Explaining the declining labor supply responsiveness of married women

Jia, Zhiyang; Thoresen, Thor O.; Vattø, Trine E.

Explaining the declining labor supply responsiveness of married women

Zhiyang Jia, Thor O. Thoresen, Trine E. Vattø

Statistics Norway

Inst. of Pub. Finance, 9 October 2024

Background

- Consensus: the labor supply response of married females are more responsive than that of married males
- But some studies find that the labor supply responses of married females are approaching those of married males
  - Blau and Kahn (2007); Heim (2007)
- Explanations to the response decline for married females
  - More career orientation (Blau and Kahn, 2007; Goldin, 2006, 2014)
  - Heim (2007): small effect of changing demographic characteristics – point to preference shifts
- But no studies have systematically discussed causes behind the decline
- Information on responses important for policy-making

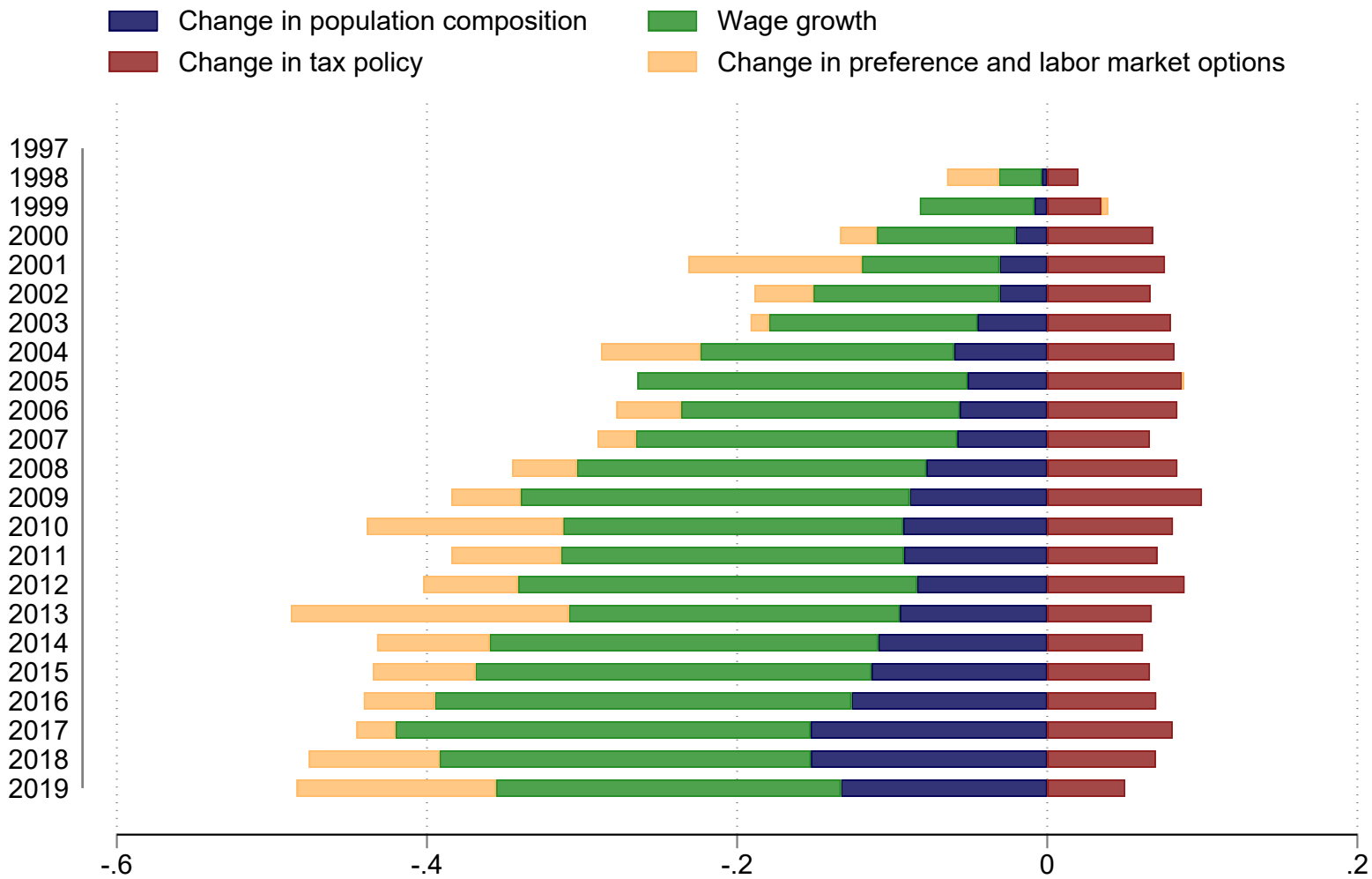
Contribution of the paper

- Do we see declining female responsiveness in Norway too?
  - Repeated estimations of structural discrete choice model 1997–2019 used to obtain (simulated) wage elasticities
- Explaining the downward trend in elasticities
  - Use the repeated cross-sectional evidence and decomposition procedure to discuss explanations
  - Discuss effects of demographic composition change, wage rate growth, tax policy change, preference shift and change in opportunities in the labor market
- Show results for the Hicksian elasticity too
  - A challenge to obtain Hicksian elasticities by discrete choice model

Preview of results

- We find a clear decline in the Marshallian (average) elasticity of married females
  - Down from approx 0.7 in 1997 to below 0.3 in 2019
  - Still it is above married males – stable at around 0.1
- Wage rate growth is the most important explanation to the decline
- Hicksian elasticity shows a decline too

Preview of main result



Overview of presentation

- Presentation of the discrete choice labor supply model
- Description of the decline in the responsiveness of married females
- Results of procedure to obtain explanations to the decline
- Evidence for the Hicksian elasticity

A discrete choice labor supply model is used

Controversy concerning structural models

- Concerns about model's ability to generate robust predictions
  - An influential paper by LaLonde (1986) demonstrated the weakness of "econometric evaluations"
- Quasi-experimental research designs have become popular
- Discussion in the literature about advantages of different approaches involving influential people
  - Angrist and Pischke (2010); Heckman (2010); Deaton, 2010
  - Imbens (2010): "Better LATE than nothing"
- In the Norwegian policy-making context
  - Policy-makers access to simulation results by structural labor supply model – the model presented here
  - Are in the process of establishing a simulation device based on "external evidence" too – incl estimates from quasi-experiments

Discrete choice labor supply models

- Departs from random utility model as a basis for discrete choice modeling (McFadden, 1984, 2001)
- A discrete choice of working hours
  - Choose between $\langle 0-5, 5-10, 10-15, ..., 50-55 \rangle$
- Discrete choice labor supply model based on stochastic utility theory (van Soest, 1995; Aaberge et al., 1995) have become popular in practical work
  - Practical tool to deal with nonlinear and non-convex economic budget constraints

A particular discrete choice model – the job choice model (Dagsvik, 1994; Dagsvik et al., 2014)

- Agents have preferences for consumption (C), working hours h, and type of job (z)
- The job choice model builds on agents choosing a job z within a discrete alternative,
- Individual preferences: $U(C,h,z) = v(C,h) + \varepsilon(z)$ where v is a deterministic part and $\varepsilon(z)$ is a random variable
- Economic budget constraint (w=wage, I=non-labor income, T=tax): $C = wh + I - T(wh,I) \equiv f(wh,I)$

The job choice model, cont'd

- The terms $\{\varepsilon(z)\}$ are assumed to be i.i.d. across individuals and across jobs for given h with the Gumbel cumulative distribution function
- Sources of uncertainty
  - Unobservable attributes, unobservable individual-specific characteristics, measurement errors, functional misspecification, bounded rationality, etc

Job choice model, cont'd

$B(h)$ denotes the agent's set of available jobs with hours of work h

Agent chooses job z in $B(h)$ if the utility of this job, $v(f(hw,I),h)+\varepsilon(z)$, is higher than (or equal to) the utility of all other jobs/options available

Job choice model, cont'd

We are interested in the probability that the agent shall choose any job within $B(h)$, $\phi(h)$, obtained by summing the choice probability over all alternatives within $B(h)$

$$\phi(h) = \sum_{z \in B(h)} \frac{\exp(v(C,h))}{\sum_{x \in D} \sum_{z \in B} \exp(v(C,h)) + \exp(v(C,h))}$$

Introducing the number of options in the labor market $m(h)$

$$\varphi(h) = \frac{\exp(v(C,h))m(h)}{\exp(v(C_0,0))m(0) + \sum_{x \in D} \exp(v(C,x))m(x)}$$

Allows the researcher to account for latent restrictions in the labor market

Job opportunity measure, $m(h)$, is key part of the job choice model

$m(h) = \theta g(h)$, where θ is the total number of jobs available to the agent, depending on education level

When S is years of education, we have $\log \theta_k = \gamma_{k1} + \gamma_{k2} S$ $(k = F, M)$

$g(h)$ is the fraction of jobs available to the agent with offered hours of work equal to h, uniformly distributed, except peaks for full-time and part-time

$m(h) = \theta g(h)$ is estimated jointly with the utility function

Box-Cox functional form for the deterministic part of the couple utility function

$$\log v(C, h_F, h_M) = \beta_C \left(\frac{\left[10^{-4}(C - C_0)\right]^{\alpha_1} - 1}{\alpha_1} \right) + \left(\frac{(L_F)^{\alpha_F} - 1}{\alpha_F} \right) X_F \beta_F + \left(\frac{(L_M)^{\alpha_M} - 1}{\alpha_M} \right) X_M \beta_M + \beta_{MF} \left(\frac{(L_M)^{\alpha_M} - 1}{\alpha_M} \right) \left(\frac{(L_F)^{\alpha_F} - 1}{\alpha_F} \right)$$

Two-step procedure – estimation by cross-sectional data

- Assign a predicted wage rate to each individual based on a Mincer wage regression (OLS)
  - Wage rate determined by education, experience and civil status
  - Random draw of error term in the wage equation (30 draws)
- Estimate the parameters of the utility function and the job opportunity measure by maximum likelihood estimation (MLE)
  - $g(h)$ is a latent variable that is estimated simultaneously with the deterministic part of the utility function

Data and estimation

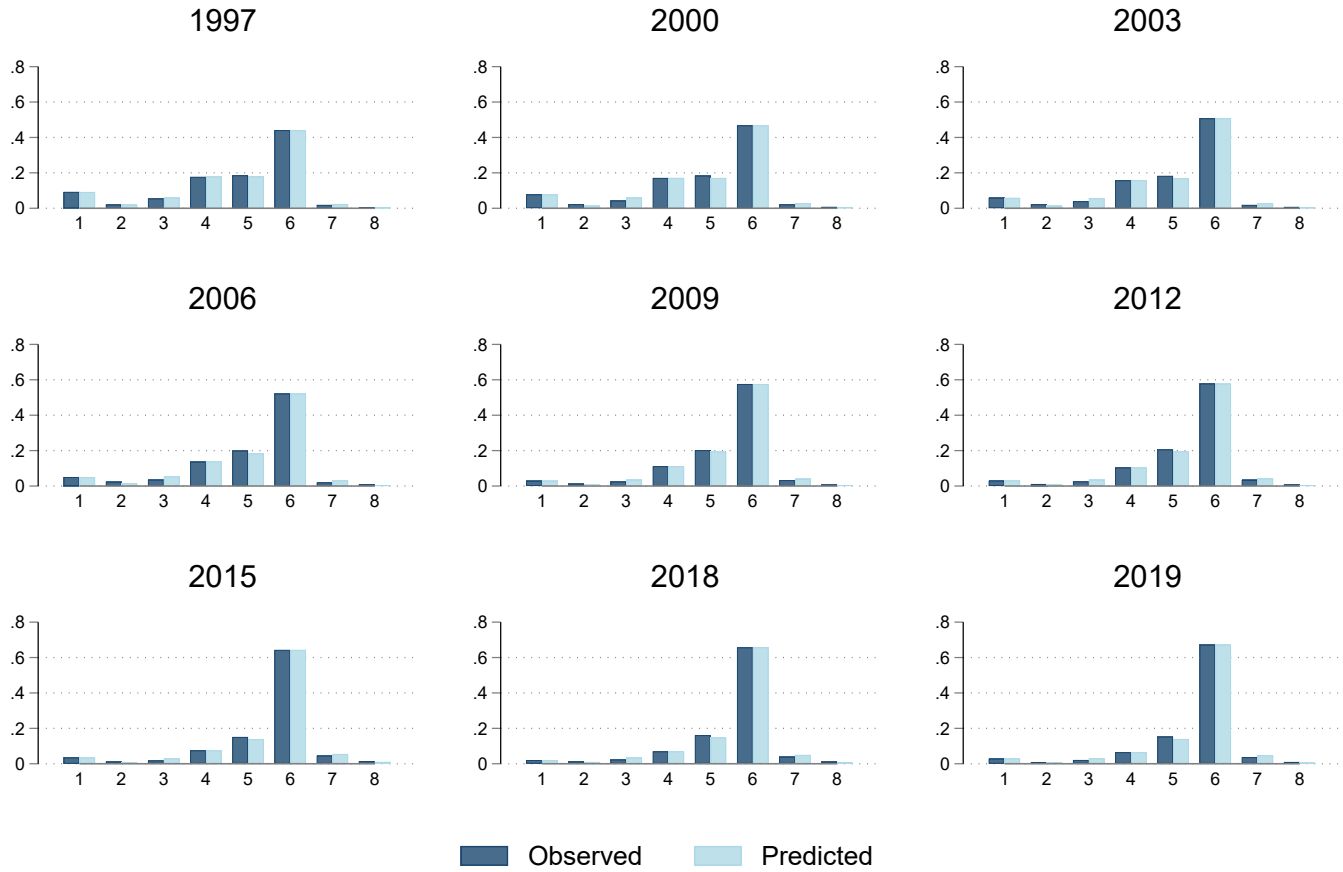
- Estimate the model for each year, 1997–2019
- Data from Labor force survey and Income and wealth statistics for households
  - Married couples
  - Age 26–62
  - Exclude self-employed/unemployed/students/disabled
- Use a detailed tax-benefit calculator to describe disposable income in the discrete choices
  - Couples have 8×8 combinations, but no category for nonwork for males

Estimation results

	Parameter	Married couples	
		Estimate	Std Error
Preferences			
Consumption			
Exponent	α_1	0.7813	0.076
Scale 10^4	α_2	0.6453	0.208
Subsistence	C_0	40,000	
Female leisure			
Exponent	α_3	-1.6194	0.416
Constant	α_5	6.2556	3.201
Log(age/10)	α_6	-5.4935	3.676
Log(age/10) squared	α_7	1.9800	1.315
No. children under or equal to 6 years	α_8	0.2142	0.117
No. children over 6 years	α_9	0.1136	0.070
Male leisure			
Exponent	α_4	-0.4285	5.618
Constant	α_{10}	0.9190	7.993
Log(age/10)	α_{11}	-0.9472	2.735
Log(age/10) squared	α_{12}	1.6682	0.444
No. children under or equal to 6 years	α_{13}	0.2206	0.241
No. children over 6 years	α_{14}	0.0084	0.149
Leisure interaction	α_{15}	0.6459	0.445
Leisure subsistence	L_0	5,110	
Labor market options: females			
Constant	γ_{F1}	0.1650	1.474
Education	γ_{F2}	0.4560	0.536
Labor market options: males			
Constant	γ_{M1}	1.9703	1.891
Education	γ_{M2}	1.3481	0.705
Opportunity density of hours offered			
Male full-time peak		2.6345	0.114
Female full-time peak		1.5225	0.103
Male part-time peak		-0.1314	0.286
Female part-time peak		-0.1677	0.125
Number of observations		1,619	
Log likelihood		-2,983.8	
McFadden's ρ^2		0.55	

Goodness of fit

Observed and predicted labor supply behavior for married females



A little detour on practical use of the model

Job choice model part of the microsimulation models to assist tax policy-making

- The labor supply is part of the microsimulation models of the LOTTE-system
  - Labor supply module named LOTTE-Arbeid
  - Connected to the non-behavioral microsimulation model LOTTE-Skatt
- Job choice model estimated for a smaller sample (than the LOTTE-Skatt sample) because of information on working hours
- Advantageous to simulate labor supply effects for same data set as in LOTTE-Skatt
  - Estimates transferred to the larger LOTTE-Skatt dataset based on imputation and common variables
- LOTTE-Arbeid less used than LOTTE-Skatt in policy-making

Use of model in the Norwegian budget process

Tax change	Self-financing ratio, pct
Reduced rate bracket tax, bracket 3	10
Increased threshold bracket tax, bracket 3	9
Reduced rate ordinary income	6
Reduced rate social insurance tax	5
Reduced rate bracket tax, bracket 2	4
Increased threshold bracket tax, bracket 2	2
Increased threshold for max. deduction in minimum stand. deduction	1
Reduced rate bracket tax, bracket 1	0
Increased threshold bracket tax, bracket 1	0
Increased personal allowance	0
Increased rate minimum standard deduction	-16

Description of the decline in the responsiveness of married women

Simulated labor supply elasticity

- The estimated models (one for each year) are used to simulate labor supply elasticities with respect to the wage rate

$$e^w = \frac{dh}{dw} \cdot \frac{w}{h}$$

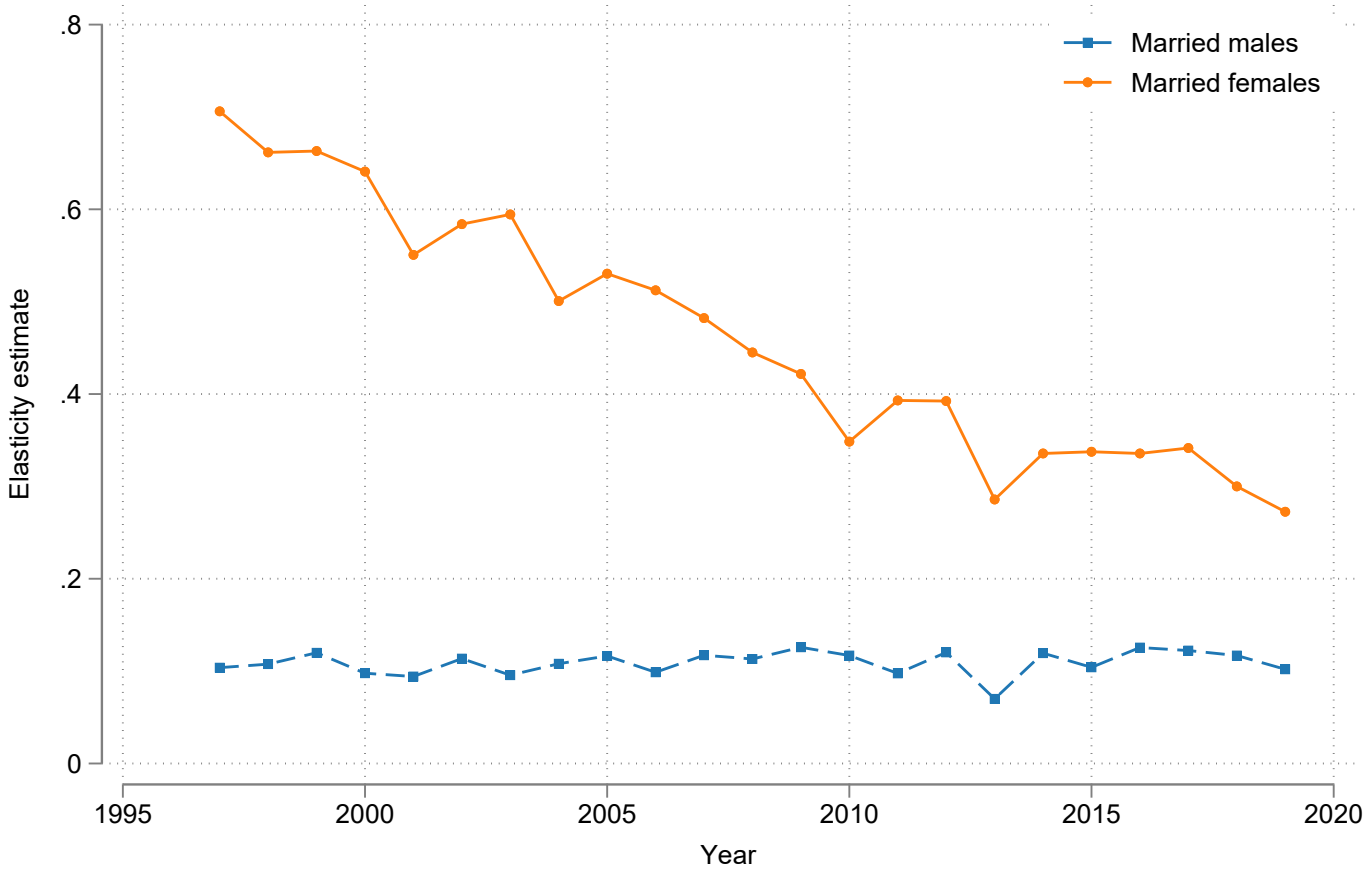
- Report the Marshallian elasticity of the aggregate (average) response in working hours

Elasticity estimates, 2019

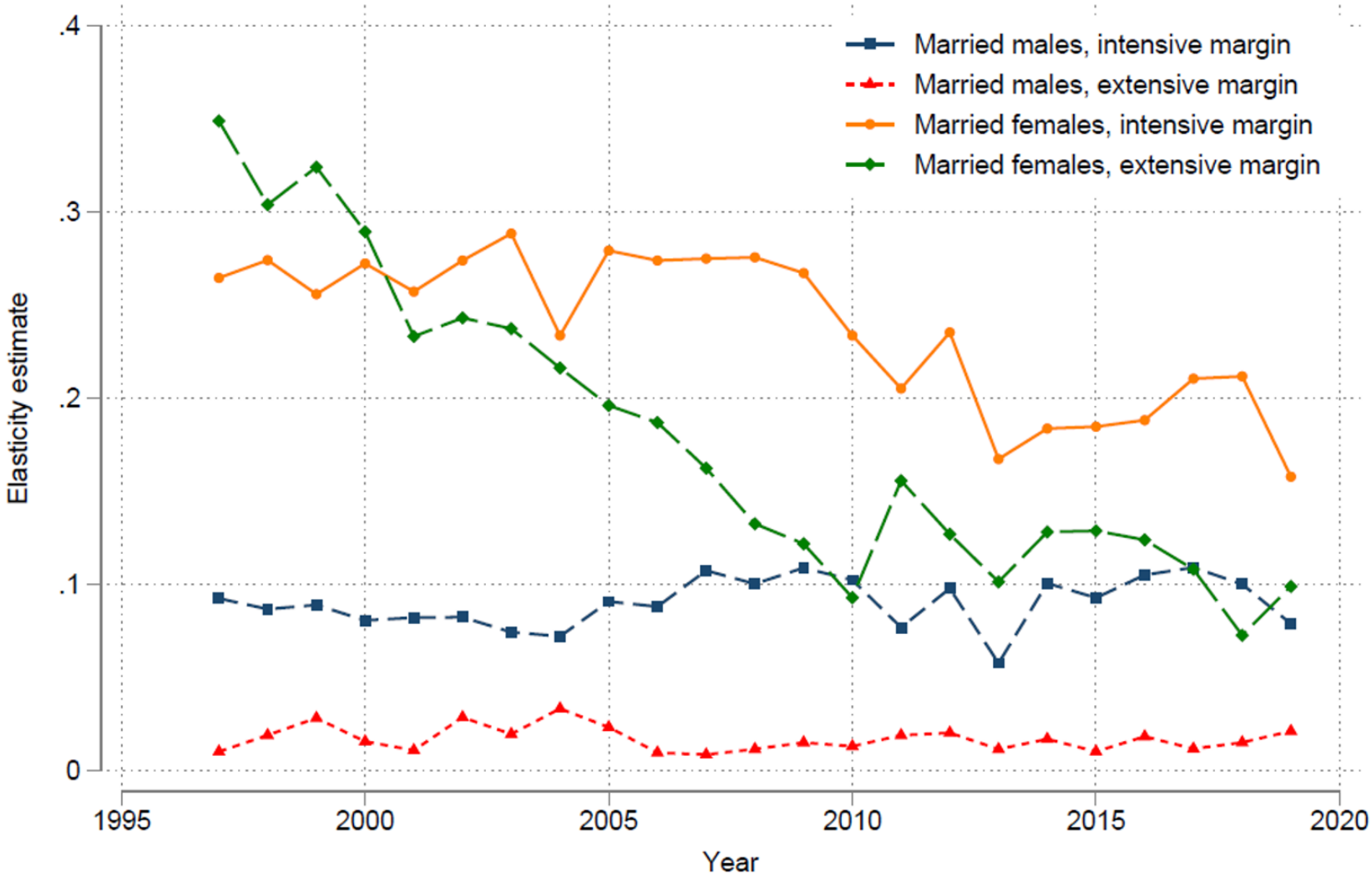
Table A3: Gross wage Marshallian labor supply elasticities for individuals in couples, 2019

	Female own wage	Male own wage	Female cross-wage	Male cross-wage
Participation (ext. margin)	0.099	0.021	-0.002	-0.006
Hours cond. on working (int. margin)	0.158	0.079	-0.047	-0.005
Total elasticity	0.273	0.102	-0.046	-0.010

Declining labor supply elasticity of married women



Married men and married women – extensive and intensive margins



A procedure to obtain explanations to the decline

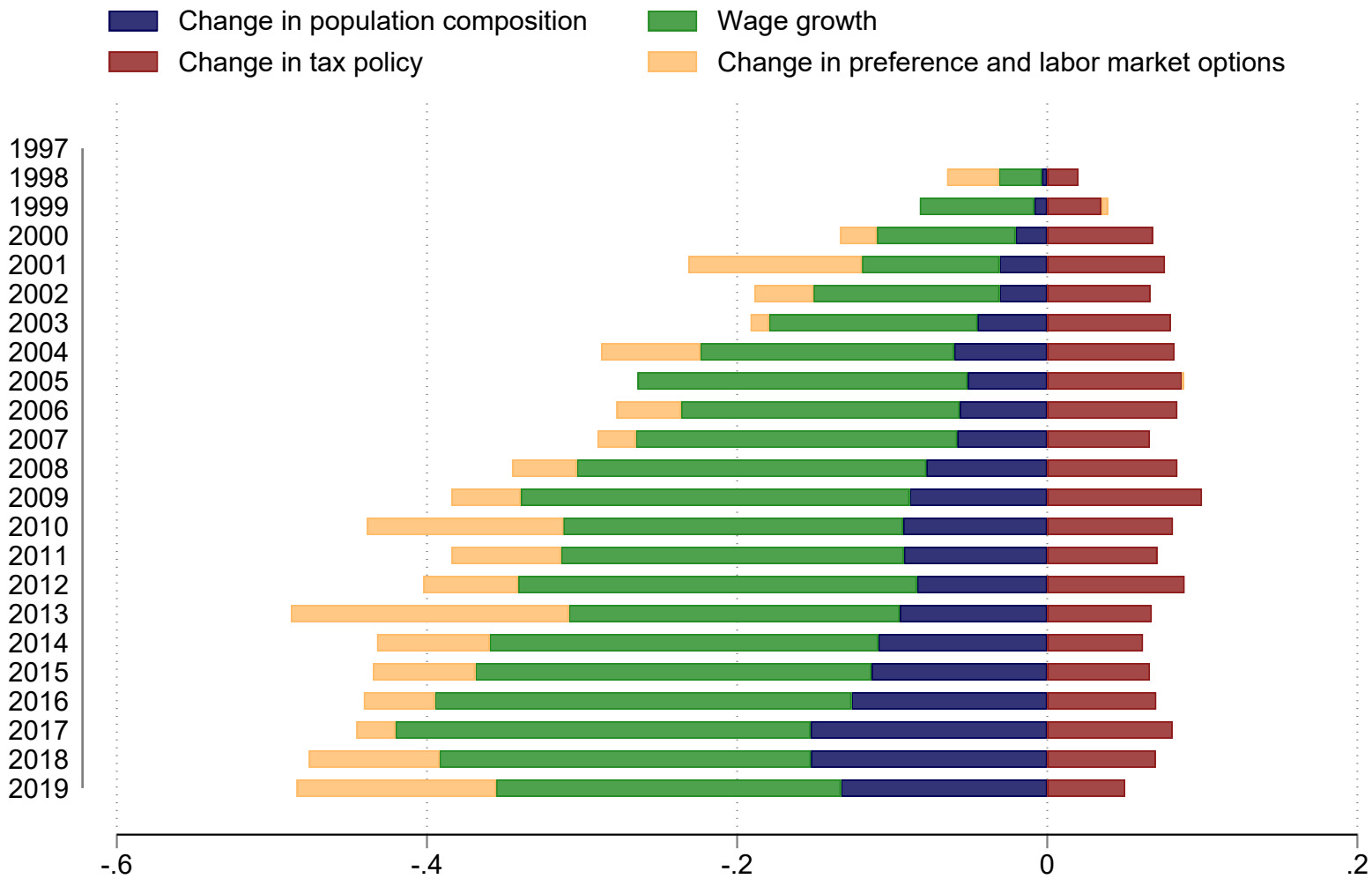
Explanations to the decline in elasticities

- Population composition change
- Wage rate growth
- Tax scheme change
- Preference shift and change in labor market opportunities merged into one category

Decomposition method – one specific sequence

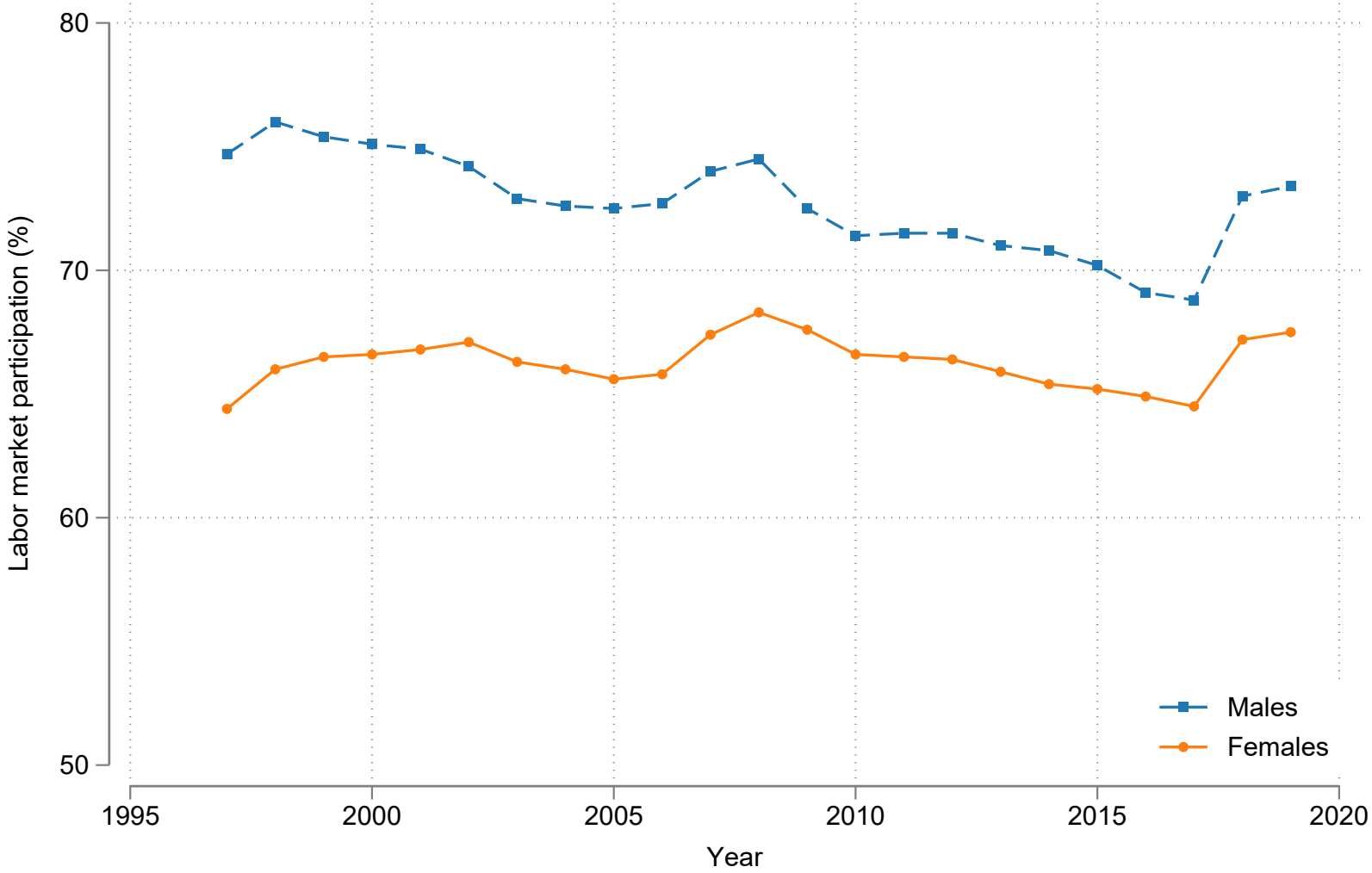
- The labor supply elasticity in 1997 serves as the baseline, e_{1997}
- For a given year t, $t \in [1998, 2019]$, the method separates out effects of different explanations to the decline in response
- Step 1: Holding model parameters fixed to 1997 parameter, get wage elasticity set $e_{t,1}$ for 1998–2019
  - Contribution due to sociodemograhic factors: $e_{t,1} - e_{1997}$
- Step 2: Let the gross wage vary over time, $e_{t,2}$
  - Contribution due to the wage rate growth: $e_{t,2} - e_{t,1}$
- Step 3: The tax scheme varies over time, $e_{t,3}$
  - Contribution due to tax schemes change: $e_{t,3} - e_{t,2}$
- Step 4: Simulations results for full model, e_t
  - Identifies contributions from change in preferences and labor market opportunities: $e_t - e_{t,3}$

Decomposition results (Shapley procedure)



More about some potential driving factors

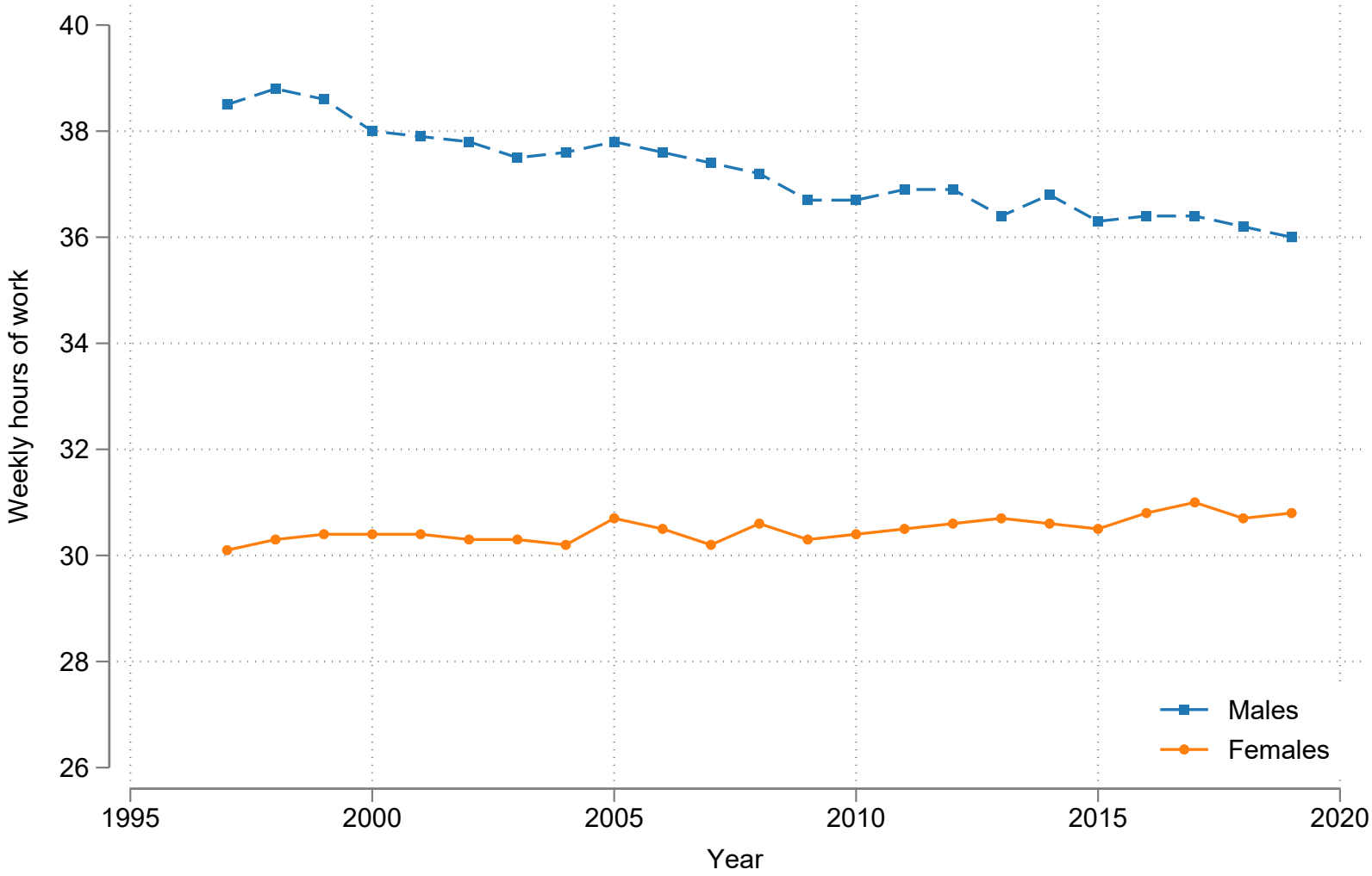
Gap in participation is narrowing



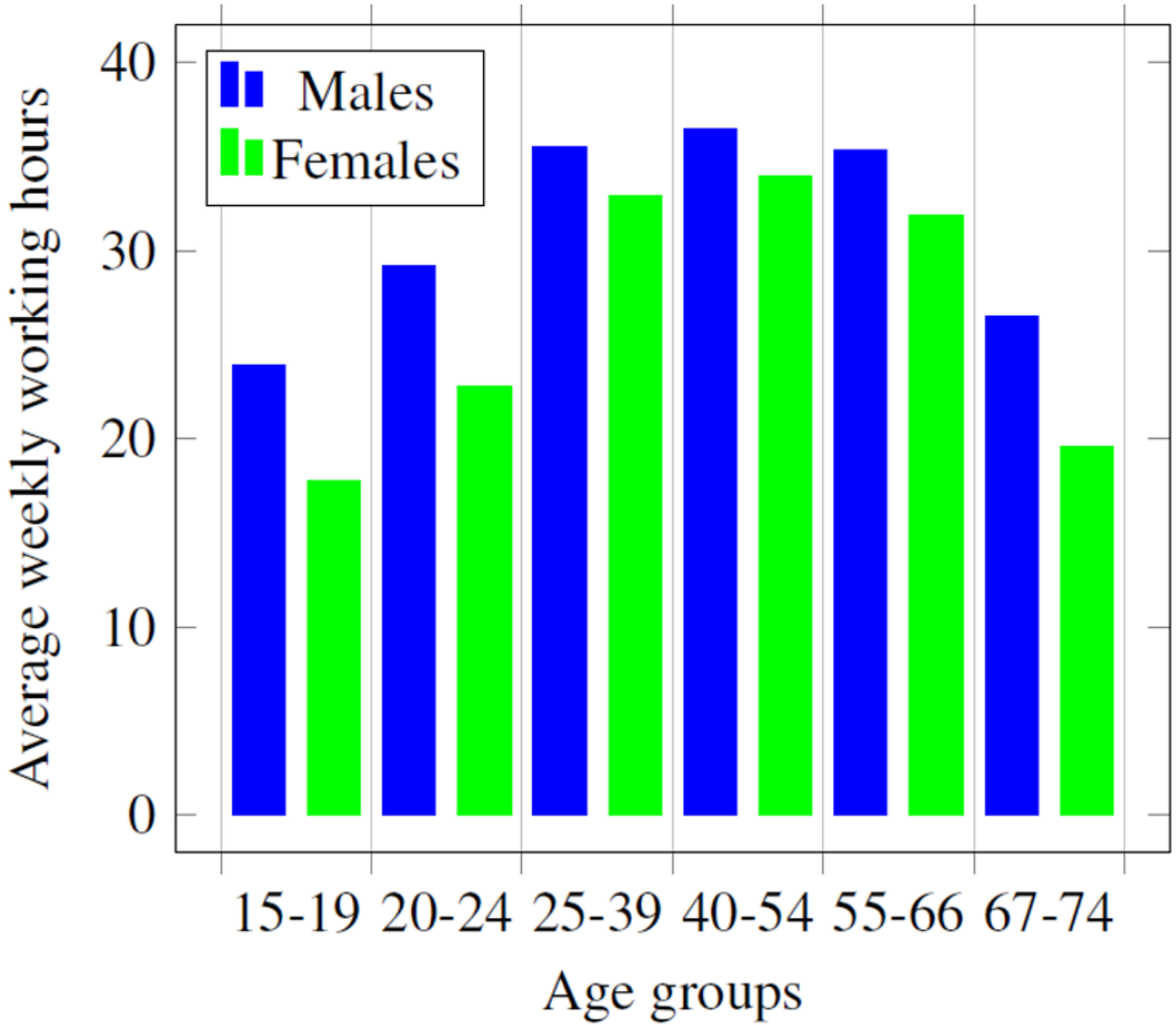
Increased participation and the decline in response

- Could argue that higher participation rates contributes to the decline in response
  - Smaller pools of people that can be incentivized to enter the labor force
- Hard to establish a causal relationship between participation and responses – simultaneity

Average female working hours stable (for those who work)

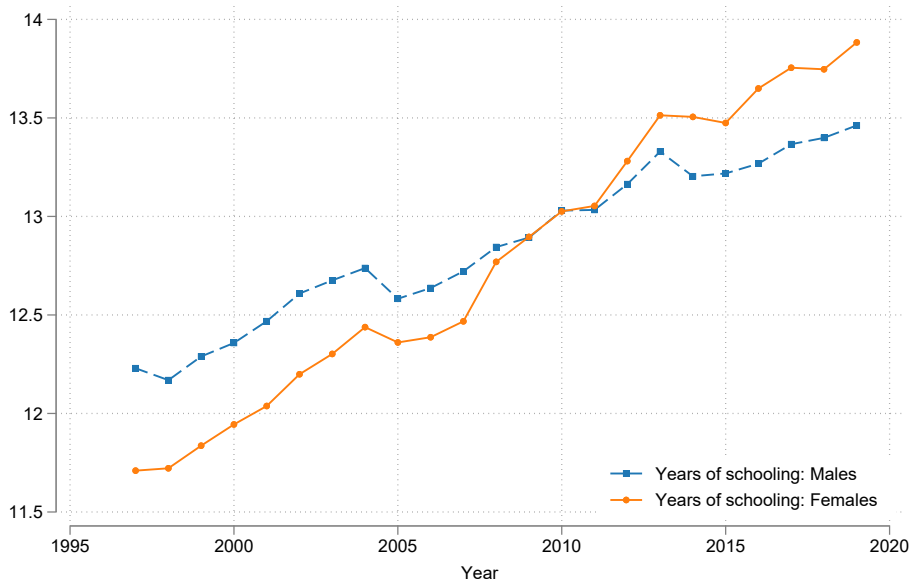


Female working hours lower over the lifecycle



Change in female education

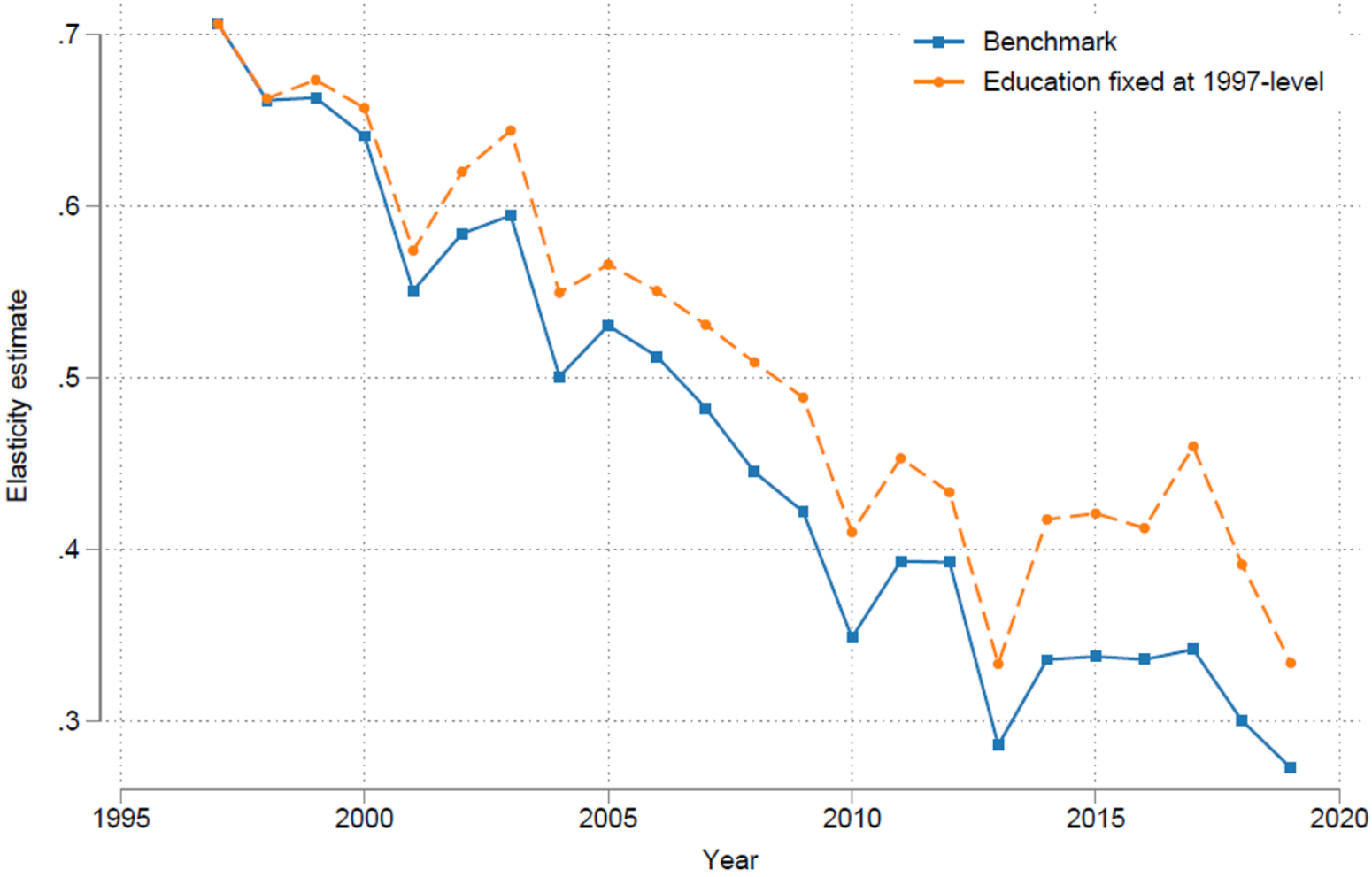
Females have increased their education above males



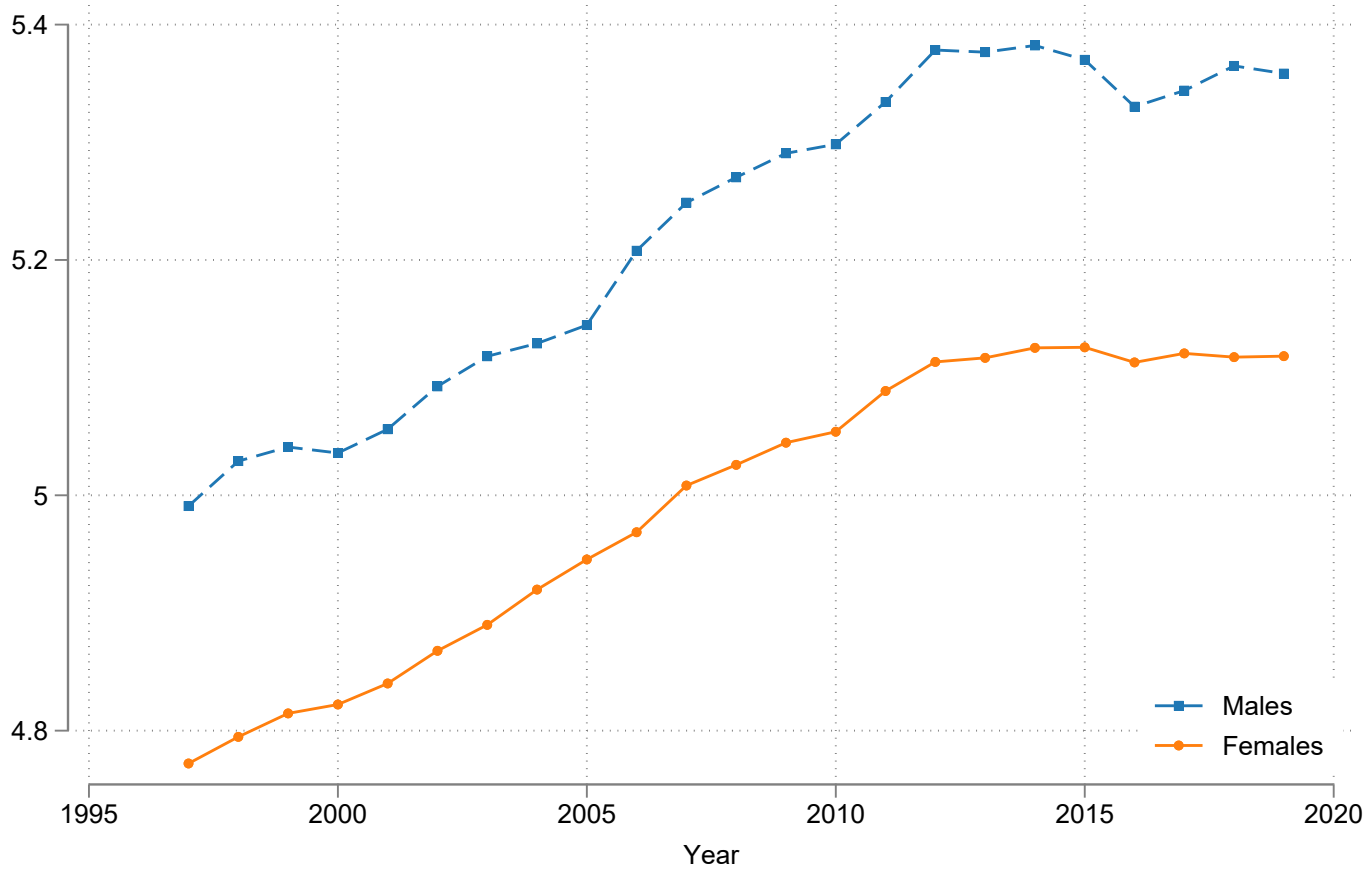
Change in education is reflected in three categories of explanations

- Education is part of the population composition factor
  - Increased education levels enter into the wage regression (for fixed parameters)
- Wage rate growth a result of higher education
  - Parameter estimates of the wage regression change
- Education also influencing labor market opportunities

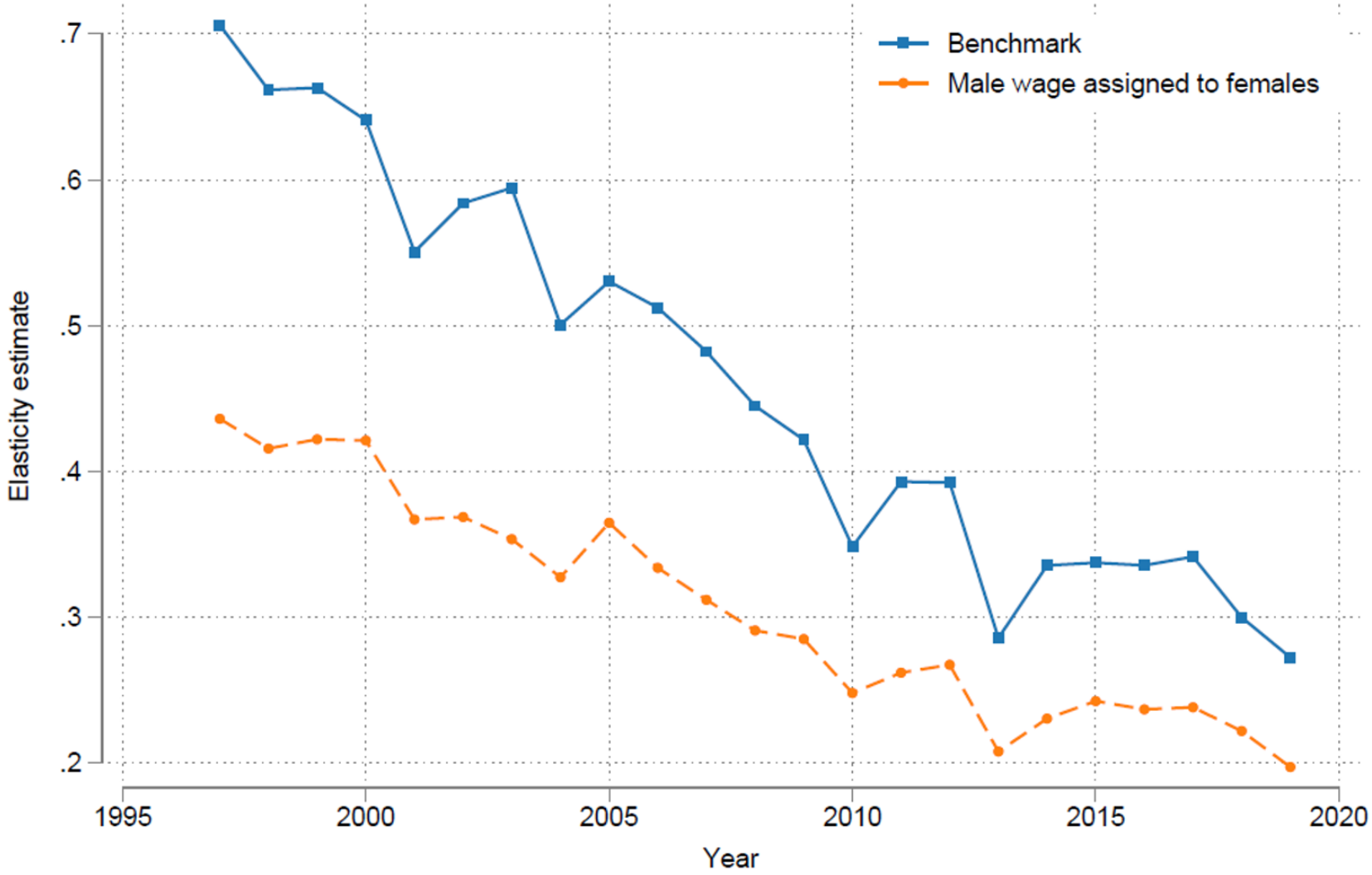
Elasticity estimates when married women's education levels are fixed at the 1997-level



Log real wage rate (40 years old and 13 years of schooling)

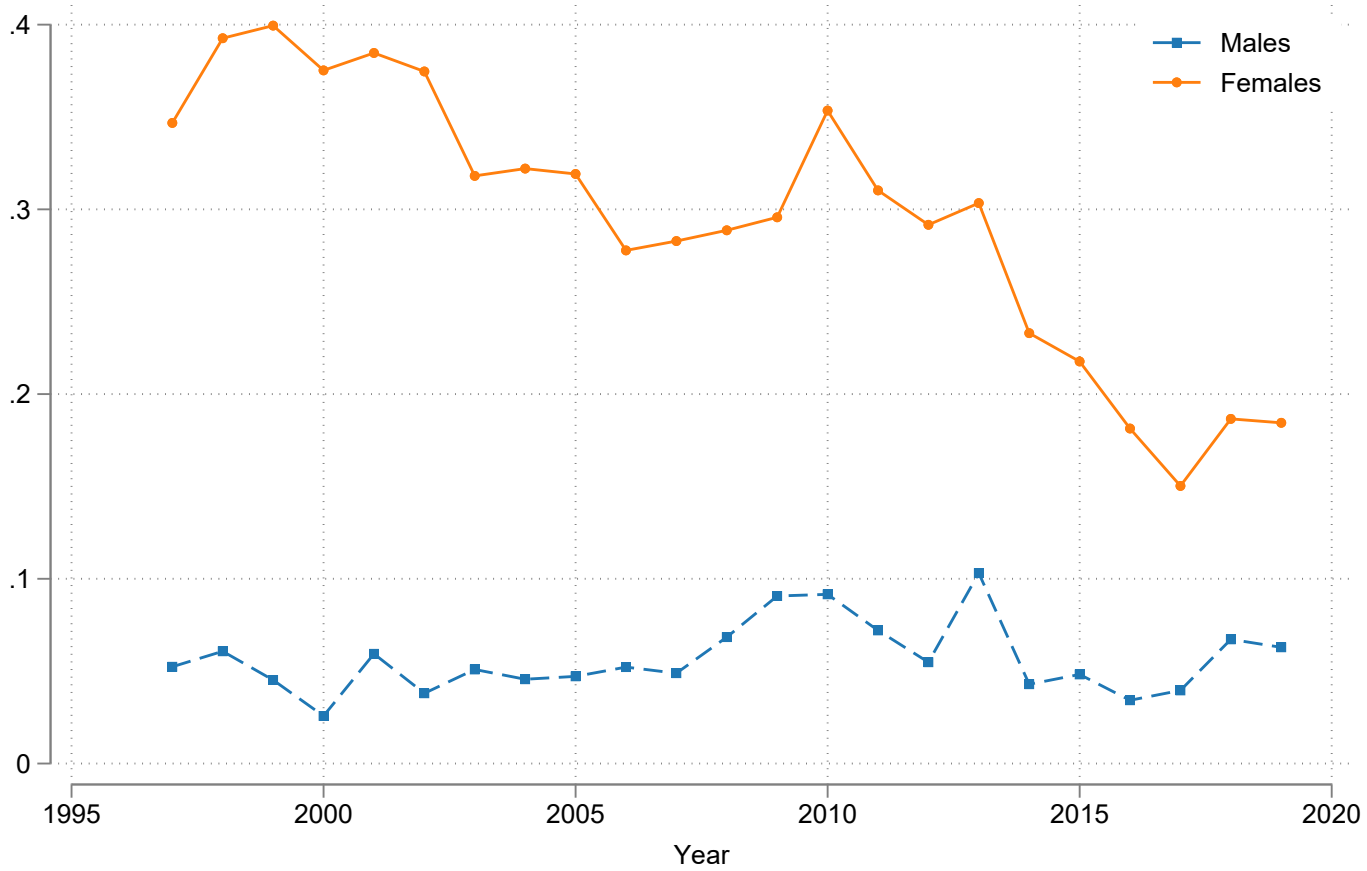


Elasticity estimates when women are given "male wages"



More full-time job opportunities

Estimated number of part-time jobs for each full-time job, $m(\text{part})/m(\text{full})$

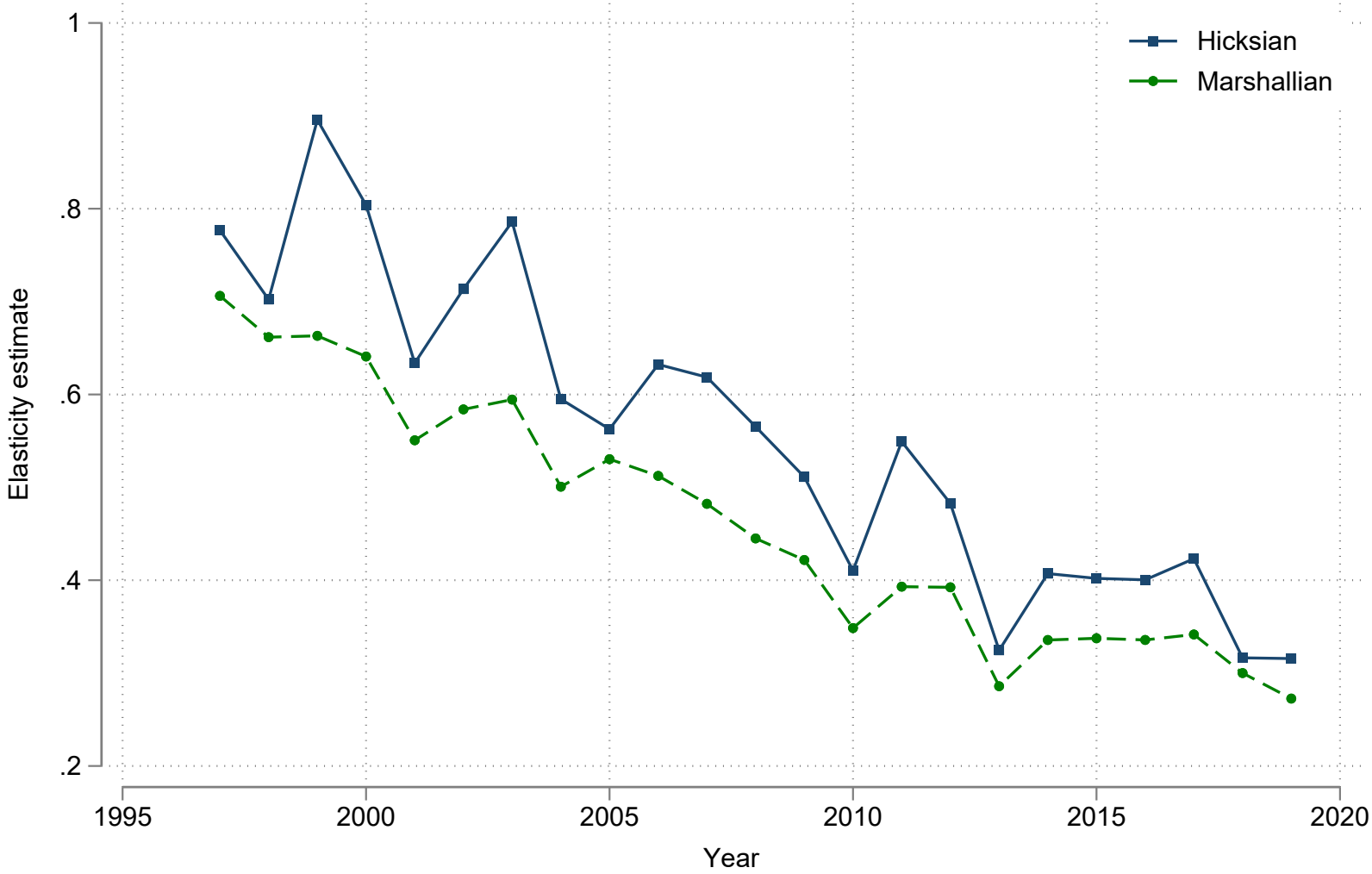


Tax changes and the decline in response

- Marginal tax rates relatively stable over the period
  - A little reduction towards the end of the period
- Reduced rates may give larger responses
  - By definition of how the labor supply elasticities are calculated

Hicksian elasticity estimates – Dagsvik and Karlstrøm (2005)

Decline in the compensated elasticity too



Concluding remarks

Summary

- Estimate a discrete choice labor supply model on cross-sectional data, for each year 1997-2019
- Find clear downward trend in the simulated labor supply elasticities for married females
- Important to have information on what influences responsiveness
  - To what extent is response subject to policy control (Slemrod and Kopczuk, 2002)?
- We decompose effects and results suggest
  - Wage rate growth is the most important contributor
  - Shift in preferences and labor market opportunities have small effect
  - Tax policy change contributes to larger response