)	0.00170 (0.00265)
$S^m$	0.0934** (0.0458)	-0.00275 (0.0364)	-9.31e-05 (0.0360)
$S^f$	0.0680 (0.0515)	-0.253*** (0.0445)	-0.265*** (0.0441)
$L^m$	0.0133 (0.0488)	0.121*** (0.0355)	0.119*** (0.0350)
$L^f$	0.0781** (0.0384)	0.253*** (0.0279)	0.258*** (0.0276)
$N^y$	-0.742*** (0.0250)	2.103*** (0.0177)	2.178*** (0.0178)
$N^o$	-0.227*** (0.0217)	-0.0633*** (0.0153)	-0.0674*** (0.0151)
Constant	3.538*** (0.115)	-4.637*** (0.0905)	-4.918*** (0.0899)
Observations	141,304	141,304	141,304

estimates



# Counterfactual-Urban, Rural



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What if we equalize parameters of women to men:

	participation rate of female (married; aged 25-55)									
	all		higher education		lower education		no child		only 0-5 aged children	
	urban	rural	urban	rural	urban	rural	urban	rural	urban	rural
Data	14.08	21.99	57.96	49.67	8.17	21.58	15.80	16.65	13.68	18.70
Model	15.73	23.09	62.40	64.89	9.45	22.47	14.74	16.58	13.06	21.12
Job security	16.72	22.34	82.66	80.57	7.85	21.48	23.05	19.24	16.48	19.54
Job finding	15.20	22.71	58.32	48.38	9.40	22.33	16.27	20.35	13.93	19.54
Wage discrimination	13.80	21.99	56.59	45.01	8.05	21.65	15.27	18.27	13.44	19.26
High educated search cost	14.03	22.02	57.55	48.89	8.17	21.62	15.39	18.04	13.55	19.29
Low educated search cost	14.31	22.09	58.03	49.64	8.43	21.69	15.70	18.79	13.46	19.41
Education	21.49	60.52	85.59	78.16	12.87	60.26	23.72	16.98	17.85	56.38
No Discrimination	14.08	21.99	57.96	49.67	8.17	21.58	15.80	16.65	13.68	18.70



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*Institute for Management  
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