Human capital and parenthood: Does skill loss during parental leave explain gender gaps in earnings?

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This study provides a missing puzzle piece for understanding the persistent gender differences in earnings. Prior research has shown that the longer child-related career interruptions of mothers are related to their lower income, but the mechanisms behind this link are still unclear. One explanation could be that mothers lose work-related skills during extended parental leave; however, empirical evidence for this link is missing. We aim at filling this research gap by investigating whether human capital depreciation during parental leave widens the gender disparities in earnings. The analysis is based on a longitudinal dataset for German adults, which matches administrative data on income and labour market histories with test scores on work-related skills. It allows us to analyse tested competencies of parents before and after they go on parental leave. Our preliminary results suggest that the birth of a child decreases work-related skills for both women and men. Depending on the skill domain, the drop is much steeper for mothers than for fathers. We also show that longer parental leave is associated with lower work-related skills. To elicit the causal effect of parental leave on work-related skills and earnings, we will employ a regression discontinuity design that utilises a German parental leave reform from 2007 as a policy experiment. The findings will offer important insights for shaping parental leave policies and tackling skilled labour shortages.

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1 Introduction

Human capital is a major determinant of individual labour market outcomes. Differences in education, experience, health, and skills are frequently identified as main factors explaining disparities in income and employment. Recent evidence suggests that returns to work-related cognitive skills are particularly large. For example, a study on OECD countries found that a one-standard-deviation increase in numeracy or literacy skills raises wages by an average of 18% (Hanushek et al., 2015).

These work-related skills change throughout the life course (Reiter, 2022). Major life events – like the birth of a child – have the potential to alter them, at least tem-

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porarily. Test scores from the Programme for the International Assessment of Adult Competencies (PIAAC) Survey of Adult Skills suggest that parents have consistently lower numeracy, literacy, and problem-solving skills than childless adults (authors' calculation based on PIAAC data). Differences are most pronounced during childbearing ages and tend to be larger for women than for men. This pattern is in line with earlier research that found higher job-related skill scores among men compared to women (Christl & Köppl–Turyna, 2020; Rebollo-Sanz & De la Rica, 2022). It is unclear what drives this gap in human capital between parents and non-parents, and between mothers and fathers. Although often suggested, pregnancy alone cannot explain the drop in mothers' cognitive skills (Christensen et al., 2010); however, existing literature provides little evidence for alternative explanations.

One hitherto unexplored reason for the lower work-related skills of parents, in particular mothers, could be skill depreciation during parental leave.[1] This hypothesis is backed up by evidence from Sweden, which shows that time away from the job reduces cognitive skills and wages (Edin & Gustavsson, 2008). The literature on the gender wage gap has long suggested potential skill losses during prolonged parental leave as a mechanism for gender differences in earnings. However, there is no empirical evidence for a link between longer parental leave, human capital depreciation, and the lower income of women.

We fill this important research gap by answering the reserach question "Does skill loss during parental leave contribute to gender disparities in earnings?" We hypothesise that work-related skills decrease during parental leave and that the longer leave duration of women is one reason for the gender gap in job skills. We further hypothesise that gender differences in leave duration and subsequent human capital loss contribute to the gender gap in earnings.

The study takes a novel approach by analysing a matched dataset that combines detailed administrative data from Germany with test scores on work-related competencies from the German National Educational Panel Study (NEPS). Such test results are increasingly used to measure human capital, especially work-related cognitive skills like numeracy and literacy (Christl & Köppl–Turyna, 2020; Hanushek et al., 2015; Rebollo-Sanz & De la Rica, 2022). By adding register data to the tested skills data, we gain additional information on employment and income histories that are less prone to measurement error than self reports from surveys.

[1]For now, we use this term to refer to both maternity and parental leave.

Our findings will inform the ongoing discussion on the reconciliation of family and work across demography, economics, and other fields of research that evaluate family-related policies. Primarily, we contribute to the multidimensional evaluation of parental leave policies and their ambigious effects on the labour market outcomes of parents. Our research will help assessing statutory leave duration from a policymaker's perspective, who has to balance care and protection during significant life events, financial aspects, workforce productivity, and broader societal objectives such as gender equity.

This study is also highly relevant in light of demographic change and the current skill shortages across high-income countries. Exploiting existing human capital potentials is considered a promising strategy to address the shrinking skilled labour force. Here, increasing the labour market participation of mothers is often seen as an important lever. Our study will assess whether long parental leave has an impact that goes beyond the mere absence of skilled mothers, i.e. whether parental leave is linked to skill depreciation. The results may also prove important at the organisational level, where skill maintenance strategies are essential for companies to manage skill erosions during parental leave and other career interruptions.

2 Literature

This study expands several strands of literature in economics and demography. Most directly, it contributes to the multidimensional assessment of family-related policies and their ambiguous impact on parents' labour market outcomes. Evidence on the effect of parental leave duration on income and employment is inconclusive. Overall, shorter parental leave appears to have a positive impact on mothers' economic outcomes, while some studies find negative effects once parental leave is too long (Olivetti & Petrongolo, 2017). Relatedly, the longer career interruptions of mothers are crucial for explaining the gender wage gap (Blau & Kahn, 2017); although for Austria, Kleven et al. (forthcoming) find only a short-term negative impact on the motherhood penalty. However, even temporary drops in earnings may – depending on the pension system – result in lower income during retirement (Hammer et al., 2020).

Little is known about the mechanisms between longer parental leave and subsequent earnings. Here we focus on human capital depreciation during parental leave as one potential mediator between parenthood and income. Our study thus also contributes to the literature on the returns to human capital, which has traditionally been operationalised as formal education and later health status, but was then also extended to cognitive, non-cognitive (Heckman et al., 2006), and social skills. More recent work

in economics and demography measures human capital based on tested competencies (Lutz et al., 2021; Rebollo-Sanz & De la Rica, 2022; Reiter, 2022) and finds substantial returns to numeracy and literacy skills (Hanushek et al., 2015). Time away from the job, however, can erode skills and earnings (Edin & Gustavsson, 2008), which is why we believe that the hitherto unexplored link between parental leave duration and job skills may prove important for understanding the effect of child-related career interruptions on labour market outcomes.

This study also relates to the literature on the gender wage gap. Recent evidence based on tested skills found that the higher scores of men are important in explaining gender differences in wages (Christl & Köppl–Turyna, 2020; Rebollo-Sanz & De la Rica, 2022). However, none of this earlier work has investigated human capital depreciation during parental leave as a mechanism for gender differences in skills and subsequent income.

Finally, a recent paper by Kawaguchi and Toriyabe (2022) explored skill use in OECD labour markets. They found that longer statutory parental leave is associated with increased skill use for lower-skilled women, but with skill underutilisation for higher-skilled women. While they did not explore the relationship between parental leave and work-related skills directly, their results point towards an important link between family-related policies and human capital allocation.

3 Data

Our analysis is based on a rich dataset from NEPS, a nationally representative panel study designed to explore skill development, labour market trajectories, and fertility and family formation across the entire life course in Germany. In addition to a rich set of socio-demographic variables, NEPS provides test scores on competencies that adults need to advance at work, including mathematical competence, reading competence, scientific competence, and information and communications technology competence. These skill dimensions are increasingly used in the literature to measure human capital and to estimate its returns (Hanushek et al., 2015; Rebollo-Sanz & De la Rica, 2022). NEPS' longitudinal data structure allows us to investigate the participants' skills at different waves and thus before and after the birth of a child, and before and after they take parental leave. Our focus is on adults aged 20 to 45.

NEPS can be linked with administrative data on employment histories, including information on absence from work, earnings, and benefits, going back as far as to 1975.

Most importantly, the register data provides us with high-quality income data over the life course, which is more reliable than the self reports from surveys.

4 Empirical strategy

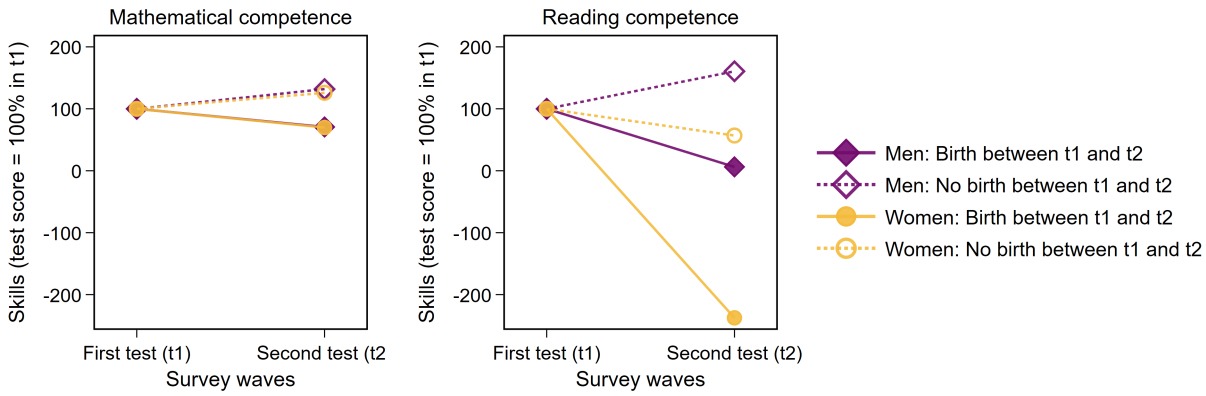
We investigating whether skill loss during parental leave widens the gender gap in earnings. We start by descriptively exploring how the birth of a child changes the work-related skills and earnings of mothers and fathers, and how the magnitude of these changes is related to the length of parental leave. We then go on to model changes in skill scores (Δskills) of individual i between two measurement points (t1 and t2) as a function of parental leave duration, previous skills (skills at t1), and a set of control variables X, thereby following Edin & Gustavsson (2008).

$$\Delta\text{skills}_i = \beta_0 + \beta_2\text{parental leave duration}_i + \beta_3\text{skills at t1}_i + \beta_4 X_i + \varepsilon_i \quad (1)$$

Δskills is either a dummy variable indicating an increase or decrease in skills between t1 and t2, or a continuous variable indicating the difference in skills between t1 and t2. Vector X includes gender, year of birth, age at childbirth, educational attainment, immigration status, and the number of children of individual i, as well as whether individual i has completed formal education or received additional training during their parental leave. We will also estimate this equation separately for women and men, and separately for parents that have their first child versus subsequent children. Using mediation analysis, we will explore how skill depreciation during parental leave affects subsequent earnings.

To estimate the causal effect of parental leave duration on work-related skills and subsequent earnings, we utilise the 2007 parental leave reform in Germany as a policy experiment. It reduced paid parental leave from two years to one year, thereby speeding up the labour market returns of German mothers (Bergemann & Riphahn, 2023). By comparing the skills and earnings of parents that had their children before the reform with those who had their children after the reform in a fuzzy regression discontinuity design, we will be able to elicit the causal effect of parental leave duration on human capital and earnings.

Figure 1: Changes in work-related skills after the birth of a child



Notes: This graph shows average test results on mathematical and reading competence across waves, i.e. at two different measurement points (t1 and t2). It differentiates between women and men that had a child between these two different measurement points (birth between t1 and t2), and those who did not (no birth between t1 and t2). The skill scores are set to 100% at t1. Source: NEPS

5 Preliminary results and outlook

This section provides preliminary results based on NEPS data. Figure 1 shows changes in work-related skills after the birth of a child. More specifically, it displays skill score changes across survey waves (t1 and t2) separately for women (yellow lines with round markers) and men (purple lines with diamond-shaped markers). It further differentiates between survey participants that had a child between the two testing points (solid lines) and those who did not (dashed lines). Skill scores are set to 100% at the first testing point (t1). For now, we focus on mathematical and reading competence, which yield the strongest returns on the labour market. The figure provides two main insights. First, in the short run, skill scores decrease for fathers and mothers after the birth of their child, while they remain constant or increase for women and men that did not have a child between t1 and t2. Second, gender differences in the development of work-related skills depend on the competence domain. While the decrease in mathematical competence is almost similar for mothers and fathers (overlapping lines in the left panel), the decrease in reading competence is much steeper for mothers than for fathers (right panel).

Table 1 provides work-related skills by parental leave duration. It shows how mathematical and reading competence differ between parents who take shorter leave of at most twelve months, and parents who take longer leave, between 13 and 60 months (German parents have one of the longest parental leave durations in all OECD countries). The skill scores used for this table are standardised. Negative values refer

Table 1: Work-related skills and parental leave duration

	Skill score (standardised)	Standard error
Mathematical competence (N = 2,706)		
Short parental leave (max. 12 months)	-0.011	(0.036)
Long parental leave (13-60 months)	-0.234	(0.027)
Difference	0.223	
Reading competence (N = 3,838)		
Short parental leave (max. 12 months)	0.113	(0.025)
Long parental leave (13-60 months)	0.080	(0.023)
Difference	0.033	

Notes: This table provides average skill scores for mathematical and reading competence of parents by length of parental leave. Skill scores are standardised – negative values refer to below-average values and positive values to above-average values in the main sample, which also includes non-parents. Source: NEPS

to below-average values and positive values to above-average values with respect to the full NEPS sample sample, which also includes non-parents, older, and younger cohorts. Parents with shorter parental leave have higher skill scores than parents that take longer parental leave. The differences is 0.223 standardised scores for mathematical competence and 0.033 standardised scores for reading competence.

While the results in Figure 1 and Table 1 back our hypothesis that children decrease work-related skills in the short run, and that parental leave duration might be an important mechanism for that link, the above findings are likely to suffer from confounding. For example, parts of the relationship between parental leave duration and work-related skills might be driven by educational attainment and lower-skilled individuals are likely to select into longer parental leave. To account for these endogeneity issues, we will employ a regression discontinuity design, using the 2007 parental leave reform as a policy experiment. This will allow us the estimate the effect of parental leave duration on human capital depreciation.We will not only explore the effect on mathematical and reading competence, but also additional competence domains, including scientific competence, and information and communications technology competence.

To explore if changes in work-related skills explain gender differences in earnings, we will further match NEPS with German administrative data on income and labour market histories. This study will thus not only contribute to the knowledge on human capital depreciation during career breaks, but also its role for the gender wage gap – a link that is frequently hinted at in the literature, but was never addressed directly. In addition, we investigate how a large parental leave policy affected the gender gap in both skills and earnings, which has wide-ranging implications for policymaking.

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