Child Penalties in Labour Market Skills

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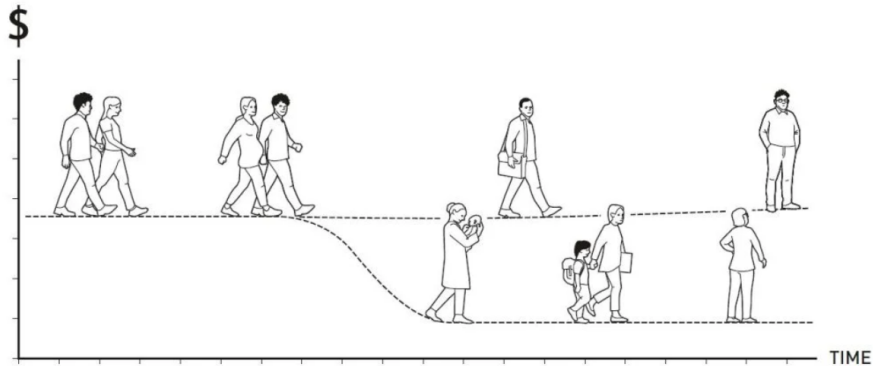
Universität Bielefeld
3 December 2024

Motivation



The parenthood effect. © Johan Jarnestad/The Royal Swedish Academy of Sciences

- Sizeable gender gaps in labour market outcomes despite decades of convergence → Role of parenthood decisive factor (Kleven et al., 2024a; Cortes, Pan, 2023)

Child Penalties

Idea: Quasi-experimental approach based on event studies around birth of first child to investigate effect of parenthood on labour market outcomes (Kleven et al., 2019)

Child penalty: Long-run difference between outcomes of mothers and fathers due to children.
We should probably call them 'parenthood effects for mothers and fathers'

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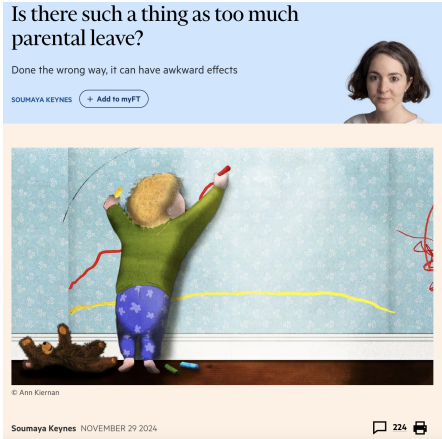
Large body of evidence on child penalties...

- ...in various countries (Kleven et al., 2024a)
- ...and the role of gender norms (Jessen, 2022; Andresen, Nix, 2022; Kleven et al., 2021)
- ...and mediating effects of policies (Kleven et al., 2024b; Ciasullo, Uccioli, 2024; Heckl, Wurm, 2023)

This Paper



What we do: Add evidence on effect of parenthood on **labour market skills**

- as *outcome* in itself
- as potential *mechanism* for penalties in wages / employment (lower returns)
- potentially can offer insights to inform policy makers about parental leave, training and labour market policies

Main challenge: no panel data available for adult skills → build upon method proposed by Kleven (2023) for estimating child penalties in repeated cross sections to single cross section

Approach:

1. validate single cross section version with German household panel (SOEP)
2. apply new method to PIAAC data for adult skills

Data: Survey of Adult Skills (PIAAC)

▸ descriptive table

- *Programme for the International Assessment of Adult Competencies* (PIAAC)
- International data collection 2012-2017 (37 countries, individuals aged 16-65)
- Short German panel PIAAC-L 2012-2016 including other household members

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- **Skills:** "Competencies necessary to successfully navigate demands in everyday life and in the workplace" (https://www.gesis.org/en/piaac/piaac-an-overview), not innate ability
- Skill measures: numeracy example, literacy example, and problem-solving in technology-rich environments example correlation scores
- Additionally: rich set of labour market information and personal characteristics

Adult Skills and Parenthood

▸ skill evolution

Some evidence on skill depreciation during unemployment (Cohen et al., 2023; Dinerstein et al., 2022), but unemployment $\neq$ parenthood (without employment)

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Evidence on adult skills:

- Gender differences (Battisti et al., 2023; Christl, Köppl-Turyna, 2020; Rebollo-Sanz, Rica De la, 2022)
- Returns to skills, especially numeracy (Hanushek et al., 2015)

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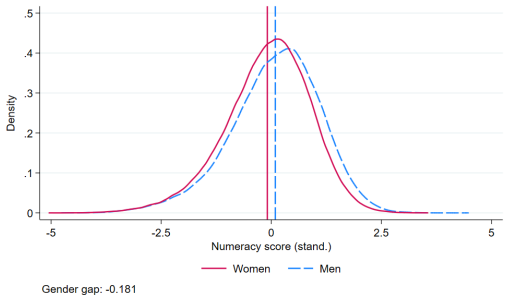
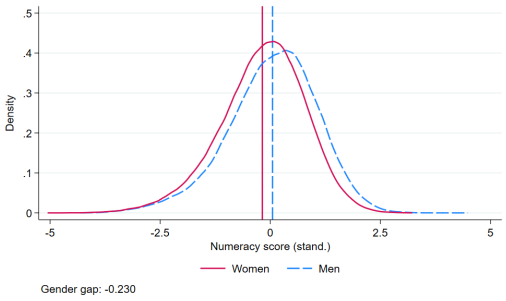
A: Numeracy score distributions men/women



B: Only parents



'Standard' Child Penalty Approach

Requirement: panel data on individual outcome for men and women before and after childbirth

Estimation as in Kleven et al. (2019), separately by gender:

$$Y_{ist}^{g} = \sum_{j \neq -1} \alpha_j^g \, \mathbb{I}[j = t] + \sum_k \beta_k^g \, \mathbb{I}[k = age_{is}] + \sum_y \gamma_y^g \, \mathbb{I}[y = s] + \nu_{ist}^g$$

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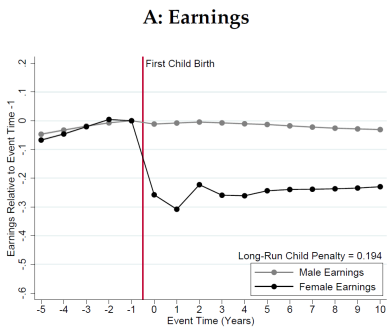

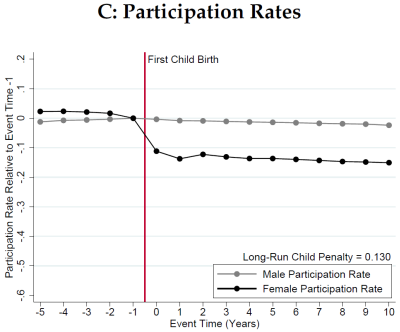

Adaptation to Repeated Cross Sections (Kleven, 2023; Kleven et al., 2024a)

But: panel data not always available → exploit rich information from repeated cross sections

Adaptation to Repeated Cross Sections (Kleven, 2023; Kleven et al., 2024a)

							event time									
	t-5	t-4	t-3	t-2	t-1	**t=0**	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9	t+10
							survey year									
	s-5	s-4	s-3	s-2	s-1	**s**	s+1	s+2	s+3	s+4	s+5	s+6	s+7	s+8	s+9	s+10
observation							age									
	a-5	a-4	a-3	a-2	a-1	**a**	a+1	a+2	a+3	a+4	a+5	a+6	a+7	a+8	a+9	a+10
1																
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1 ($X_1 = X_7$)	y_1															
2 ($X_2 = X_7$)		y_2														
3 ($X_3 \neq X_7$)		y_3														
4 ($X_4 = X_7$)			y_4													
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empirics

	event time														
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Adaptation to Single Cross Section

validation SOEP

	event time															
	t-5	t-4	t-3	t-2	t-1	**t=0**	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8	t+9	t+10
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	s	s	s	s	s	**s**	s	s	s	s	s	s	s	s	s	s
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Child Penalties in PIAAC (Single Cross Section)

▸ with controls ▸ first-time parents

Estimation from Kleven et al. (2019) adapted to international setting with single cross section:

$$Y_{it}^{g} = \sum_{j \neq -2} \alpha_j^g \, \mathbb{I}[j = t] + \sum_k \beta_k^g \, \mathbb{I}[k = age_i] + \mu_c + \nu_{it}^g$$

Challenge: single cross-section does not allow to account for time trends in outcomes (cohort differences)

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Figure: Any employment, PIAAC 2012

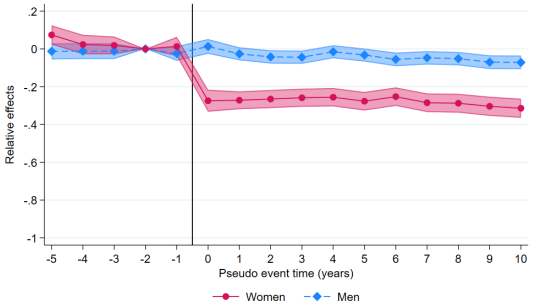
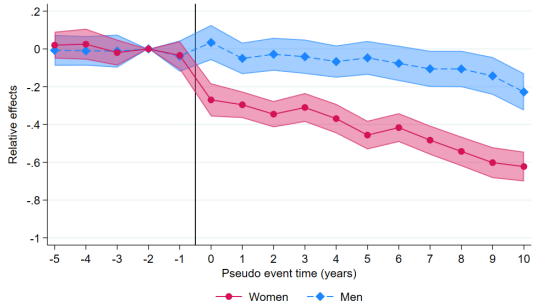


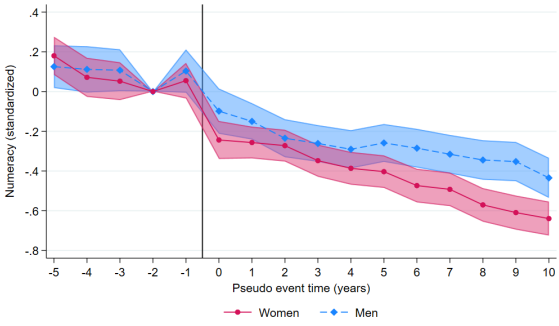
Figure: Monthly Gross Earnings, PIAAC 2012



Numeracy Skills (standardized) around Childbirth

literacy and problem-solving

Figure: Without controls, PIAAC 2012



estimation table

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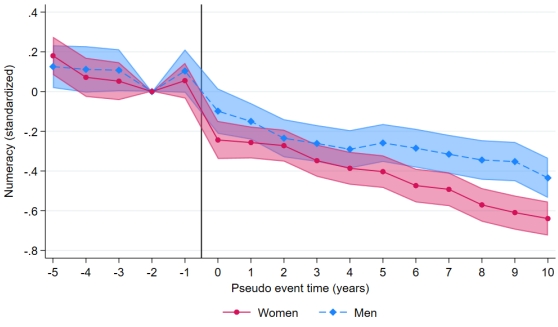

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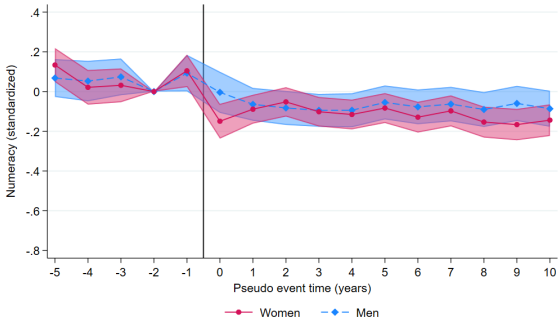
Figure: With controls, PIAAC 2012



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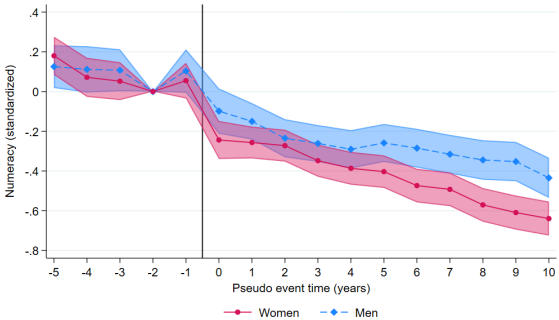

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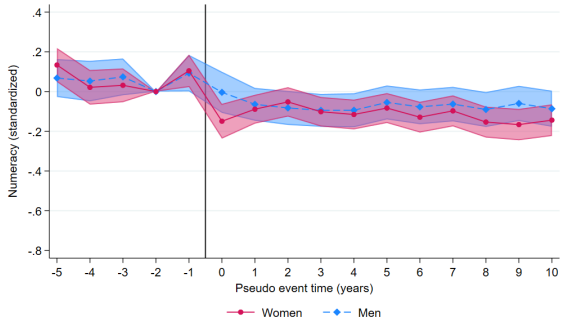

estimation table

- seem to be picking up time trends in education education cohorts cps edu
- selection into survey of young parents, differences in ages at first childbirth (Melentyeva, Riedel, 2023)
- results related to those of Hanushek et al. (2024)

Implications on skill (mis)match

- Build on Bandiera et al. (2024) to construct measures of skill requirements in occupations
- How does alignment of skill requirements and actual skills change?

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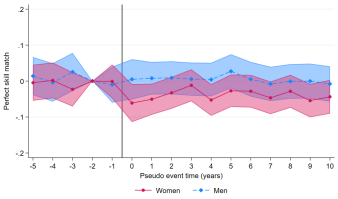

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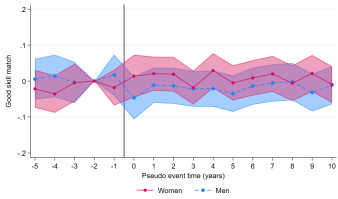

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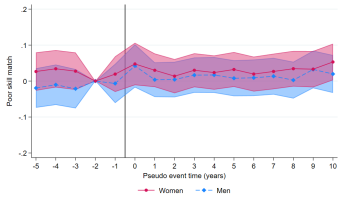

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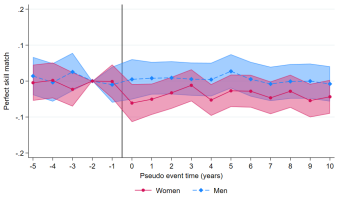

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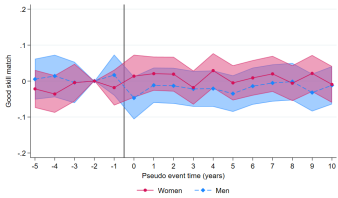

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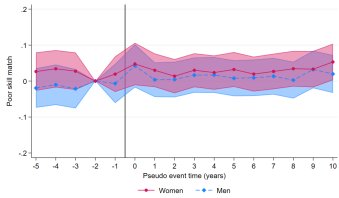

→ Weak evidence of a relative shift from *perfect* (same skill quintile) to *good* (one quintile apart) at the expense of mothers

How is numeracy use changing?

employed only

- PIAAC data captures to what degree skills are used at work and at home

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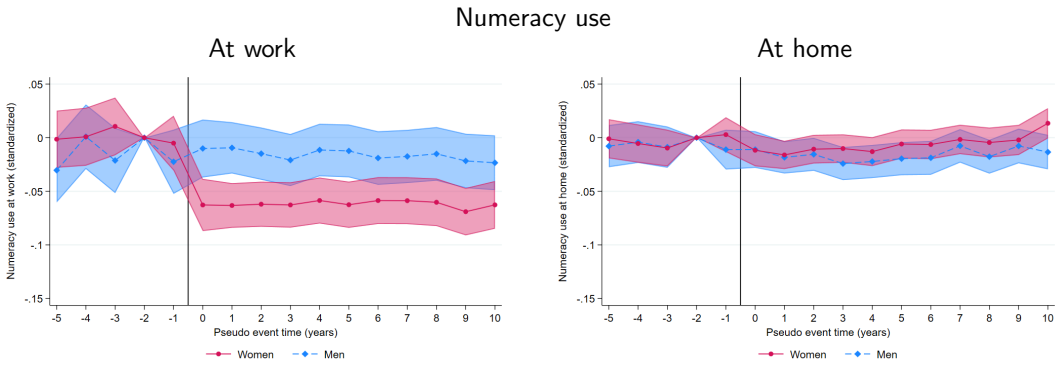

→ Despite reduced skill use at work for mothers, their skills don't deteriorate

Conclusion and Other Results

Takeaways:

1. No evidence for pronounced child penalties in labour market skills (despite employment drop)
2. Child penalties in labour market after childbirth cannot be explained by loss of general labour market-relevant human capital $\rightarrow$ role of occupation- and firm-specific skills?
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Other Results/Robustness:

- **Time-use data** to better understand mechanisms around survey behaviour (non-response, answer time potentially driven by stress/effort) graphs
- **Numeracy components**: actual responses graph; (non-)work-related graph
- Limited power to detect differences across countries

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Thanks a lot for your attention and your feedback!

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Descriptive Table PIAAC (I)

back

Country	Numeracy score		Age at first childbirth	
	Men	Women	Men	Women
Belgium	289	271	28	26
Chile	217	197	25	23
Czech Republic	280	270	26	23
Denmark	283	273	28	26
Ecuador	190	182	25	22
Estonia	276	270	25	23
Finland	288	277	28	26
France	260	249	28	25
Greece	256	249	30	25
Hungary	273	272	27	24
Ireland	262	250	28	26
Israel	258	246	28	25
Italy	253	241	30	26
Japan	294	283	30	27
Kazakhstan	247	247	26	24

Descriptive Table PIAAC (II)

back

Country	Numeracy score		Age at first childbirth	
	Men	Women	Men	Women
Korea	268	258	29	26
Lithuania	269	266	26	24
Mexico	215	207	25	23
Netherlands	288	272	30	27
New Zealand	278	266	28	26
Norway	286	271	28	25
Peru	187	172	26	22
Poland	259	258	27	24
Singapore	265	252	30	27
Slovak Republic	277	274	26	23
Slovenia	260	256	27	24
Spain	252	240	29	26
Sweden	284	272	28	26
United Kingdom	270	255	28	25
Total: 29	262	251	27	25

First-time Parents in PIAAC (I)

notes back

Country	Survey year	First-time parents	First-time mothers	First-time fathers	Median education	Live with partner	Born in country
Belgium	2011/12	29	14	15	4	0.95	0.90
Chile	2014/15	65	41	24	2	0.68	0.98
Czech Republic	2011/12	31	25	6	2	0.81	0.97
Denmark	2011/12	41	15	26	4	0.92	0.71
Ecuador	2017	25	17	8	2	0.73	1.00
Estonia	2011/12	35	21	14	2	0.93	0.86
Finland	2011/12	52	26	26	2	0.91	0.95
France	2011/12	62	36	26	4	0.93	0.95
Greece	2014/15	29	12	17	2	0.91	0.86
Hungary (A,W)	2017	100	66	34	2	0.71	0.86
Ireland	2011/12	15	8	7	2	0.92	0.93
Israel	2014/15	21	9	12	2	0.89	0.97
Italy	2011/12	37	24	13	3	0.78	0.78
Japan	2011/12	12	5	7	4	0.96	0.82
Kazakhstan	2017	28	15	13	2	0.92	0.92

First-time Parents in PIAAC (II)

notes back

Country	Survey year	First-time parents	First-time mothers	First-time fathers	Median education	Live with partner	Born in country
Korea	2011/12	58	31	27	4	0.93	1.00
Lithuania	2014/15	26	16	10	3	0.79	0.95
Mexico	2017	43	22	21	4	0.90	0.98
Netherlands	2011/12	34	22	12	3	0.80	0.99
New Zealand (A)	2014/15	75	38	37	1	0.77	1.00
Norway	2011/12	44	17	27	2	0.95	0.93
Peru (W)	2017	28	12	16	4	0.89	0.83
Poland	2011/12	30	18	12	3	0.77	0.71
Singapore (A,W)	2014/15	8	3	5	2	0.72	1.00
Slovak Republic	2011/12	49	31	18	2	0.89	1.00
Slovenia	2014/15	14	7	7	4	0.95	0.49
Spain	2011/12	19	14	5	2	0.92	0.99
Sweden (W)	2011/12	26	12	14	2	0.95	0.91
United Kingdom	2011/12	43	26	17	3	0.93	0.81
Total	29	1,079	603	476	2	0.85	0.90

Table notes first-time parents PIAAC

back

Notes: Education levels: 1-lower secondary or less, 2-upper secondary, 3-post-secondary/non-tertiary, 4-tertiary - professional degree, 5-tertiary - bachelor degree, and 6-tertiary - master/research degree; (A) denotes countries where individual age is only available in 5-year intervals, (W) indicates missing monthly earnings (Hungary, Peru, and Singapore) or monthly earnings only reported in deciles (Sweden).

PIAAC Numeracy

back

OECD PIAAC

Section _42

Unit 5 - Question 2/2

Look at the graph about the number of births. Click to answer the question below.

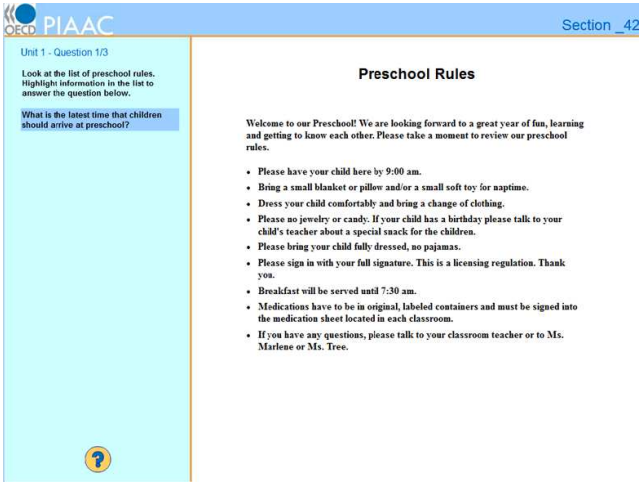
During which period(s) was there a decline in the number of births? Click all that apply.

- ☐ 1957 - 1967
- ☐ 1967 - 1977
- ☐ 1977 - 1987
- ☐ 1987 - 1997
- ☐ 1997 - 2007

The following graph shows the number of births in the United States from 1957 to 2007. Data are presented every 10 years.

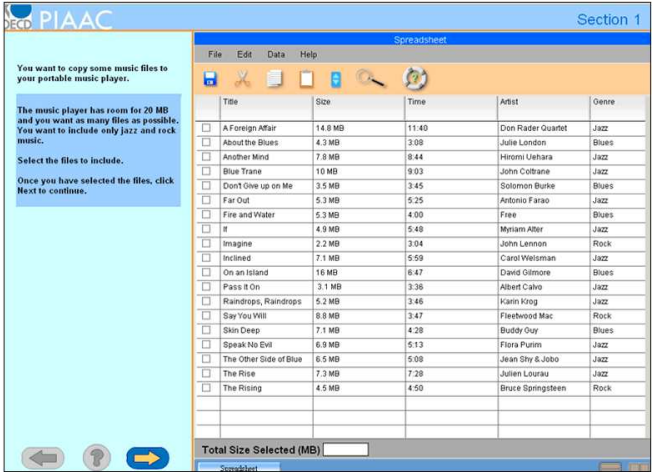
PIAAC Literacy

back



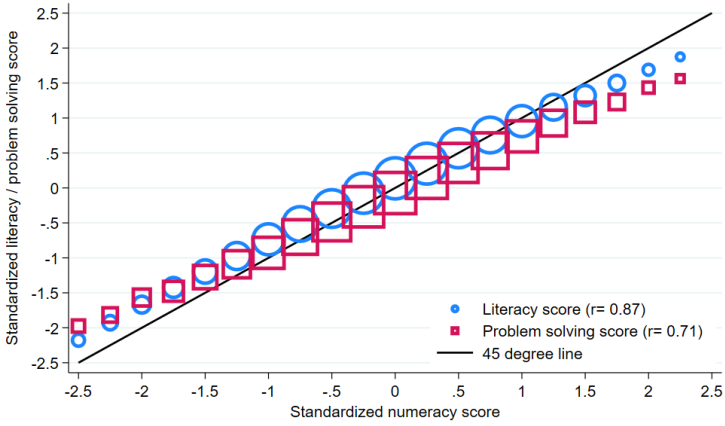
PIAAC Problem Solving

back



Correlation of PIAAC scores

back



Notes: Size of scatters indicates number of observations per bin. The correlation coefficient refers to the correlation between standardised numeracy score and the respective measures. If the scores were perfectly correlated ($r = 1$) all observations would lie on the 45 degree line. Source: PIAAC international PUF

The Evolution of Skills

back

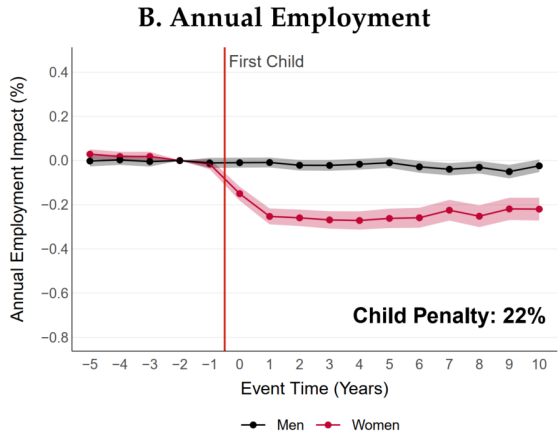
Skills: competencies you need to advance in a certain environment, e.g. the workplace, rather than innate ability

- Skill production during education influenced by many factors (Hanushek, 1986; Woessmann, 2016)
- Depreciation of skills if not used (Edin, Gustavsson, 2008; Ortego-Marti, 2017; Dinerstein et al., 2022)
- Parenthood affects stress & sleep (Parfitt, Ayers, 2014) which has impact on cognitive functioning (Pilcher, Huffcutt, 1996; Minkel et al., 2012; Duarte-Guterman et al., 2019; Orchard et al., 2023)

Child penalties in adult skills not as obvious since skill depreciation might/should not be immediate

- Some evidence on skill depreciation during unemployment (Cohen et al., 2023; Dinerstein et al., 2022), but unemployment $\neq$ parenthood (without employment)

Results for Repeated Cross Sections (Annual Employment, Source: Kleven (2023))



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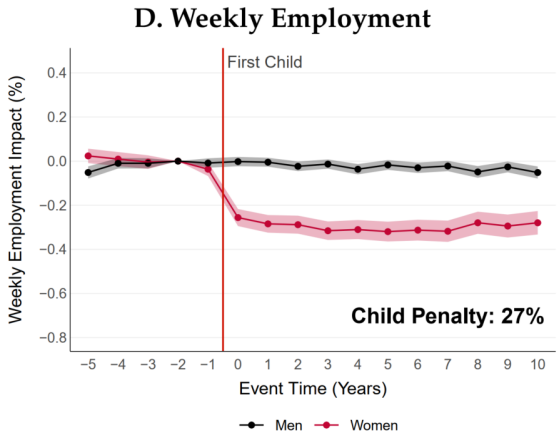
Results for Repeated Cross Sections (Weekly Employment, Source: Kleven (2023))



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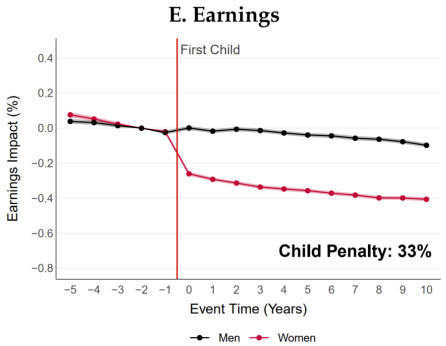
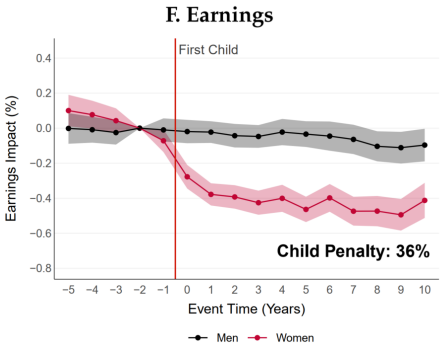
Panel vs Repeated Cross-Section

back





annual employment

weekly employment

Expansion to Single Cross Section

back

Validation with German SOEP data

- matching on gender, Abitur (yes/no), married (yes/no), born in Germany (yes/no), East Germany (yes/no) *in the same survey year*
- estimate event study regression with event and age dummies only, by gender; cluster SEs on individual level

Figure: Monthly Gross Earnings, SOEP 1995-2020

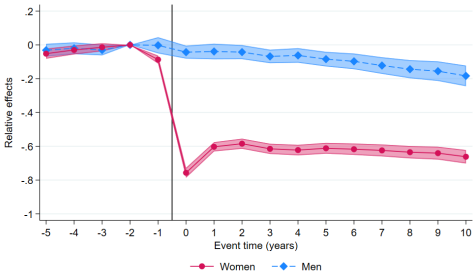
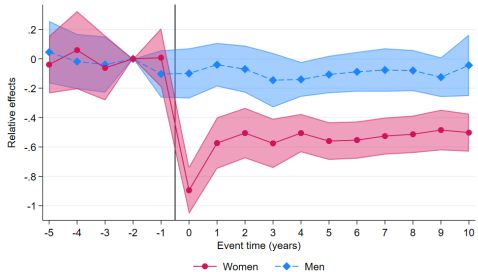


Figure: Monthly Gross Earnings, SOEP 2014



Employment
Pseudo-Panel Earnings
Pseudo-Panel Employment

Expansion to Single Cross Section

back

Validation with German SOEP data

- matching on gender, Abitur (yes/no), married (yes/no), born in Germany (yes/no), East Germany (yes/no) *in the same survey year*
- estimate event study regression with event and age dummies only, by gender; cluster SEs on individual level

Figure: Monthly Gross Earnings, SOEP 1995-2020

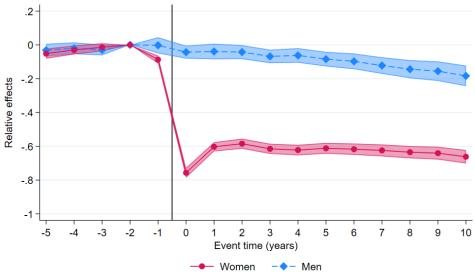
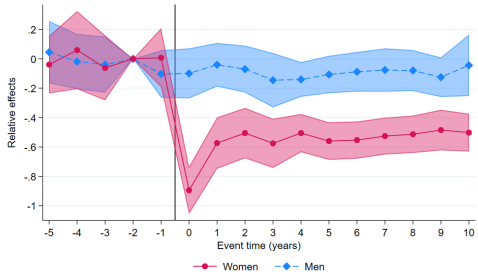


Figure: Monthly Gross Earnings, SOEP 2014



Employment
Pseudo-Panel Earnings
Pseudo-Panel Employment

Validation for Repeated Cross Sections (Monthly Gross Earnings, SOEP)

Figure: SOEP 1995-2020 as panel

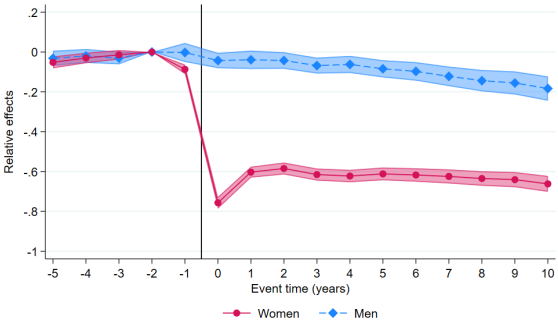
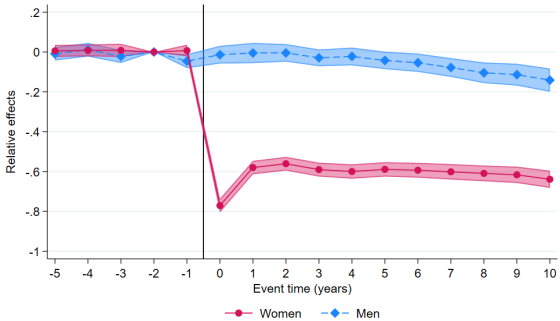


Figure: SOEP 1995-2020 as repeated cross-sections



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Validation for Repeated Cross Sections (Employment, SOEP)

Figure: SOEP 1995-2020 as panel

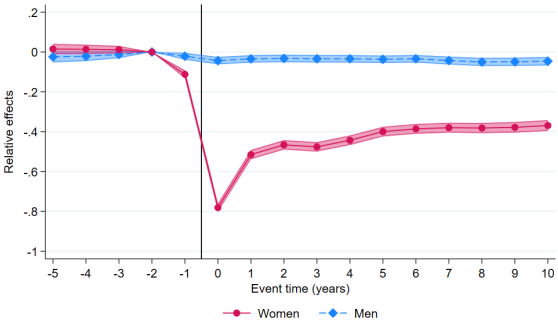
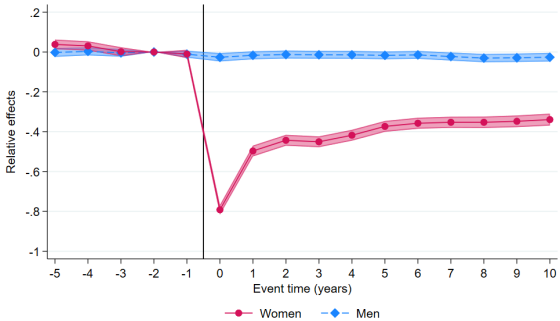


Figure: SOEP 1995-2020 as repeated cross-sections



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Validation of Single Cross Section with SOEP data, Any Employment

Figure: Any Employment, SOEP 1995-2020

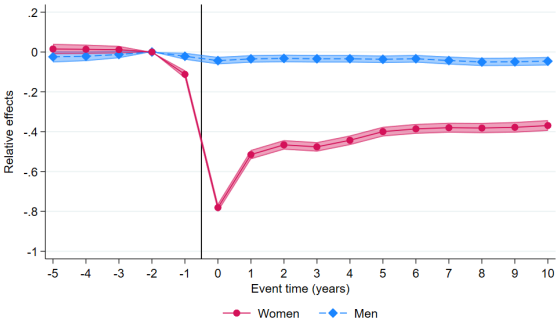
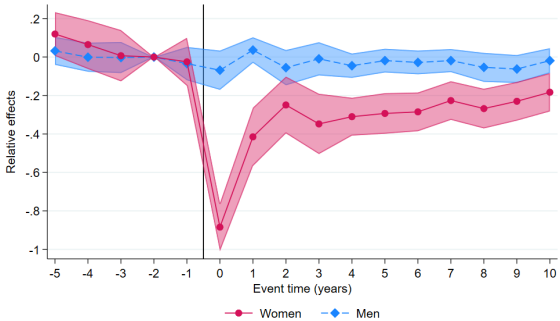


Figure: Any Employment, SOEP 2012



back

Validation with PIAAC, including controls

back

Figure: Any employment, PIAAC 2012

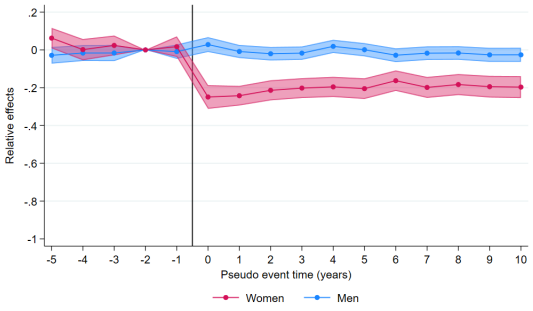
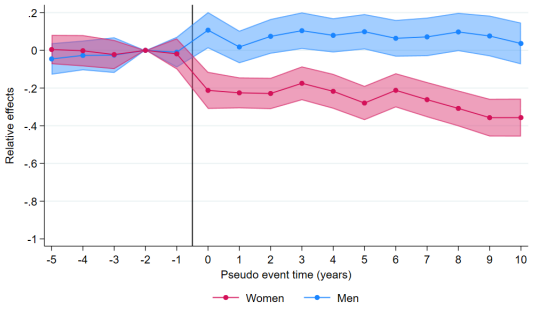


Figure: Monthly Gross Earnings, PIAAC 2012



Summary estimates for effect on numeracy skills (no controls)

back

	(1) Men	(2) Women	(3) Men-Women
Pre-birth	0.0711*	0.0525*	-0.0186
	(0.0366)	(0.0310)	(0.0480)
Short-term effect	-0.2536***	-0.3403***	-0.0867**
	(0.0321)	(0.0264)	(0.0415)
Long-term effect	-0.3536***	-0.5476***	-0.1940***
	(0.0337)	(0.0278)	(0.0437)
Observations	14,824	18,700	33,524

Notes: Table shows summary estimates for child penalties in numeracy scores corresponding to event-time coefficients. The pre-birth periods covers event-time -5 to -3, the short term effect is 0 to 4 years, and the long-term effect 5 to 10 years. The two years before birth is the omitted category. Source: PIAAC international PUF

Summary estimates for effect on numeracy skills (with controls)

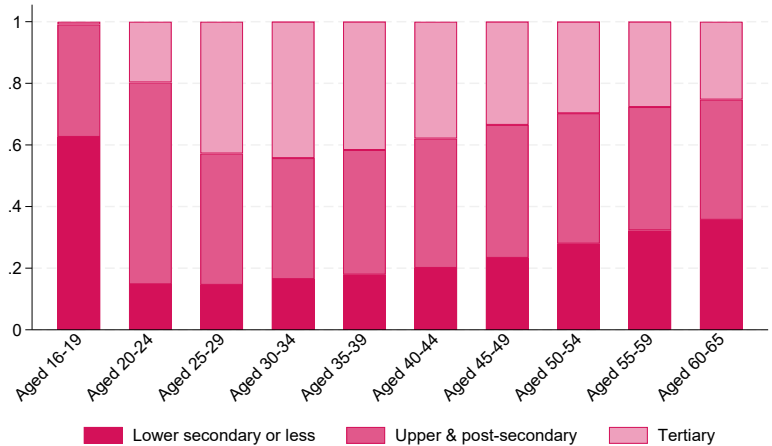
back

	(1) Men	(2) Women	(3) Men-Women
Pre-birth	0.0287	0.0162	-0.0125
	(0.0320)	(0.0283)	(0.0426)
Short-term effect	-0.1408***	-0.1566***	-0.0158
	(0.0281)	(0.0247)	(0.0374)
Long-term effect	-0.1406***	-0.1980***	-0.0574
	(0.0297)	(0.0265)	(0.0398)
Observations	13,624	17,689	31,313

Notes: Table shows summary estimates for child penalties in numeracy scores corresponding to event-time coefficients controlling for education, living with the partner, and being born in the country. The pre-birth periods covers event-time -5 to -3, the short term effect is 0 to 4 years, and the long-term effect 5 to 10 years. The two years before birth is the omitted category. Source: PIAAC international PUF

Cohort differences in education

back



Literacy and problem-solving skills (standardized) around childbirth

Figure: Literacy, PIAAC 2012

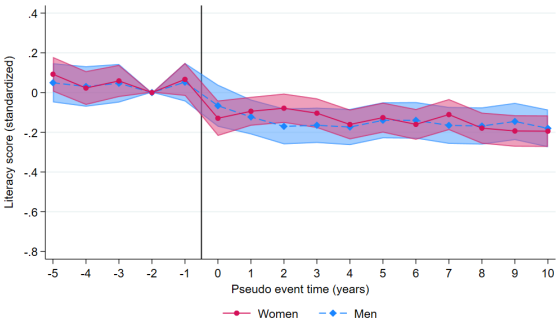
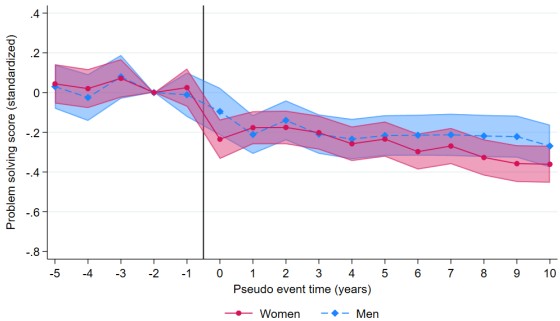


Figure: Problem-solving, PIAAC 2012



back

Child Penalty in Education

▸ live with partner ▸ back

Figure: Education secondary or less, PIAAC 2012

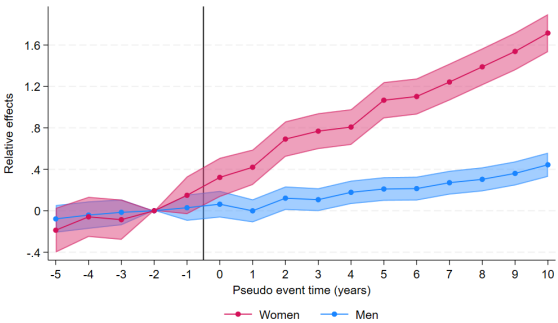
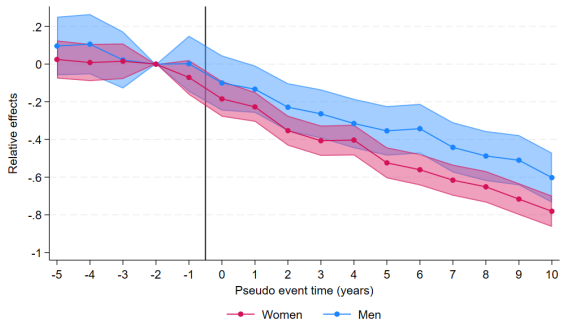


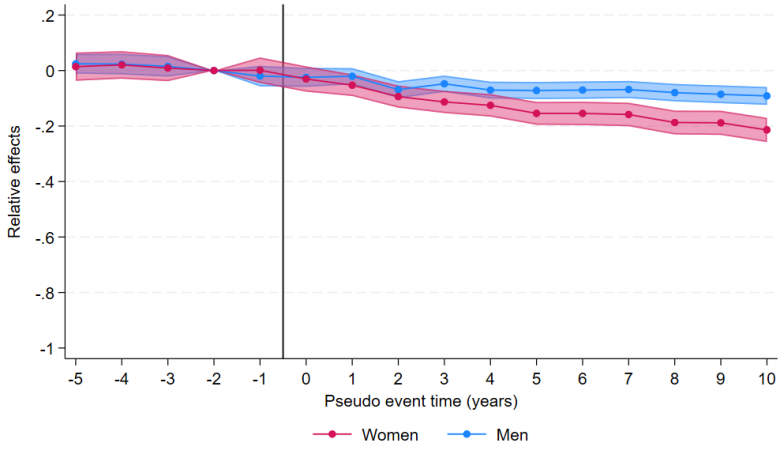
Figure: Tertiary education (bachelor or master), PIAAC 2012



Child Penalty in Cohabitation

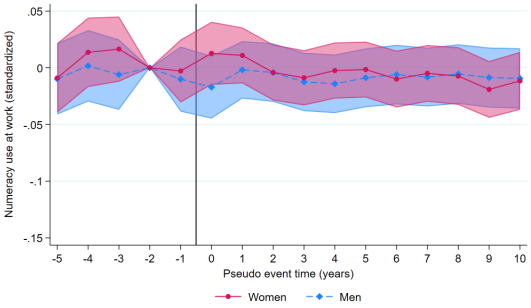
back num back edu

Figure: Living with their partner (0/1), PIAAC 2012

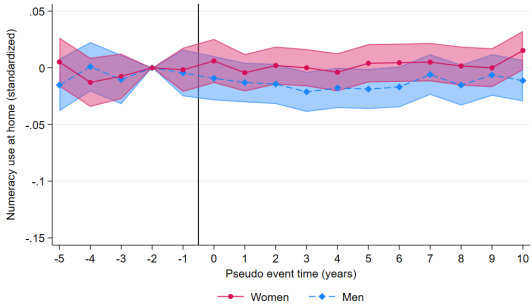


Child Penalty in Numeracy Skill Use – Employed

back



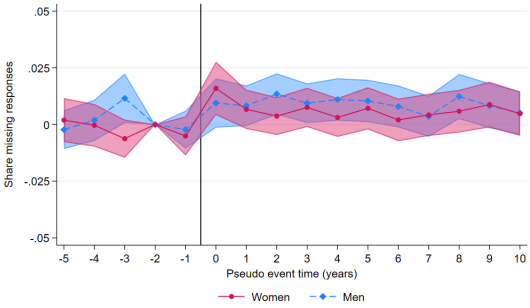
Numeracy use at work (employed, with controls)



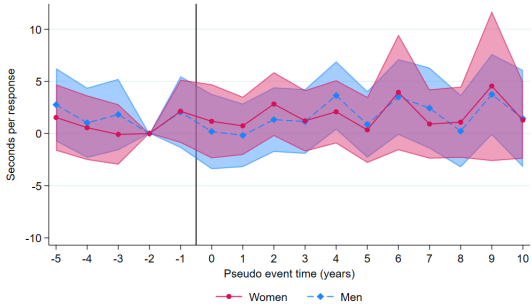
Numeracy use at home (employed, with controls)

Child Penalty in Response Behavior

back



Share of numeracy questions left unanswered (with controls)

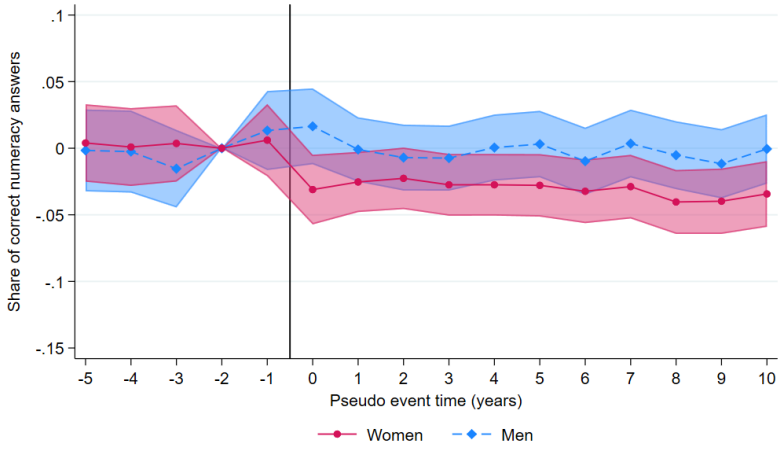


Average time per numeracy question (in seconds, with controls)

Child Penalty in Actually Answered Numeracy Questions

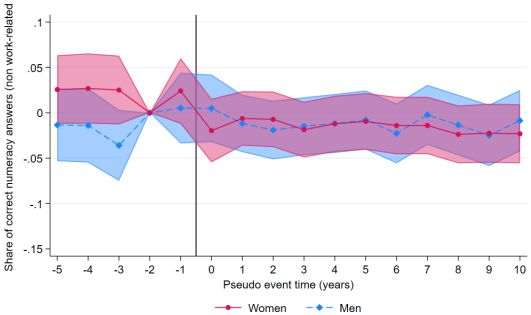
back

Figure: Numeracy score of actual responses (with controls)

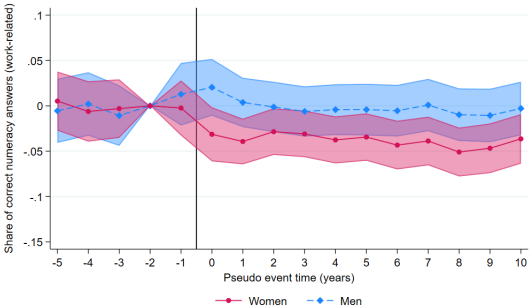


Child Penalty in Numeracy Score Components

back



Numeracy score in non-work related questions (with controls)



Numeracy score in work-related questions (with controls)