There and Back Again: Women's Marginal Commuting Cost

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Motivation & Background

- commuting as a negative job attribute
- women's shorter commutes (raw gap in West Germany: 18%)
- gender wage gap (raw gap in West Germany: 33%)
- aim: estimate the willingness to pay to reduce commuting
  - differences over gender and parenthood, as a contributor to gender and parenthood wage gaps
- major advantage of our empirical approach:
  1. search friction on the labor market
  2. unobserved heterogeneity
  3. flexible hazard rate approach with day precise data
  4. careful modeling of family composition

Literature

- Gronberg and Reed (1994) and Van Ommeren et al. (2000):
  - With partial job search model, WTP for a job attribute can be directly estimated with the aid of a hazard model of job transitions.
- Borghorst et al. (2024)
  - Denmark: Commuting cost of women increases substantially after have children
- Le Barbanchon, Rathelot and Roulet (2021)
  - France: Unemployed women have a stronger dislike for commuting (20%) than unemployed men, explain around 14% of the residual wage gap

Contribution

- Focus on employed individuals in West Germany, particularly large gender and motherhood wage gap.
- Assessment of dependence of WTP on a spouse's income and commuting distance.
- Flexibility of empirical approach
  - stratified Cox Model model
  - WTP modeled very flexibly, i.e. varying over gender, wage, and number and age of children (not a fixed preference parameter in the sense of Lundberg (2022))

Model (van Ommeren, van den Berg, Gorter 2000)

- search labour market with on-the-job search
- job offer tuples drawn from an exogenous distribution
- optimal strategy is myopic: reservation utility property
- addresses biases from search frictions

$\rightarrow$ marginal willingness to pay for a job attribute equals ratio of marginal effects of job attribute & wage on the hazard of a job transition

$$\frac{\frac{\partial \theta(w,x)}{\partial x}}{\frac{\partial \theta(w,x)}{\partial w}} = \frac{\frac{\partial \theta(w,x)}{\partial u(w,x)}\frac{\partial u(w,x)}{\partial x}}{\frac{\partial \theta(w,x)}{\partial u(w,x)}\frac{\partial u(w,x)}{\partial w}} = \frac{\frac{\partial u(w,x)}{\partial x}}{\frac{\partial u(w,x)}{\partial w}}$$

Our measure of WTP *to reduce* commuting

Redefinition as usually job attributes create positive utility:

$$-\frac{\frac{\partial \theta(w,d)}{\partial d}}{\frac{\partial \theta(w,d)}{\partial w}} = -\frac{\frac{\partial u(w,d)}{\partial d}}{\frac{\partial u(w,d)}{\partial w}}$$

Model

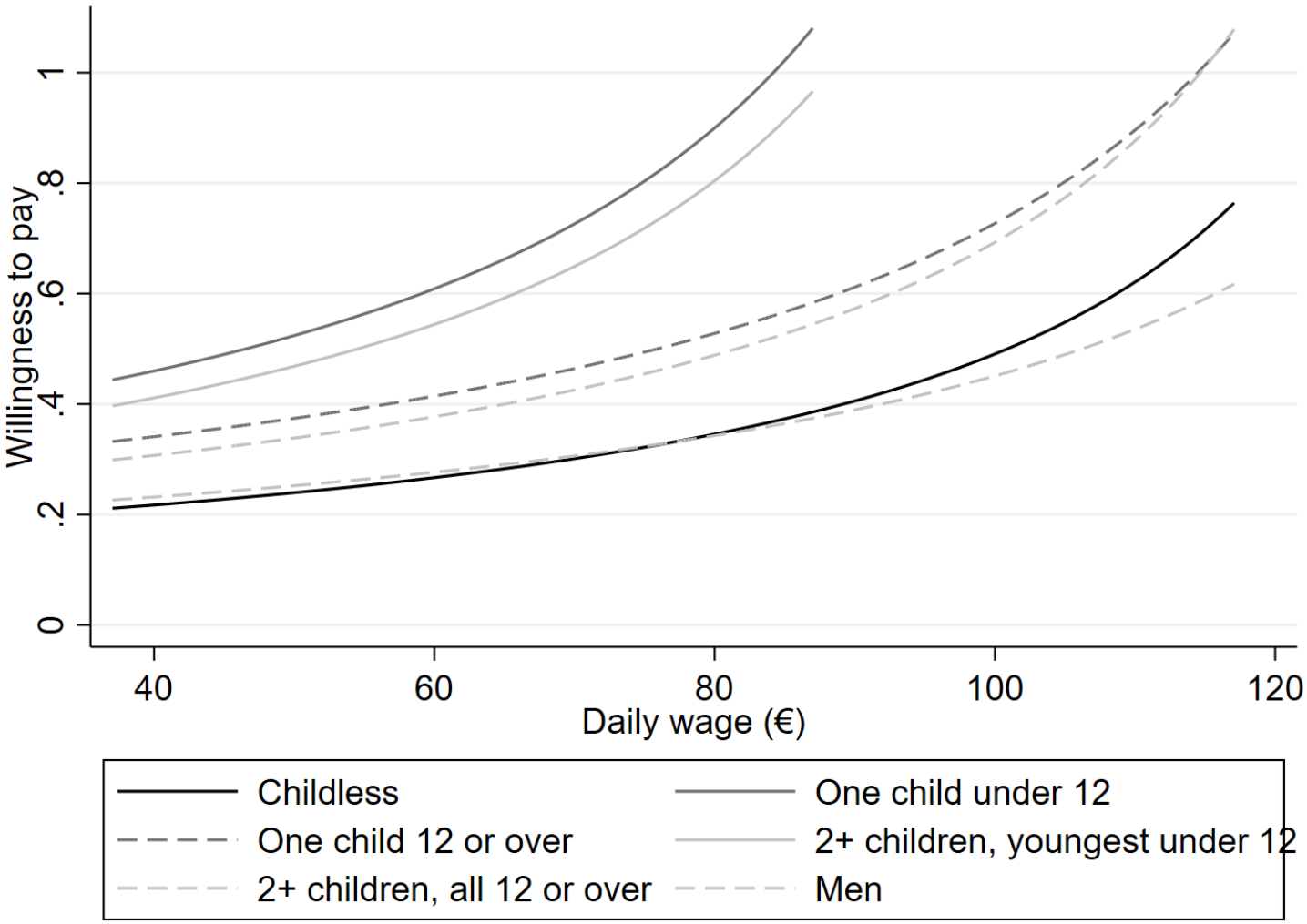
1. Assumption: Residential location exogenous in search process:
   - no endogenous re-adjusting of location during specific job spells.
     - low residential mobility, as in Germany
     - focus on non-university graduate, as residential mobility decreases with education.
     - exclude long commutes
     - sensitivity analysis, which partly also includes rents
2. Assumption: Job exits are job-to-job transitions
     - high protection from dismissals
     - sensitivity analysis: treating jobs end that are followed by a nonemployment spell of more than one months as censored.

Sample + Estimation Method

- national insurance data, 10% sample of the Integrated Employment Biographies in Westgermany
- inflow sample 2000-2013
- exclude university graduates $\rightarrow$ minimise impact of wage top-coding
- distance as Euclidean distance between postcode area centroids
- identify birth by routine of Müller and Strauch (2017)
- Stratified Cox partial likelihood model
  - individual baseline hazards capture heterogeneity that has the same shape across spells
  - Log relative risk that is linear in commuting distance and linear plus quadratic in the daily wage. $\Rightarrow$ Marginal willingness to pay that depends non-linearly on the wage.

equations.

Results: Men and Women: Marginal Willingness to Pay to Reduce Commuting, in Euro per km



Results: Marginal Willingness to Pay, in Euro per km

- women's MWP without children per km 0.44% of daily wage $\Rightarrow$ €0.27 at the mean wage
- men's MWP is similar to the one of childless women up men's mean wage and then falls below.
- For women: 130% increase after birth of first child

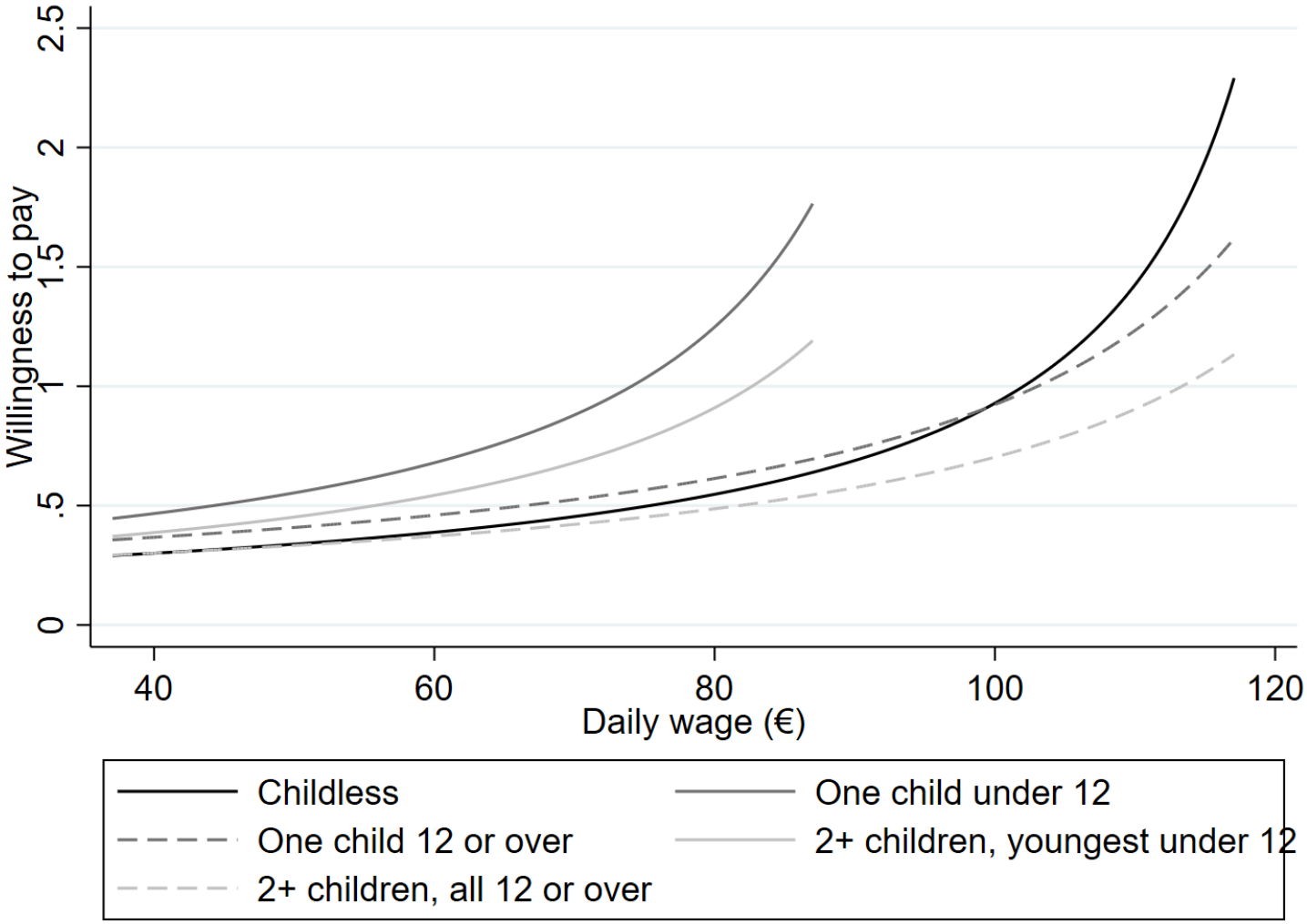
Additional results

- Rural areas: Child related MWP increase highest in rural area's
- Parttime work: MWP higher for parttime worker (at the same weekly wage)
- Increase in MWP upon first child smaller for parttime worker

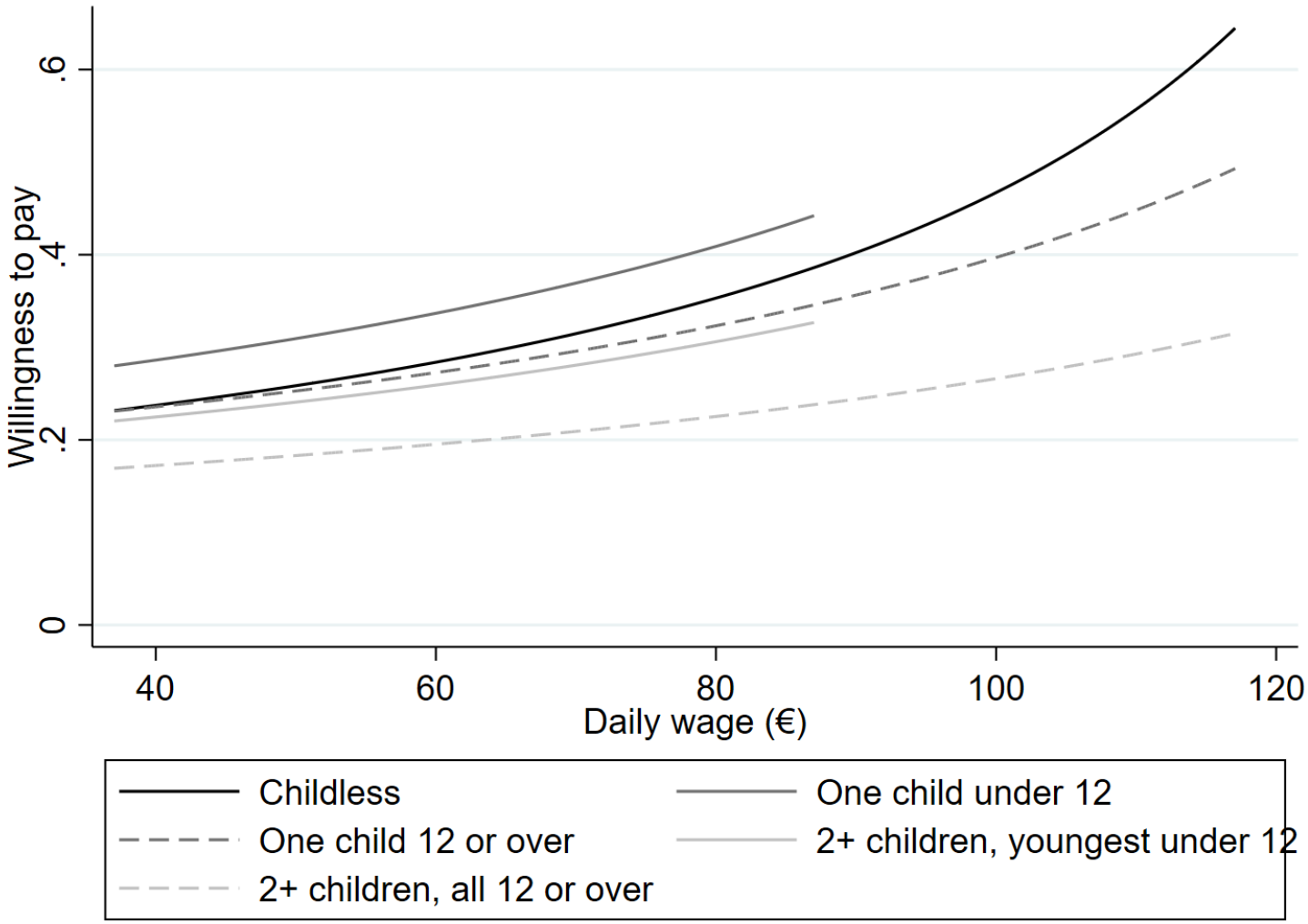
Married Couples' Sample

- match children to men's jobs
- household decisions $\rightarrow$ partner's wage & characteristics affect marginal commuting cost
- algorithm uses geo-coded data and last names to identify married couples in 2008
- misses couples, misclassifies few pairs
- we assume if they live before and after in the same CIP code, that they were a couple before and after.

Results, married women: Marginal Willingness to Pay, in Euro per km



Results, married men: Marginal Willingness to Pay, in Euro per km



Results, married men: Marginal Willingness to Pay, in Euro per km

- compared to baseline sample:
  - higher MWP for childless married women.
  - MWP of women increases stronger with wage.
  - similar MWP for married childless men to average MWP of men
  - married men MWP increases insignificantly with first child, but decreases with age and number of children

Additional analysis - taking into account household position

- heterogeneity of female WTP with respect to husband's job position:
  - income husband $>$ income wife $\Rightarrow$ WTP of wife $\Uparrow$
  - distance husband $>$ distance wife $\Rightarrow$ WTP of wife$\Downarrow$
- heterogeneity of male WTP with respect to wife's job position
  - income wife $>$ income husband $\Rightarrow$ WTP of husband $\Uparrow$
  - income wife $>$ income husband $\Rightarrow$ still no significant increase in WTP when child arrives
  - wife commutes changes from zero to relative small commute $\Rightarrow$ WTP of husband $\Uparrow$.
  - But: distance wife $>$ distance husband $\Rightarrow$ change of sign of WTP of husband, paradox!

Summary

- used a stratified partial likelihood model to estimate marginal commuting cost in a partial-equilibrium search model
- women's marginal commuting cost 0.4% of the daily wage per km without child
- increases by 130% with first child
- no substantial gap in WTP between childless women and average men.
- substantial motherhood gap
- matched married couples: men's WTP does not increase significantly with a first child
- back of the envelope calculation: comparing WTP of childless women and mothers with young children, can explain 8% of raw motherhood wage gap.

Estimation model

- The hazard rate can be expressed as

$$\theta_i(t, \mathrm{X_t}) = \theta_i(t) \exp(\beta_{w_1} wage_t + \beta_{w_2} wage_t^2 + \beta_d distance_t + \beta_{\mathrm{x}} f(\mathrm{X(t)}))$$

- Marginal willingness to pay is given by

$$MWP = \frac{\beta_d}{\beta_{w_1} + 2\beta_{w_2} wage_t}$$

Back to main.

Estimation

- worker controls: age (linear and squared), occupational skill level, full-time status, occupational field, motherhood (for women)
- Local and regional controls: rural/urban (9 dummies), local unemployment rate & local GDP growth
- Allow for nonlinearity at lower bound (regional structure interacted with zero-distance dummy)

Job-level summary stats, baseline estimation sample

	Women		Men	
	Mean	Std. Dev.	Mean	Std. Dev.
Daily Wage, 25th percentile	40.3		58.4	
Daily Wage, mean	62.2	30.1	82.7	34.5
Daily Wage, 75th percentile	79.4		102.2	
Euclidean distance in km	11.5	14.0	13.6	15.8
Age at start of job	35.9	10.4	35.2	10.1
Full-time work	0.61	0.48	0.91	0.26
Unskilled job	0.13	0.33	0.10	0.29
Major cities	0.28	0.45	0.27	0.44
Urban areas	0.50	0.50	0.50	0.50
Rural areas	0.22	0.41	0.23	0.42
Child(ren) present	0.40	0.49		
Child(ren) over age 12	0.20	0.39		
Observations	6,433,713		6,876,548	
Jobs	2,435,009		2,679,887	
Persons	968,607		1,027,065	

Baseline Estimates

	Women		Men	
Age	-.0074*	(.003)	.0553***	(.0028)
Square root	-.0733*	(.035)	-1.02***	(.0324)
Full time	.219***	(.0037)	.167***	(.0059)
First child	-.392***	(.018)		
Second child	-.0183	(.0225)		
Youngest $>$ 12 yrs	-.0808***	(.02)		
Wage	-.0275***	(2.8e-04)	-.0249***	(2.1e-04)
Squared	9.3e-05***	(1.7e-06)	7.6e-05***	(1.1e-06)
Distance	.0044***	(1.4e-04)	.0039***	(9.7e-05)
Child $\times$ Wage	.0054***	(4.8e-04)		
Child $\times$ Wage squared	-2.2e-06	(3.1e-06)		
Child $\times$ Distance	.0025***	(2.7e-04)		
2nd child $\times$ Wage	-.0032***	(6.3e-04)		
2nd child $\times$ Wage squared	1.3e-05**	(4.2e-06)		
2nd child $\times$ Distance	1.6e-04	(3.6e-04)		
Older child $\times$ Wage	.0022***	(5.7e-04)		
Older child $\times$ Wage squared	-2.6e-05***	(3.8e-06)		
Older child $\times$ Distance	-.0018***	(3.3e-04)		
Jobs	2,435,009		2,679,887	
Persons	968,607		1,027,065	

Results: Marginal Willingness to Pay, in Euro per km

	Low wage		Mean wage		High wage	
Childless	-.218	(.007)	-.274	(.0087)	-.343	(.0109)
One child u12	-.462	(.018)	-.631	(.0242)	-.888	(.0354)
One child over 12	-.342	(.02)	-.424	(.0244)	-.524	(.0305)
2+ children, youngest u12	-.413	(.0211)	-.564	(.0283)	-.794	(.0414)
2+ children, all over 12	-.308	(.0236)	-.387	(.0292)	-.484	(.0369)
Men	-.243	(.0062)	-.316	(.0081)	-.416	(.0109)

Low and high wage are the 25th and the 75th percentile of overall daily wages by gender, respectively.

Marginal willingness to pay to reduce commuting when censoring by non-employment for more than 90 days (in Euro per day per km)

	Low wage		Mean wage		High wage	
Childless	.263	(.015)	.304	(.017)	.347	(.019)
One child u12	.382	(.044)	.473	(.053)	.583	(.066)
One child over 12	.461	(.045)	.542	(.051)	.629	(.059)
2+ children, youngest u12	.374	(.056)	.491	(.072)	.651	(.095)
2+ children, all over 12	.449	(.059)	.558	(.072)	.691	(.090)
Men	.259	(.011)	.324	(.014)	.407	(.018)