Child-Related Earnings Gaps in Germany

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10th Annual MannheimTaxation Conference

September 2023

Recent Debate

Topic: Impact of childbirth on earnings inequality



A family during a picnic in Stockholm. Researchers say that if men took on more child car responsibilities, it could help shrink the gender pay gap.

Recent Debate

Topic: Impact of childbirth on earnings inequality



Recent Debate

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Conclusion: Gender inequalities arise after the birth of the first child

Kleven et al. (2019): Child Penalties in Denmark

Topic: Impact of childbirth on earnings trajectories



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Note 1: Gaps do not necessarily reflect discrimination \Rightarrow Child-related Earnings Gaps (CREGs)

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Note 2: Gaps reflect extensive and intensive margin decisions

Question: What about other countries?

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Child-related earnings gap (CREG): Percentage by which women's earnings fall behind men's earnings due to children



Source: Kleven et al. (2019, AER P&P). Period: 90th-00s

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Q1: Have the German gaps always been that large?

Question: What about other countries?

Child-related earnings gap (CREG): Percentage by which women's earnings fall behind men's earnings due to children



Source: Kleven et al. (2019, AER P&P). Period: 90th-00s

Q2: Why are the German gaps so large?

Question: What about other countries?

Child-related earnings gap (CREG): Percentage by which women's earnings fall behind men's earnings due to children



Source: Kleven et al. (2019, AER P&P). Period: 90th-00s

Q3: Are the German gaps the result of policy choices?

Question: What about other countries?

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Source: Kleven et al. (2019, AER P&P). Period: 90th-00s

Q3: So could we counteract them with policy (if we wanted to)?

Question: What about other countries?

Child-related earnings gap (CREG): Percentage by which women's earnings fall behind men's earnings due to children



Source: Kleven et al. (2019, AER P&P). Period: 90th-00s

Q4: Or is inequality driven by factors outside the government's control?

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Result IV: The 2007 Parental benefit reform instead reduced gender inequality

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- 2. studies if family policies are drivers of gaps

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And: Female labor supply

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Focus: Impacts of single policies

And: Female labor supply

Our paper...

- 1. changes the outcome: child-related gaps
- 2. also estimates dynamic impacts on earnings trajectories
- 3. explicitly focuses on inequality
German Setting

A gender-unequal setting

- Third-largest unadjusted gender wage gap in Europe (21%)
- Largest child-related earnings gap (60%)

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Substantial variation in the CREGs over time

 $\rightarrow\,$ Allows us to explore whether policy reforms contributed to these changes.

Data

Data

First data set: monthly administrative pension register data

- Mandatorily insured citizens who are older than 14 and born after 1935
- Information on monthly earnings, 1949-2018, $\approx 0.5\%$ sample
- Data for West and East Germany, even before reunification (Source: GDR's social security records)

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Second data set: yearly administrative income tax data

- All taxpayers
- Information on yearly earnings, 2001-2014, 5% sample
- Data for West and East Germany



Estimation Strategy

Estimation Strategy

Approach: Use the standard estimation strategy to enable direct comparisons (Kleven et al. 2019)

Step 1: Estimate impact of the first child on mothers' trajectories using event studies (ES): (Angelov et al. 2016; Kleven et al. 2019)

$$Y^{\mathsf{w}}_{iyj} = \sum_{j
eq -12} lpha^{\mathsf{w}}_{j} \cdot \mathbb{1}[\mathsf{Birth}\; j \; \mathsf{periods}\; \mathsf{away}_{iy}] + u_{iyj}$$

- Y_{iyi}^{w} reflects gross earnings of *i* in month *y* at time *j* relative to birth
- $\hat{\alpha}_1^w = -100$: Mothers earn, on average, 100 Euro less (j = 1)

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Identification

- If the average earning path is smooth w/o children, then α s identify the impact of children
- Relax assumption: Use age and year dummies to control for lifecycle and business cycle effects
- Relax assumption: Use men or women w/o children as comparison group. Then: common trends

Details: Methodology

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Potential Concern

- The fertility decision is not random
- But: The results are robust to using IV strategies (twin or sibling-sex mix)

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Step 3: Estimate for each event time *j* the CREG (also: child penalty):

 $\hat{P}_j = \frac{\text{Mothers' additional earnings loss in }j}{\text{Mothers' countf. earnings absent children in }j} = \frac{\hat{\alpha}_j^c - \hat{\alpha}_j^w}{E[\tilde{Y}_{ijj}^w]j]}$

Result I:

The Current Child-Related Earnings Gaps Are Substantial



Child-Related Participation Gap in Germany



1. The current child-related earnings gaps are substantial

- Earnings gap: 60%
- Participation gap: 49%

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2. No equivalent effects for fathers

- No impact on fathers' earnings
- No impact on fathers' participation decisions

Fathers

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- Earnings gap: 60%
- Participation gap: 49%

2. No equivalent effects for fathers

- No impact on fathers' earnings
- No impact on fathers' participation decisions

3. There is some heterogeneity

- CREGs in West Germany are much larger than in East Germany
- CREGs strongly increase in the number of children
- CREGs decrease in mothers' education

Turners



Result II: The CREGs Increased Over The Last Decades

Child-Related Earnings Gap in West Germany in the 1960s



P(Work = 1|j = -12): 65.9%





P(Work = 1|j = -12): 68.3%





Result: Delay of re-entry and larger short-run gap





Child-Related Earnings Gap in West Germany in the 2000s



Result: Even more extreme patterns in the 00s

Child-Related Earnings Gap in West Germany in the 2000s



Note: Not only composition effects. Increases w/n subgroups

- 1. From the 1960s to the 2000s, later re-entry and larger short-run gaps
- 2. But also larger long-run gaps

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Question 1: What does the increase in the CREGs imply for overall gender inequality?

- 1. From the 1960s to the 2000s, later re-entry and larger short-run gaps
- 2. But also larger long-run gaps

Question 1: What does the increase in the CREGs imply for overall gender inequality?

Question 2: Did policy reforms drive the gap's increase?
Result III: Decomposing Overall Gender Inequality

Question 1: What does the increase in the CREGs imply for overall gender inequality?

Overall gender gap in earnings in calender month *y*:

$$\Delta_{y} \equiv \underbrace{\frac{E[Y_{ijj}^{m}|y] - E[Y_{ijj}^{w}|y]}{E[Y_{ijj}^{m}|y]} \cdot 100}_{E[Y_{ijj}^{m}|y]}$$

Perc. by which females earnings fall behind males earnings

Example: $\Delta_y = 80$ implies that women earn 80% less than males

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Gender gap without children (residual gender gap):

$$ilde{\Delta}_{y} \equiv rac{\mathcal{E}[Y_{iyj}^{m}|y] - \mathcal{E}[ilde{Y}_{iyj}^{w}|y]}{\mathcal{E}[Y_{iyj}^{m}|y]} \cdot 100,$$

where \tilde{Y}_{ijj}^{w} are predicted earnings without children (i.e., setting event dummies to zero). Assumption: No penalties for males

Child-related gender gap in earnings:

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where γ_{yj} measures the fraction of mothers who are at event time j in month y

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where γ_{yj} measures the fraction of mothers who are at event time j in month y

Message: Δ_v^c depends on P_{yj}

Derivation

Focus: Sample of all people aged 20 to 40 in pension register data between 1976 and 2018



Figure: Decomposition of gender gap in earnings



Result: Overall gap decreased from 70.5% to 56.2%



Result: Child-related gender gap heavily increased from 13.4% to 42.3%



Result: Ratio of child-related to overall gap increased from 18.9% to 75.2%



Result: As a result, w/o children, the gender gap would have been only 13.9%

Taking Stock

1. Contribution of child-rel. gen. gap to overall gap heavily increased over the decades

Result III: The Role of Policies

Question 2: Did policy reforms drive the child-related earnings gap's increase?

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Two candidates:

- Parental leave reforms
- Parental benefit reforms

Parental Leave and Benefit Reforms

Goal: Identify effects of parental leave and benefit extensions on CREGs

Further Details

Parental Leave and Benefit Reforms

Goal: Identify effects of parental leave and benefit extensions on CREGs **Exploit** a series of leave and benefit reforms (Ludsteck and Schönberg 2014) **Key feature:** Eligibility depends on date of birth \Rightarrow Dynamic RDD

	Leave Period	Parental Benefits
before	2m	750 DM
Jul. 1979	бт	
Jan. 1986	10m	
Jan. 1988	12m	
Jul. 1989	15m	600 DM
Jul. 1990	18m	
Jan. 1992	36m	18 × 600 DM
Jan. 1993	36m	12×900 DM or 24×600 DM
Jan. 2007	36m	12 imes 65-100% of pre-birth net earnings

Candidate 1: Parental Leave reforms

Idea: Use a dynamic RDD to identify effects of PL extensions on CREGs

Illustration: Two exemplary PL reforms in 1979 and 1986

I	_eave Period	Parental Benefits
before	2m	750 DM
Jul. 1979	бт	
Jan. 1986	10m	I

The Impact of the 1979 Reform (2 to 6 Months)



The Impact of the 1979 Reform (2 to 6 Months)



The Impact of the 1986 Reform (6 to 10 Months)



The Impact of the 1986 Reform (6 to 10 Months)



The Joint Impact of PL Reforms on Gender Inequality



The Joint Impact of PL Reforms on Gender Inequality



Total effect: Taken together, the PL reforms increased CREGs by 4.7 pps (\approx 12.8%)

Aggregated Lifects

The Joint Impact of PL Reforms on Gender Inequality



PL reforms account for 20% of increase in CREGs in 1976-2005 (33% of increase 1976-1994)

forms Aggregated Effects

Candidate 2: Parental Benefit Policies

Idea: Use a dynamic RDD to identify effects of the 2007 parental benefit reform on CREGs

36m	12×450 Euro or $~24\times300$ Euro
36m	$12 \times 65-100\%$ of net earnings in 12 pre month (300-1800 Euro)
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Further Details Estimation

Note: About 73% of couples benefit from this reform (Cygan-Rehm 2016)

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Goal: Counteract long absences from the workplace

The Impact of the 2007 Parental Benefit Reform



The Impact of the 2007 Parental Benefit Reform



The Impact of the PB Reforms on Gender Inequality



The Impact of the PB Reforms on Gender Inequality



Reform Effect: The Parental Benefit reform decreased CREGs in 2018 by 2.8 pps ($\approx 6.5\%$).

The Impact of the PB Reforms on Gender Inequality



Without PB reform, CREGs would have increased by 23% more between 2000 and 2018.

Taking Stock

1. Parental leave and benefit policies impact re-entry decisions and CREGs

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- 2. PL reforms led to later re-entry and implied higher CREGs in the short run
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- 1. Parental leave and benefit policies impact re-entry decisions and CREGs
- 2. PL reforms led to later re-entry and implied higher CREGs in the short run

3. The PB reform led to earlier re-entry and implied lower CREGs in the short and long run

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Result IV: The 2007 Parental benefit reform instead reduced gender inequality

Thank you!

Appendix

German Context

Parental leave and benefits

- Parental leave: extended from 2 to 36 months between 1979 and 1992
- Parental benefits: during parental leave parents are entitled to parental benefits; lump sum (before 2007); 65%-100% of net earnings (after)

Context

Type: Maternity leave and benefits reform

Cutoff: 31. Jun. 1979

Leave	before	after
Work ban	2m	2m
Job Protection	4m	8m
Maternity leave		бт
Compensation		
Salary compensation	2m	2m
Maternity benefit (after salary comp.)		750 DM; 4m

Reforms

Type: Parental leave and benefits reform

Cutoff: 31. Dec. 1985

Leave	before	after
Job Protection	8m	10m
Maternity leave	бm	
Parental leave (family)		10m
Compensation		
Maternity benefits (after salary comp.)	510 DM; 4m	
Parental benefits (after salary comp.)		600 DM; 8m

Cutoff: 31. Dec. 1987

Leave	before	after
Job Protection	10m	12m
Parental leave (family)	10m	12m
Compensation		
Parental benefits (after salary comp.)	600 DM; 8m	600 DM; 10m



Type: Parental leave and benefits reform

Cutoff: 30. Jun. 1989

Leave	before	after
Job Protection	12m	15m
Parental leave (family)	12m	15m
Compensation		
Parental benefits (after salary comp.)	600 DM; 10m	600 DM; 13m



Type: Parental leave and benefits reform

Cutoff: 30. Jun. 1990

Leave	before	after
Job Protection	15m	18m
Parental leave (family)	15m	18m
Compensation		
Parental benefits (after salary comp.)	600 DM; 13m	600 DM; 16m



Cutoff: 31. Dec. 1991

Leave	before	after
Job Protection	18m	36m
Parental leave (family)	18m	36m
Compensation		
Parental benefits (after salary comp.)	600 DM; 16m	600 DM; 22m



Type: Parental leave and benefits reform

Purpose: counteract long absence from work

Eligibility: depends on date of birth (cutoff: Dec. 2000) and family net income during leave (< 60.000 DM)

Leave	before	after
Parental leave	36m	36m
Right to work part time		\leq 30h
Joint leave of mother and father		Yes
Re-schedule leave		3-8 year after birth
Compensation		
Parental benefits	600 DM; 24m	12×900 vs 24×600 DM

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Type: Parental benefits reform

Purpose: counteract long absence from work

Eligibility: depends on date of birth (cutoff: Dec. 2006) and worked hours (less than 30)

Compensation	before	after
Parental benefits	12x450 vs 24x300 Euro	65-100% of net earnings in 12 pre-birth month 12x300-1800 Euro



Schedule

- Less than 1.000 Euro: 67 100%
- 1.000 euros to 1.200 euros: 67%
- 1.200 euros to 1.240 euros: 67 65%
- More than 1.240 euros: 65% (up to maximum of 2.770 euros)

Reforms

Dataset 1: Pension Register Data (PRD)

Data Type

• Monthly administrative pension register data

Sample

- 1949-2018
- Mandatorily insured Germans, aged 14-66, and born 1935 and after Between 1,000 and 3,5000 females per birth cohort

Content

• Occupational biographies

Special Features

- Will be matched with GSOEP
- Contains data for the former German Democratic Republic; Source: GDR's social security records
- Children can be only matched to women

Dataset 2: German Taxpayer Panel (TPP)

Data Type

• Yearly administrative tax (panel) data

Sample

- 2001-2014
- 5% of taxpayers; universe for selected specifications

Content

• Information relevant for the tax assessment

Special Features

- Children can be matched to mothers and fathers
- Regional identifiers

Empirical Strategy: Control Group

Estimate same equation for women without kids

Problem: There is no birth (i.e., no event)

Approach

- Assign a placebo birth to each childless woman by drawing an artificial age at birth from the empirical age \times education distribution
- Estimate event study based on placebo birth events

Details

- 1. Consider mothers' birth \times education groups separately
- 2. Approximate age at first birth A by log-normal within each group $A_c \sim \mathcal{LN}(\hat{\mu}_c, \hat{\sigma}_c^2)$
- 3. Assign artificial age at birth as random draw from this distribution
- 4. Estimate event study

Empirical Strategy: Further Details

1. Calculate child-related earnings gap at *j*:

$$P_j = \hat{\alpha}_j^c - \hat{\alpha}_j^w$$

- Example: $\hat{\alpha}_1^c = -100$ and $\hat{\alpha}_1^w = -500$, then $P_1 = 400$
- 2. Predict counterfactual earnings absent children at j (setting event dummies to zero): $E[\tilde{Y}_{ijj}^{w}|j].$
- **3.** Calculate child penalty at *j*:

$$P_j = rac{\hat{lpha}_j^c - \hat{lpha}_j^w}{E[ilde{Y}_{iyj}^w|j]}$$

• Percentage of counterfactual income that mothers lose relative to childless women

Results

TPP: Earnings Gap in West Germany



Summary

TPP: Participation Gap in West Germany



Baseline probability to work: 86.3%

Summary

TPP: Earnings Gap in East Germany





TPP: Participation Gap in East Germany



Baseline probability to work: 86.4%

Summary



Participation Gap: West vs. East



Earnings Gap: One Child Birth period: 1993m1-2008m12 20in month *j* in percent) 0 -20-∆Earnings i (effect size i -40--60--80 -100--12 12 84 108 36 60 -36 Event month *j* relative to birth --- One child

Earnings Gap: Two Children





Earnings Gap: More Than Two Children



Participation Gap: One Child



Participation Gap: Two Children



Participation Gap: More Than Two Children







Earnings Gap: Vocational & High School




Earnings Gap: University



Participation Gap: No Training



Participation Gap: Vocational & High School



Participation Gap: University



Participation Decision: West Germany

















Decade





Decomposition Framework

Child-related gender gap: Recall that we have $\tilde{\Delta}_y^c \equiv \Delta_y - \tilde{\Delta}_y$ and, hence,

$$\begin{split} \tilde{\Delta}_{y}^{c} &= \left[\frac{E[Y_{iyj}^{m}|y] - E[Y_{iyj}^{w}|y]}{E[Y_{iyj}^{m}|y]} - \frac{E[Y_{iyj}^{m}|y] - E[\tilde{Y}_{iyj}^{w}|y]}{E[Y_{iyj}^{m}|y]} \right] \cdot 100 \\ &= \frac{E[\tilde{Y}_{iyj}^{w} - Y_{iyj}^{w}|y]}{E[Y_{iyj}^{m}|y]} \cdot 100 \end{split}$$

Note: We can express $\tilde{Y}_{iyj}^w - Y_{iyj}^w$ as a function of the perc. penalty: $\tilde{Y}_{iyj}^w - Y_{iyj}^w = P_{yi} \cdot \tilde{Y}_{iyj}^w$

Consequently, we can reformulate the expression as:

$$ilde{\Delta}_y^c = rac{\sum_j \gamma_{yj} \cdot \mathcal{E}[\mathcal{P}_{yj} \cdot \widetilde{Y}_{iyj}^w | y, j]}{\mathcal{E}[Y_{iyj}^m | y]},$$

where γ_{yj} measures the fraction of mothers who are at event time j in month y

composition

Empirical Strategy: Parental Leave Reforms

Estimate impact of parental leave reforms on labor market trajectories

Goal: Estimate a model that combines RDDs and event studies

$$egin{aligned} &Y_{iyj}^{\mathsf{w}} = \sum_{j
eq -12} lpha_j \cdot \mathbbm{1}[\mathsf{Birth}\ j \ \mathsf{periods}\ \mathsf{away}] \ &+ \sum_{j
eq -12} eta_j \cdot \mathbbm{1}[\mathsf{Birth}\ j \ \mathsf{periods}\ \mathsf{away}_{iy}] imes \mathbbm{1}[\mathsf{Birth}\ \mathsf{after}\ \mathsf{reform}] \ &+ \mathsf{age}\ \mathsf{dummies} + u_{iyj} \end{aligned}$$

Notes: Choose the RDD window optimally (no overlap). Triangular weights. Present estimates relative to counterfactual $E[\tilde{Y}_{ivi}^w]j$, after reform]

Interpretation 1: RDD for each of the different "graphs" **Interpretation 2:** ES for before/after reform period

RDD Approach: Identifying Assumption



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RDD Approach: Identifying Assumption



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RDD Approach: Identifying Assumption



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Impact of 1979 Reform: Extension from 2 to 6 Months



Impact of 1979 Reform: Extension from 2 to 6 Months



Impact of 1986 Reform: Extension from 6 to 10 Months



Impact of 1986 Reform: Extension from 6 to 10 Months







Impact of 1988 Reform: Extension from 10 to 12 Months



Impact of 1989 Reform: Extension from 12 to 15 Months



Impact of 1989 Reform: Extension from 12 to 15 Months



Impact of 1990 Reform: Extension from 15 to 18 Months



Impact of 1990 Reform: Extension from 15 to 18 Months







Impact of 1992 Reform: Extension from 18 to 36 Months



Aggregated Significant Effects of All PL Reforms

