The Parental Wage Gap and the Development of Socio-emotional Skills in Children*

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Abstract

Converging labor market opportunities between men and women have changed the economic incentives for how families invest monetary and time resources into their children. In this paper I study the causal impact of changes in the parental wage gap on the socio-emotional development of children. I draw on administrative and survey data from Germany to construct potential wages for mothers and fathers through a shift-share design. In turn I investigate family responses to changes in these potential wages and the ensuing effects on children's socio-emotional skills by comparing siblings of the same age within the same families across different calendar years. I find that decreases in the parental wage gap lead to i) an increase of household's total financial resources, ii) an increase of financial resources controlled by mothers, and iii) an increase in the use of informal care providers. In spite of these changes, I find no effect on the socio-emotional development of children as measured by the Big Five inventory. These null effects are precise enough to exclude various effect sizes from other quasi-experimental interventions studied in the existing literature. In sum, my findings suggest that strides towards gender equality in the labor market do not necessarily come at the cost of detrimental effects on child development.

JEL-Codes: J13; J16; J22; J24
Keywords: Family Decision-Making; Human Capital Formation; Gender Wage Gap; Socio-emotional Skills

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1 INTRODUCTION

How does the expansion of labor market opportunities for women relative to men affect the socio-emotional development of their children? Throughout the post-World War II period, the convergence of wages and labor market participation rates of men and women has been a shared element of labor markets in many industrialized societies (Blau and Kahn, 2017; Olivetti and Petrongolo, 2016). In response to changing economic incentives, heterosexual couples with children have adjusted their time-use and spending patterns, henceforth leading to marked changes in the way they invest into the skill formation of their children (Aguiar and Hurst, 2007; Kornrich and Furstenberg, 2013). While these long-run trends are well-documented, there is currently no study that causally links the convergence of labor market opportunities across gender groups in the parental generation to the skill formation of children in the following generation.

In this paper, I study how changes in the parental wage gap influence the process of children's skill formation by focusing on socio-emotional skills as measured by the Big Five personality inventory.

My research design relies on two main features. First, I use the 2005–2017 waves of the German Socio-economic Panel (GSOEP) to construct a sample of $6,070$ siblings aged 2-17 for whom I observe measures of the Big Five inventory at the same age but in different calendar years. This sample allows me to implement a within-family sibling design (e.g. Løken et al., 2012) in which I rule out confounding effects through time constant factors that are specific to families when their children are of a particular age. For example, think of two families that have different preferences for the mother to stay home while their children are under school age. If the Big Five personality traits are affected by different care arrangements in this age period, a comparison across families would confound the effect of the parental wage gap on child development with family differences in childcare preferences. However, a focus on within-family variation rules out such confounding effects.

Second, comparisons across siblings at the same age may still reflect parental labor supply responses that are endogenous to the skill development of their children. For example, think of

a mother of two that responds to the behavioral problems of one of her children by switching to a lower paying but less time consuming job. If such an adjustment has a spillover effect on the skill development of her second child, the effect of intra-family changes in the parental wage gap on child development would be confounded by reversed causality. To circumvent such concerns, I draw on a shift-share design to construct potential wages that reflect variation in the sex- and education-specific labor demand across commuting zones in Germany (Goldsmith-Pinkham et al., 2020). The general idea of shift-share designs is to predict group-specific wages based on sectoral shocks ("shift") and the historic employment shares of sectors in the respective group ("share"). As a consequence of replacing actual wages with potential wages, within-family changes in the parental wage gap reflect temporal variation in the labor market incentives for mothers and fathers that is plausibly exogenous to within-family decision-making.

This study makes two contributions in relation to the existing literature. First, the production of child skills can be conceived as a function of monetary investments (Akee et al., 2018; Dahl and Lochner, 2012; Løken et al., 2012; Milligan and Stabile, 2011) and time investments by the parents (Del Boca et al., 2017; Del Bono et al., 2016; Fiorini and Keane, 2014; Hsin and Felfe, 2014).[1] The existing literature studies the provision of these resources by focusing on mothers as the primary caretaker and by-and-large neglects the dynamics of family decision-making within the context of two-parent households.[2] However, the investigation of these dynamics is important. Even in an age of declining marriage and increasing divorce rates, 73% (65%) of all German (US-American) children live in a household with their two married parents (Federal Statistical Office, 2020; Livingston, 2018). Furthermore, the well-documented changes in relative labor market incentives for men and women suggest strong shifts in how these households allocate monetary and time resources across various activities that potentially affect the skill development of their children. In this paper I close this gap by studying

[1]This stylized representation of the skill formation process focuses on the family context. It is incomplete as it omits other important input factors that are not directly linked to intra-family decision-making, including the quality of schools (Chetty et al., 2014; Jackson, 2019), neighborhoods (Agostinelli et al., 2020; Chetty et al., 2016) and individual natural endowments (Black et al., 2019; Papageorge and Thom, 2020). See Almond et al. (2018) and Heckman and Mosso (2014) for recent overviews.

[2]In particular the trade-off between the provision of monetary and time resources by mothers has garnered increased interest in the recent literature on child development (Agostinelli and Sorrenti, 2018; Nicoletti et al., 2020).

how changes in the relative wages of parents influence family decisions with respect to labor market participation and childcare arrangements, and the extent to which these choices have an influence on the skill development of their children. Closest to this ambition are the papers of Del Boca et al. (2014) and Bruins (2017). Del Boca et al. (2014) provide a structural model of child development in which both mothers and fathers provide time investments, the benefits of which are balanced against the financial resources generated through increased labor market participation. In contrast to their paper, I focus on the development of socio-emotional skills of children in Germany instead of the development of cognitive skills in the US. Bruins (2017) uses a shift-share design to investigate the impact of gender convergence on parental time investments. In comparison to her paper, I tighten the identification approach by combining the shift-share design with a within-family sibling comparison. Furthermore, while having more detailed information on parental time-use, her data sources do not avail measures of child development. Hence, in comparison to Bruins (2017) I provide direct evidence on how changes in the relative wages of parents affect the process of skill formation in their children.

Second, next to cognitive skills and health, socio-emotional skills are a dimension of human capital that matters for a variety of important life outcomes.[3] In view of this importance, social scientists have dedicated increased attention to the causal factors that underlie the formation of these skills. In the context of families, these factors include the home environment (Carneiro et al., 2013), monetary resources (Akee et al., 2018), parental time investments (Agostinelli and Sorrenti, 2018) and parenting styles (Deckers et al., 2020). In this paper, I contribute to this literature by investigating how changes in the relative labor market incentives for mothers and fathers influence the socio-emotional development of children as measured by the Big Five inventory (Widiger, 2018).

Guided by a stylized model of collective household decision-making, my empirical analysis proceeds in three steps. First, I analyze the labor market adjustments of households in response

[3]The exact definition of socio-emotional skills is contested (Humphries and Kosse, 2017). They are oftentimes interpreted as a residual dimension of skills not captured by test scores and may include various economic preferences as well as personality traits. In this work I draw on the Big Five personality taxonomy to measure socio-emotional skills. Among others, recent work analyzes the impact of the Big Five personality traits on schooling decisions (Almås et al., 2016), job search behavior (Flinn et al., 2020), matching in marriage markets (Dupuy and Galichon, 2014), task productivity (Cubel et al., 2016), and longevity (Savelyev, 2020).

to changes in the relative wages of mothers and fathers. In this step, I pay particular attention to changes in hours worked as well as the consequential labor market earnings of mothers, fathers and the overall availability of financial resources at the household level. Second, I analyze how households reorganize the provision of childcare in response to changes in the relative wages of mothers and fathers. In this step, I pay particular attention to hours of care provision by mothers and fathers, and changes in total parental care provision as opposed to the use of extra-parental care providers. Third, I analyze the effect of changes in the relative wages of mothers and fathers on the development of the Big Five personality traits of their children. This last step establishes a reduced-form causal effect of changes in the parental wage gap on the formation of socio-emotional skills in children. The previous steps allow me to interpret these results in light of the mechanisms that are emphasized in the literature on collective household decision-making (Blundell et al., 2005; Browning et al., 2014; Cherchye et al., 2012; Knowles, 2012).

My findings can be summarized as follows. First, both fathers and mothers are characterized by a positive own-wage elasticity of labor supply: They both increase their labor hours in response to increasing potential wages. However, mothers and fathers tend to react differently to changes in the potential wages of their partners. While mothers tend to decrease their labor supply in response to positive wage shocks of their partners, the labor supply of fathers is insensitive to changes in the potential wages of their partners. As a consequence, the effect of closing parental wage gaps on the financial positions of households depends on whether the convergence is driven by wage gains of mothers or wage losses of fathers. If the former, gender convergence in wages leads to an expansion of total household resources since the labor supply of fathers does not adjust to the gains of mothers. If the latter, there is no effect on total household resources since women tend to substitute for the losses of fathers. In both cases, however, closing parental wage gaps lead to an increase in the relative share of financial resources controlled by mothers.

Second, the gendered asymmetry in cross-wage elasticities is also reflected in the way households adjust their childcare arrangements in response to changes in the relative wages of

mothers and fathers. Wage gains of fathers lead to an increase in the hours of care provided by mothers and a decrease in the probability that the child is subject to extra-parental care provision. This response is consistent with the abovementioned finding that mothers decrease their labor supply in response to positive wage shocks of their partners. To the contrary, neither maternal nor paternal hours of care provision react to the relative wage gains of mothers. Mothers maintain the time they devote to their children in spite of their increasing engagement in the labor market. Descriptive analyses of German time-use diaries suggest that the constancy of maternal care provision results from shifting the timing of maternal time investments into the afternoon hours after they return from work. However, they substitute for their absence during the day by increasingly relying on informal childcare arrangements.

Third, in spite of the previously described changes in the financial positions and time-use of households, changes in the intra-household gender wage gap do not have an effect on the socio-emotional development of children. I can exclude at the 95% level of statistical significance that a €1 decrease in the intra-household hourly wage gap leads to shifts larger than 0.254 standard deviations in any of the Big Five dimensions. To put these numbers into perspective I compare them to existing evidence on the effects of various interventions on the Big Five inventory. For example, Akee et al. (2018) find that an unconditional cash transfer program worth $\$3,500$ per annum, decreased neuroticism in children of the Eastern Band of Cherokee Indians by 0.381 standard deviations. When it comes to a €1 decrease in the parental hourly wage gap in Germany I can rule out effects that are less than half of this size.[4]

These findings have important implications for economic policy-making. On the one hand, increasing gender equality has become a prominent goal for public policy in recent years.[5] On the other hand, one may oppose such policies as the increasing labor market participation of

[4] I furthermore show that a €1 decrease in the intra-family gap of hourly wages wage leads to a €$2,922$ increase of annual family earnings. The two interventions are thus broadly comparable in terms of their effects on family resources.

[5] In Germany, recent policy initiatives with the explicit goal to foster the economic convergence of men and women include the introduction of a 30% quota on supervisory boards of publicly traded companies in 2016 and the Pay Transparency Act from 2017. Similar policy initiatives exist in other industrialized countries as well, see for example Baker et al. (2019b), Bennedsen et al. (2019), Bertrand et al. (2018), and Gregory-Smith et al. (2014).

mothers could potentially exert adverse effects on the skill development of their children. The evidence presented in this work is not consistent with such claims.

To be sure, my identification strategy does not allow me to causally separate the impacts of the different channels of parental adjustments on child development. Instead I provide causal estimates for an omnibus treatment that shifts the time-use and financial positions of both mothers and fathers simultaneously. Furthermore, I analyze the average effects of these adjustments across children aged 2–17.[6] Therefore, my findings do not contradict existing work showing alternative care arrangements to be imperfect substitutes for the quality of care provided by mothers (e.g. Baker et al., 2019a). Nor do my findings contradict existing work that demonstrates the existence of sensitive age periods in which decreases in the time investments of mothers could have detrimental consequences for child development (Carneiro et al., 2015; Danzer and Lavy, 2018; Del Boca et al., 2017; Nicoletti et al., 2020). However, my work shows that across the life-cycle of German children, potentially existing quality gaps between the time investments provided by mothers and the time investments provided by other actors in the process of child development are small enough to be offset by the increase of total household resources and the relative increase of monetary resources controlled by mothers.

The remainder of this paper is structured as follows. In section 2, I present a stylized model of non-unitary household decision-making to guide the empirical analysis. Section 3 introduces the main data sources and details the construction of the relevant samples and variables. After outlining my identification strategy in section 4, I present the results of my analysis in section 5. Section 6 concludes.

[6] I do provide heterogeneity analyses with respect to child age in section 5.5.

2 THEORETICAL BACKGROUND

Assume mothers and fathers indexed by $g \in \{m, p\}$ derive utility from consumption c_g and the development of their child C. Maternal utility is specified as follows:[7]

$$\begin{aligned} U_m(c_m, C) = & \underbrace{w_m h_m - I_m + \delta_m(w_p h_p - I_p)}_{=c_m} \\ & + \beta_m \underbrace{\ln[\alpha_m(1-h_m) + \alpha_p(1-h_p) + \gamma(I_m + I_p)]}_{=C} \end{aligned} \tag{1}$$

The consumption value c_m depends on private consumption – defined as the difference between individual earnings ($w_m h_m$) and the personal allocation of monetary resources to children (I_m) – and a spillover from her partner's consumption evaluated at a discount factor of δ_m.

Child development C depends on time investments of both mothers and fathers ($1 - h_m$, $1 - h_p$) and monetary investments $I_m + I_p$. Among others, the latter includes the purchase of extra-parental care services during the working time of parents. The productivities of these input factors are defined by the parameters α_m, α_p, γ.[8]

Parents dispose of one unit of time and make two individual decisions: First, how much time to spent in the labor market ($0 \leq h_g \leq 1$), where each increase in labor supply decreases the time available for childcare activities. Second, how much money to invest into the development of their child ($0 \leq I_g \leq w_g h_g - \bar{z}_g$), where each increase in child investments reduces the budget for private consumption and $\bar{z}_g$ specifies its desired minimum floor.

For the sake of the following illustration, I impose a number of restrictions on the set of exogenously given parameters w_g, δ_g, α_g, γ, β_g, $\bar{z}_g$. First, in line with evidence on the

[7] Paternal utility is the exact mirror case.

[8] Note that C does not necessarily correspond to a production function for the development of specific cognitive or socio-emotional skills (Cunha et al., 2010). First, parenting decisions may involve mixed objectives including both the child's contemporary well-being as well as endowing it with the skills necessary to succeed in life (Doepke et al., 2019). Second, even if parents were to target a particular child skill, they may have mis-perceptions about the actual technology that produces the relevant trait (Attanasio et al., 2019; Cunha et al., 2013). For my purposes it is sufficient that the resources that are subject to the parental optimization calculus are relevant for the production of socio-emotional skills. This assumption is backed by the large body of literature showing the relevance of monetary resources and parental time investments for the development of socio-emotional skills (see among others Agostinelli and Sorrenti, 2018; Akee et al., 2018).

continued existence of gender wage gaps (Blau and Kahn, 2017, see also Figure 1), I assume $w_p > w_m$. Second, parents may place different discount factors on the value of their partner's consumption. Consistent with evidence on male breadwinner norms I impose $0 \leq \delta_p < \delta_m \leq 1$ (Bertrand et al., 2015, see also Figure 2). Third, the quality of maternal care is generally perceived as dominating alternative care arrangements including paternal and extra-parental care (Baker et al., 2019a; Del Boca et al., 2014, see also Figure 2). Therefore I impose $\alpha_m > \gamma > \alpha_p$. Fifth, mothers and fathers may differ in the utility value they place on child development β_g and the required minimum amount of private consumption $\bar{z}_g$. In line with the spending patterns documented in Lundberg et al. (1997), I impose $\beta_m > \beta_p$ and $w_p > \bar{z}_p > \bar{z}_m = 0$.[9]

Parents take the decisions of their partner as given and maximize their individual utilities while observing the budget constraints on working hours ($0 \leq h_g \leq 1$) and monetary investments into their children ($0 \leq I_g \leq w_g h_g - \bar{z}_g$). The first order condition for each parent yields:

$$\begin{gathered} w_g = \frac{\beta_g \alpha_g}{C}; \quad 1 = \frac{\beta_g \gamma}{C}; \\ h_g \lambda_g = 0; \quad (1 - h_g)\eta_g = 0; \quad (w_g h_g - \bar{z}_g - I_g)\psi_g = 0; \quad I_g \phi_g = 0. \end{gathered} \tag{2}$$

Observing the set of restrictions introduced above, we can distinguish six cases that vary in terms of i) the relative emphasis that parents put on the development of their children ($w_g \lesseqgtr \beta_g$) and ii) their relative productivity in providing the necessary inputs via time or monetary investments ($w_g \gamma \lesseqgtr \alpha_g$). Table 1 shows the respective solutions to the household problem.

Panels (a) and (b) are similar in that fathers care strongly about their private consumption and put less emphasis on the development of their children ($w_p > \beta_p$). In these cases, the relevant inputs for the development of children are provided by mothers only. Panels (a) and (b) are different in the extent to which mothers care about their children as opposed to their

[9] I also assume that $w_g \gamma \neq \alpha_g$, i.e. that time investments at home and time spent in the labor market are not equally productive in fostering the development of the child. This restriction limits the set of possible solutions by forcing at least one parent to be at a corner solution.

Table 1 – Overview of Model Solutions

Panel (a): $w_p > \beta_p;\ w_m < \beta_m$				
$w_m\gamma < \alpha_m, w_p\gamma \lesseqgtr \alpha_p$	$1-h_p=0;$	$I_p=0;$	$1-h_m=1;$	$I_m=0$
$w_m\gamma > \alpha_m, w_p\gamma > \alpha_p$	$1-h_p=0;$	$I_p=0;$	$1-h_m=0;$	$I_m=w_m$
Panel (b): $w_p > \beta_p;\ w_m > \beta_m$				
$w_m\gamma < \alpha_m, w_p\gamma \lesseqgtr \alpha_p$	$1-h_p=0;$	$I_p=0;$	$1-h_m=\frac{\beta_m}{w_m};$	$I_m=0$
$w_m\gamma > \alpha_m, w_p\gamma > \alpha_p$	$1-h_p=0;$	$I_p=0;$	$1-h_m=0;$	$I_m=\beta_m$
Panel (c): $w_p < \beta_p;\ w_m < \beta_m$				
$w_m\gamma < \alpha_m, w_p\gamma < \alpha_p$	$1-h_p=1-\frac{\bar{z}_p}{w_p};$	$I_p=0;$	$1-h_m=1;$	$I_m=0$
$w_m\gamma > \alpha_m, w_p\gamma > \alpha_p$	$1-h_p=0;$	$I_p=w_p-\bar{z}_p;$	$1-h_m=0;$	$I_m=w_m$

private consumption ($w_m \lesseqgtr \beta_m$). Lastly, Panel (c) shows cases where both mothers and fathers care strongly for the development of their children ($w_g > \beta_g$). How do changes in the relative wages of mothers and fathers affect the provision of resources to the child in each of these scenarios?

In Panel (a) mothers care strongly for their child ($w_m < \beta_m$). If maternal wage rates are high enough and/or monetary investments are very conducive to child development ($w_m\gamma > \alpha_m$), she will work full time while purchasing the required inputs for the child in the market. In such a scenario, increases in maternal wage rates will lead to a one-to-one increase in monetary resources devoted to children. To the contrary, if maternal wages are low and/or monetary investments are relatively less productive than time investments ($w_m\gamma < \alpha_m$), she will care for the child at home with I_m and $1-h_m$ remaining unresponsive to changes in maternal wage rates.

In Panel (b) mothers care less strongly for their child ($w_m > \beta_m$) but still provide the entirety of the family's child investments. In such a scenario, the effect of changes in w_m on the resources devoted to children is ambiguous. If mothers perceive monetary investments as an inferior mode of child investment ($w_m\gamma < \alpha_m$), children will receive a decreasing share of maternal time as female wage rates and the opportunity cost of staying at home increase. To the contrary, if mothers prefer monetary investments, the child will receive an income bundle equal to β_m irrespective of the changes in w_m.

Panel (c) shows the cases where both mothers and fathers care strongly for the development

of their children ($w_g > \beta_g$). Again we can distinguish two cases of how changes in the relative wages of mothers and fathers affect the provision of resources to the child. If wages are high enough and/or parental time investments are relatively more productive than monetary investments ($w_g\gamma > \alpha_g$), fathers will spent a minimum amount of time in the labor market to generate $\bar{z}_p$ while mothers specialize in home care for the children. Wage increases of fathers lead to a greater share of paternal time resources devoted to children since it takes less working time to satisfy their need for private consumption. In this case, resource allocations are unaffected by changes in w_m. To the contrary, if parents favor monetary investments, they will both work full time. Mothers invest their entire income into their children while fathers top up the maternal investments since the wage rate of mothers is too low to satisfy the paternal preferences for investments into the child. Hence, the resources devoted to children are again insensitive to changes in the wage rates of mothers. However, every increase of w_p that is in excess of $\bar{z}_p$ will lead to a one-to-one increase in the monetary resources devoted to children.

The solution of this stylized model illustrates that changes in the relative wages of mothers and fathers may impact both the amount and the mix of resources devoted to children. First, they alter the relative prices of private consumption and child investments for both mothers and fathers. Second, they alter the relative prices of important input factors for the development of children – time and money in particular. However, the illustration also highlights that gendered preferences for parental roles, i.e. β_g, $\bar{z}_g$, as well as beliefs about the productivity of different modes of child investments, i.e. α_g, γ, may insulate the resources devoted to children from changes in parental economic incentives

3 CONTEXT AND DATA

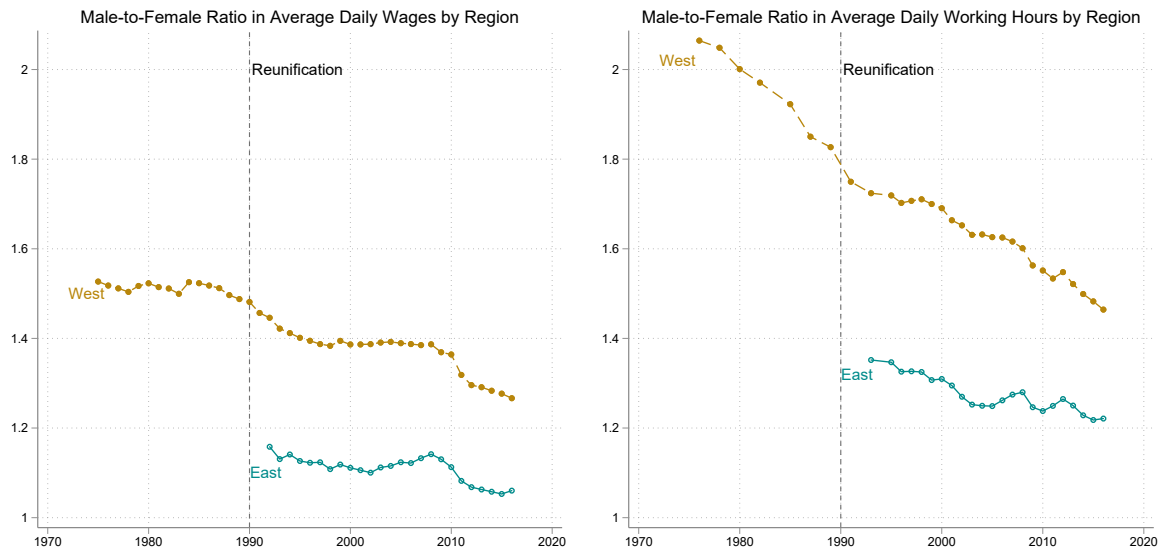
3.1 Gender Gaps in the Labor Market and at Home - The Case of Germany

As in many industrialized societies, labor market outcomes for men and women in Germany have been converging in recent decades (Olivetti and Petrongolo, 2016). However, in spite of these strides towards gender equality, there still remain marked gender differences in labor

market participation and home production, with the male breadwinner model being the norm among German households with children.

A particularity in the German context are the differences in gender roles between the former socialist East Germany and West Germany that continue to exist even three decades after reunification in 1990 (Boelmann et al., 2020; Lippmann et al., 2020). Figure 1 shows the development of the male-to-female ratios in average daily wages (daily working hours) over the time period 1975–2016 (1973–2016) separately for both regions. While there is a clear trend towards increased gender equality in both East and West, the remaining gender gap in daily wages (daily working hours) amounts to 27% (46%) in the West but only 6% (22%) in the East.

Figure 1 – Development of the Unconditional Gender Wage/Hours Gap in Germany by Region, 1973-2016

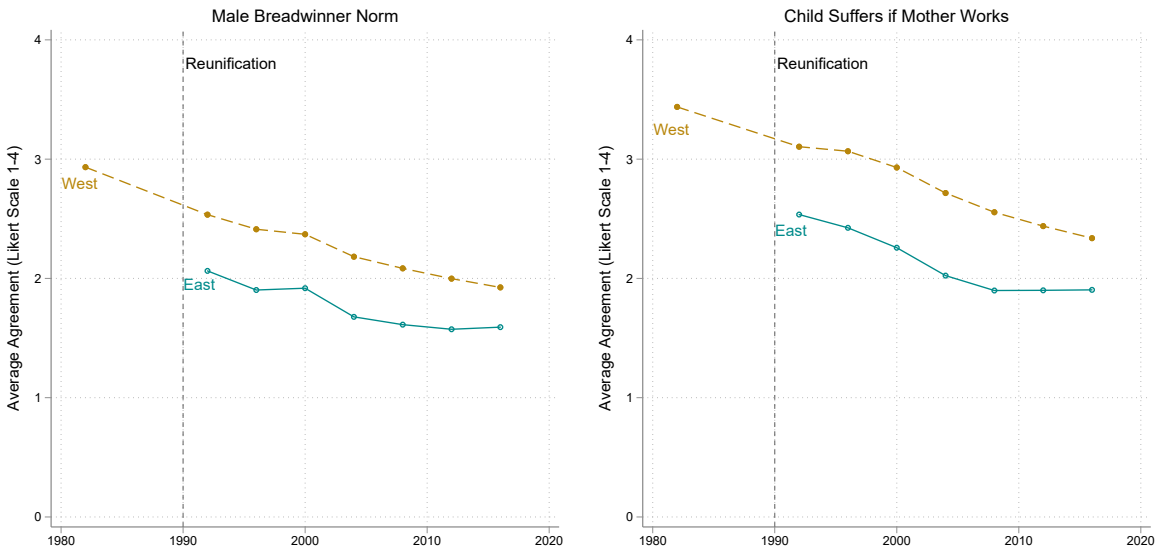


Data: Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This figure shows the development of the male-to-female ratio in mean daily wages (working hours) from 1975 to 2016 (1973–2016) by region in Germany. Daily wages are calculated for all SIAB observations aged 18–63 that are subject to social security contributions. Daily working hours are calculated for all MZ observations aged 18–63 by dividing their working hours in a typical work week by five. A detailed description of the underlying data sources is provided in section 3.2.

The legacy of the 41-year division is also reflected in gender role attitudes. In comparison to other industrialized countries, Germany as a whole is characterized by rather traditional gender norms (Kleven et al., 2019). However, this comparison masks important heterogeneity

within the country. Figure 2 shows the evolution of preferences for the male breadwinner model and stated concerns about the adverse effects of working mothers on the development of children by region within Germany. While more conservative attitudes have been eroding over time, the two regions started to converge only recently when the trend towards more gender-equal attitudes plateaued in the East.

Figure 2 – Development of Gender Role Attitudes in Germany by Region, 1982-2016



Data: German General Social Survey (ALLBUS).
Note: Own calculations. This figure shows the development of gender role attitudes from 1982–2016 by region in Germany. Each data point reflects average agreement to the following statements among respondents aged 18–63 measured on a four point Likert scale : *People have different opinions about the role of women in the family and in bringing up children. For each of the statements on the card, please tell me whether you completely agree, tend to agree, tend to disagree, or completely disagree:* [Left-hand panel:] *It is much better for everyone concerned if the man goes out to work and the woman stays at home and looks after the house and children.* [Right-hand panel:] *A small child is bound to suffer if his or her mother goes out to work.*

In recent years, Germany has implemented a number of policy reforms to foster gender equality and to support the reconciliation of family and work. In 2007, Germany introduced a new parental leave benefit with a 67% replacement rate of pre-birth earnings. The duration is 12 months with an additional 2 months – the so called "daddy months" – reserved for the partner of the primary caretaker (Raute, 2019). In addition, Germany has expanded the provision of center-based childcare significantly. Since 2013 the legal claim for publicly subsidized childcare has been extended from children aged 3–6 to all children aged one year and

above (Felfe and Lalive, 2018). Current plans for the expansion of public childcare provision include a legal claim for afternoon care in elementary schools until 2025 (Federal Government of Germany, 2019). In contrast to these reform efforts, the German tax code is an inhibitor of increased gender equality since it combines the joint taxation of couples with a progressive schedule. It thus places high marginal tax rates on the secondary earner within a tax unit, i.e. females in the vast majority of cases (Bick and Fuchs-Schündeln, 2017).

3.2 Data

My research design combines a sibling comparison with a shift-share design to approximate within-family changes in the relative earnings potential between mothers and fathers. To operationalize this identification approach in the German context I rely on three principal data sources. The German Socio-economic Panel (GSOEP) provides the core data set in which I observe household responses to changes in the relative labor market incentives of mothers and fathers as well as measures of child development. The sample of the GSOEP, however, is too small to reliably calculate potential wages based on a shift-share design. Therefore, I use the Sample of Integrated Labour Market Biographies (SIAB) and the German Microcensus (MZ) to calculate hourly potential wages in gender times education times commuting zone cells ($2 \times 3 \times 96$) that are linked back to the GSOEP based on observable household characteristics.

The German Socio-economic Panel (GSOEP). Established in 1984, the GSOEP is an annual, nationally representative survey that covers approximately 15,000 private households and 25,000 individuals in its most recent waves (Goebel et al., 2019). Next to comprehensive information on socio-economic and demographic background characteristics, the GSOEP contains detailed information on financial positions, labor market participation, and the time-use of households and their members. Furthermore, there are dedicated questionnaires administered to primary caretakers and children themselves that allow me to construct established measurements for the socio-emotional development of children.

Guided by my empirical strategy, I restrict the GSOEP to intact families with two resident working age parents (18–63 years) who have at least two children for whom I observe the

outcomes of interest at the same chronological age.[10] From 2005 onward, the GSOEP contains a mother-and-child questionnaire that includes a short scale for the personality development of children. From 2006 onward, the GSOEP contains a battery of self-reported personality questions that allow the derivation of analogous personality measures for older children. As a consequence, I restrict my analysis to the GSOEP waves covering the years 2005–2017. Following these restrictions, I obtain a sample of $6,070$ child-year observations and $2,833$ sibling groups for whom I provide descriptive statistics in Table 2.[11]

The resulting sample is gender-balanced. Only 1% of the sampled children have been born outside of Germany while 19% reside in the formerly socialist East.[12] On average, they are 8.6 years of age and the second-born child to their parents.

In my analysis I focus on the following set of variables. First, I analyze the labor market response of parents by reference to their working hours and earnings. Working hours are self-reported and I convert the provided variable on annual working hours into daily working hours by dividing with 260 days.[13] Earnings are self-reported, deflated to 2015 prices, and include all income from employment and self-employment in the year that precedes the survey wave. As shown in Table 2, there are marked gender gaps in the labor market outcomes of mothers and fathers in my sample. Fathers spend almost triple the time of mothers (8.4 vs. 3.0 hours/day) in the labor market and contribute four times the earnings of mothers to the financial resources of the household (51.2k vs. 12.5k €/year).

Second, I analyze the childcare response of parents by reference to the hours of care provided by both partners and the use of extra-parental care providers. Information on the

[10] I define intact families as follows: Children below age 18 must i) live in the same household as their mother in all available waves, ii) refer to the same person as their mother figure in all available waves, iii) be either a biological child, adopted child or the child of the partner of the head of the household in which they reside. Following this definition, I allow for non-biological family relationships if they are characterized by a sufficient degree of stability over time. In section 5.4 I show that my results are robust to the exclusion of non-biological family ties.

[11] Note that the number of sibling groups is less than half the child-year observations since I allow for sibling groups that contain more than two siblings, i.e. triplets, quadruples etc., if they exist.

[12] In my baseline analysis I do not explicitly exclude children from the refugee over-samples that were added to the GSOEP in the waves of 2016 and 2017. However, as a consequence of my sample restrictions there are only 6 child-year observations from the refugee over-samples in my core sample. Excluding these observations does not change any of the results presented below.

[13] 260 days≈12 months×4.33 weeks/month×5 days/week.

Table 2 – Summary Statistics

	N=6,070, Sibling Groups=2,833			
	Mean	SD	Min	Max
Children				
Female	0.49	0.50	0.00	1.00
Migration Background	0.01	0.10	0.00	1.00
East Germany	0.19	0.39	0.00	1.00
Age	8.64	5.24	2.00	17.00
Birth Rank	2.04	1.10	1.00	12.00
Formal Care	0.58	0.49	0.00	1.00
Informal Care	0.27	0.44	0.00	1.00
Openness	0.02	0.95	-4.05	2.12
Conscientousness	0.05	0.96	-3.39	1.92
Extraversion	-0.02	0.99	-3.89	1.79
Agreeableness	0.00	0.98	-3.76	2.02
Neuroticism	-0.03	0.97	-2.50	3.06
Mother				
Annual Earnings ('000 €)	12.47	18.73	0.00	576.00
Work Hours/Day	2.97	3.05	0.00	16.00
Childcare Hours/Day	6.50	4.62	0.00	16.00
Father				
Annual Earnings ('000 €)	51.23	45.39	0.00	672.00
Work Hours/Day	8.35	2.99	0.00	16.00
Childcare Hours/Day	1.99	2.31	0.00	16.00

Data: German Socio-economic Panel (GSOEP).
Note: Own calculations. This table shows summary statistics for the core analysis sample. The sample spans the years 2005–2017. It includes two-parent households aged 18–63 with at least two resident children aged 2–17 in year t who have non-missing information on the CZ of residence, parental education, parental working hours, parental child care hours and parental earnings in periods t and $t-1$. It only includes child-year observations with a valid measurement for at least one of the Big Five dimensions. Child-year observations without information on the child's sex, birth brank, migration background as well as the number of children in the household are subject to listwise deletion.

hours of care are elicited from both partners separately and refer to a typical day in a work week. A comparison of the GSOEP with the German Time-Use Study (GTUS) suggests that the information on childcare is best understood as spending time with the child but not necessarily as a dedicated time investment into the child (see Table S.1 in the Appendix). I separate extra-parental care into formal and informal care. Formal care includes center-based childcare for children under six, after-school care for children aged six years and older, as well as the use of childminders outside of the parental household. Informal care includes care provision by the extended family, older siblings, friends, neighbors as well as paid in-home

babysitters. As shown in Table 2, the gender gaps observed in the labor market reverse in the domain of childcare provision. Mothers invest more than triple the time of fathers into childcare activities. The use of external care providers is wide-spread with 58% (27%) of all children being exposed to some form of formal (informal) childcare.

Third, I analyze the impact of converging labor market opportunities on the socio-emotional development of children as measured by the Big Five dimensions of personality: openness, conscientousness, extraversion, agreeableness, neuroticism. The Big Five taxonomy evolved from the study of personality traits in Psychology and is derived by factor analysis on a battery of self-reported and/or observer-reported behaviors. While not without critics, it is the most widely accepted taxonomy of personality traits and has gained widespread traction in the economics literature.[14] In the GSOEP information on the Big Five dimensions are derived from assessments of the primary caretaker at child ages 2–3, 5–6, and 9–10 and child self-reports at ages 11–12, 13–15 and 17. These assessments are based on a battery of questions that rate the child in terms of various behaviors on a 10-point (7-point, in case of self-reports) Likert scale. Each question has a mapping into one of the Big Five dimensions.[15] I aggregate the questions additively such that higher values correspond to a higher expression of the underlying trait and standardize the resulting variables at each child age on the full sample to account for personality differences as children grow up. Table 2 shows that the sibling sample is slightly positively selected in terms of openness and conscientousness, and is characterized by lower levels of extraversion and neuroticism than the full sample.

Potential Wages. I approximate the differential changes in the labor market incentives for mothers and fathers by calculating potential wages for socio-demographic groups in Germany. While this section is dedicated to the construction of potential wages, I will elaborate on their econometric intuition in section 4. I use two data sets for the construction of potential wages.

[14]See Almlund et al. (2011) and Borghans et al. (2008) for comprehensive overview articles. See also Table S.6 for short descriptions of each Big Five personalty dimension.

[15]See Table S.7 for an overview of the questions and their mapping into the Big Five dimensions.

The Sample of Integrated Labour Market Biographies (SIAB). The SIAB is an administrative data set compiled by the research institute of the Federal Employment Agency of Germany that contains a 2% random sample of Germans who are either employed, recipients of social benefits, or officially registered as job-seeking (Antoni et al., 2019).[16] The data is organized in spells and allows to trace the labor market biographies of the sampled individuals as long as they fall into one of the categories mentioned above. The latest version of the SIAB covers the time period 1975–2017 and contains information on socio-demographics, occupation, industry affiliation and daily wages. The data does not include self-employed workers and civil servants.

For the purpose of this study I restrict the SIAB to all spells in the time period 1995–2016 that refer to individuals of working age (18–63 years) and who are subject to social security contributions. Based on information about the individual's establishment, I aggregate the spells to job cells where each observation represents one job per individual in a particular year. As a result I obtain a data set with more than 12 million job observations ($N \approx 577,720$/year).[17] The SIAB contains information on daily wages that are right-censored at the cap for social security contributions. In my baseline analyses I impute the upper tail of the wage distribution by following the procedure proposed in Gartner (2005). However, in section 5.4 I show the robustness of my conclusions to a variety of different imputation assumptions.

The German Microcensus (MZ). The MZ is an annual household survey covering 1% of all German households. It contains information on family socio-demographics, living arrangements and labor force participation (GESIS, 2020). Importantly - and in contrast to the SIAB - the MZ contains information on working hours. For the purpose of this study I use the MZ waves 1995–2016. In order to match the sample composition of the SIAB, I restrict the MZ data to employed individuals of working age (18–63 years) while excluding individuals who are either self- or marginally employed.[18] As a result I obtain a data set with more than 3

[16] In this study, I use the regional file SIAB-R 7517 which contains regional markers while cutting back on detail in other dimensions to preserve data confidentiality.

[17] I drop individuals who change their jobs more than three times per annum to exclude individuals with marginal labor force attachment.

[18] Tables S.4 and S.5 provide evidence that the resulting samples of the SIAB and the MZ are indeed comparable in terms of their socio-demographic, industry and occupation compositions.

million individual observations ($N \approx 166,849$/year). In my baseline analysis I use reports on individual working hours that refer to a typical work week of the respondent. However, in section 5.4 I show the robustness of my conclusions to alternative working hours definitions.

Construction of Potential Wages. I combine the SIAB and the MZ to calculate potential wages for individuals according to a shift-share design. The general idea of shift-share designs is to predict group-specific wages based on sectoral shocks and the group's exposition to such shocks as approximated by the historic importance of the different sectors for the respective group.

I define *groups* by partitioning the German population into 576 cells that are pinned down by 2 expressions of gender, 3 education levels and 96 regional units. The low education group includes individuals with no more than a low-track secondary degree and without vocational training. The intermediate education group includes individuals with a low-track secondary degree and vocational training as well as individuals with a high-track secondary degree but no further tertiary education. The high education group consists of people with a tertiary education at the university level. The 96 regional units correspond to Germany's spatial planning regions. Spatial planning regions describe economic centers and their surroundings that are nested within the 16 federal states of Germany. Since commuting flows are an essential criterion for the definition of spatial planning regions, I will refer to them as commuting zones (CZ) in the following.

I define employment *sectors* by grouping employed individuals into 27×14 occupation-industry cells that are based on the German Classification of Occupations 2010 (KldB10) and the German Classification of Activities 2008 (WZ08).[19]

Based on these specifications, I calculate potential wages for individuals of gender g, with

[19]The cross-walks from the industry and occupation classification used in this paper to the German Classification of Occupations 2010 (KldB10) and the German Classification of Activities 2008 (WZ08) at the three digit level are accessible through the author's homepage.

education level e, residing in region r, in year t as follows:

$$\hat{w}_{gert} = \sum_{j} \sum_{o} \underbrace{\frac{E^{oj}_{ger,1995}}{E_{ger,1995}}}_{(1)} \times \underbrace{w^{oj}_{t,-r}}_{(2)} . \tag{3}$$

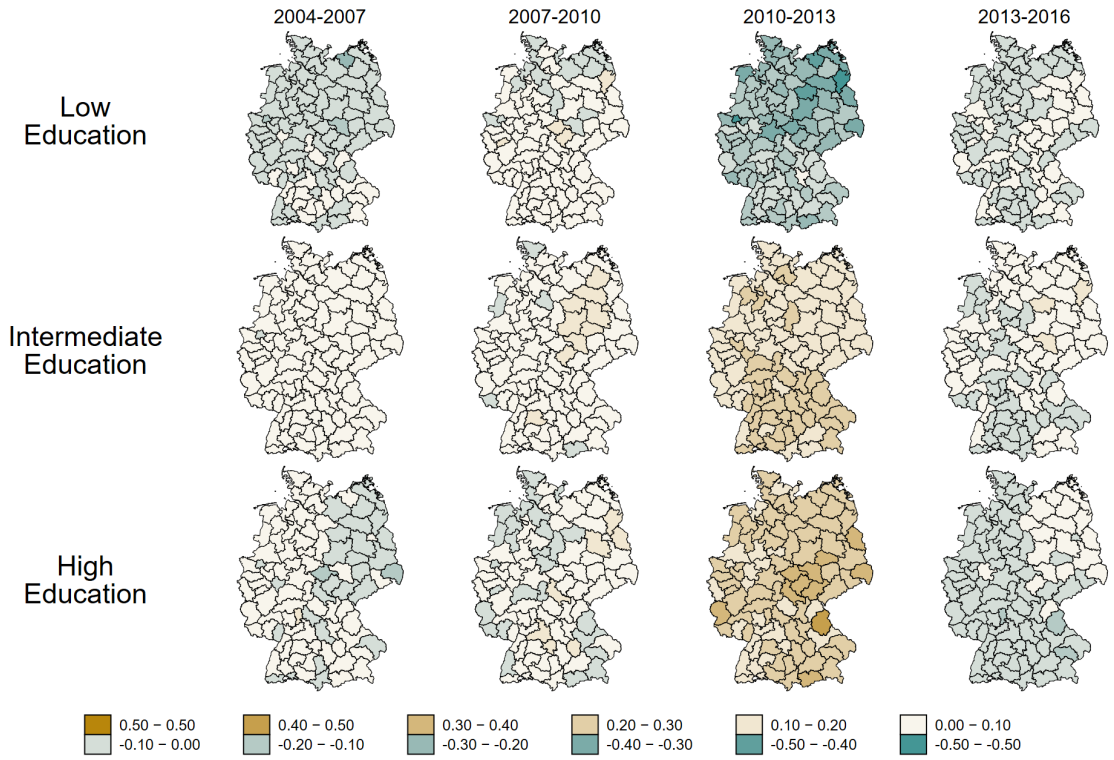
Term (1) of equation (3) indicates the group-specific employment share of each industry-occupation cell in base year 1995. Term (2) of equation (3) indicates the leave-one-out average wage paid to individuals working in occupation o and industry j in year t at the national level. Hence, the group-specific potential wage $\hat{w}_{gert}$ is constructed as a weighted average across the wages paid in the different sectors of the economy where the weights are given by the historic exposure of the groups to the respective sectors.

Specifically, I use the SIAB wave of 1995 to construct the group-specific employment share of each industry-occupation cell in base year 1995 (Term (1) of equation (3)). Tables S.2 and S.3 in the Supplementary Material document the differential sorting of gender and education groups into industries and occupations in 1995. For example, while almost a quarter of all low educated males worked in logistics occupations, an equally high share of low educated females worked in occupations related to facility management. The most important occupations for highly educated males are business administration and engineering, while their female analogues tend to work in nursing and teaching occupations. Furthermore, I use the SIAB waves 2004–2016 to construct the average wage paid to workers in each sector at the national level (Term (2) of equation (3)). However, the SIAB does not contain information on hourly wages. Therefore, I divide the average daily wage of individuals working in a particular sector in year t by the corresponding average daily working hours from the MZ.[20]

Figure 3 displays the change of the gender gap in potential wages by education group across the 96 CZs of Germany over the time period of my analysis (2005-2016). Blue areas indicate changes in favor of male wages, while red areas indicate changes in favor of female wages. There is strong heterogeneity in the evolution of gender gaps across regions and education

[20]Note that the MZ does not contain geographic information at the level of commuting zones. Hence, average daily wages at the national level that leave out a particular CZ are matched with average daily working hours at the national level that leave out the entire federal state in which the CZ is nested.

Figure 3 – Change in Gender Gap of Potential Hourly Wages by Education and Commuting Zone, 2004-2016



Data: Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This figure shows the change in the gender gap of potential wages from 2004 to 2016 in three-year windows by education level and commuting zone. Positive values (in red) indicate relative gains of females. Negative values (in blue) indicate relative losses of females. Potential wages are calculated according to equation (3). The 96 commuting zones are defined by the official territory definition of spatial planning regions of the Federal Office for Building and Regional Planning from 31.12.2017. Education is classified as follows – lower secondary degree without tertiary education (*Low*), lower secondary degree with vocational training or higher secondary degree without vocational training (*Intermediate*), university qualification (*High*).

groups, ranging from changes in hourly potential wages of €0.40 to the advantage of females to changes of €0.51 to the advantage of males.

Data Linkage. I match potential wages calculated from the SIAB and the MZ to the GSOEP sample based on an individual's expression in the group characteristics gender, education and CZ of residence. That is, for each year in the time period 2005–2017 GSOEP parents receive one out of 576 potential wages to approximate the respective parent's labor market incentives.

4 EMPIRICAL STRATEGY

Identification Strategy. I am interested in the causal effect of the parental wage gap on the development of socio-emotional skills in children as well as the household decisions through which parents provide the input factors for the production of these skills. Let us denote the outcomes of interest by Y_{ifat} and the parental wage gap as the difference between maternal and paternal wages, $w^{\Delta}_{ifat}(= w^{m}_{ifat} - w^{p}_{ifat})$, respectively. Both variables of interest are measured when child i from family f is of age a in year t.

If w^{Δ}_{ifat} was randomly assigned across families and time we could estimate the sought-after average treatment effect with the following OLS regression:

$$Y_{ifat} = \alpha + \beta w^{\Delta}_{ifat} + \epsilon_{ifat}. \tag{4}$$

However, w^{Δ}_{ifat} is not randomly assigned and the identification assumption implicit in equation (4), namely that $Cov(\epsilon_{ifat}, w^{\Delta}_{ifat}) = 0$, may be violated through joint determinants of parental wages and child outcomes as well as reversed causality.

In response to the various threats to identification I estimate the following model instead:

$$Y_{ifat} = \alpha + \beta \hat{w}^{\Delta}_{ifat-1} + \gamma_{fa} + \tau_t + X'_{ifat}\delta + \epsilon_{ifat}. \tag{5}$$

First, I leverage the panel dimension of my data to construct a sibling sample in which I observe children from the same family f at the same child age a but in different calendar years t (see section 3 for details). This data structure allows me to include a vector of family times child age fixed effects, γ_{fa}, that absorbs all confounding factors nested in differences across families that are particular to a specific child age. Examples of confounding factors that are ruled out by the inclusion of γ_{fa} include family differences in gender norms (Boelmann et al., 2020; Lippmann et al., 2020), assortative matching (Eika et al., 2019), and genetic endowments (Demange et al., 2020).

Second, I include a vector of time fixed effects τ_t. As shown in Figure 1, the gender wage

gap in Germany has a clear negative time trend. Hence, one may worry that within-family sibling comparisons confound the effect of changes in the parental wage gap with sibling birth order and parental age effects. The inclusion of τ_t takes care of both of these concerns. To see this, note that the inclusion of γ_{fa} fixes the age for the sibling comparison. Since a child's birth cohort is a linear combination of its age a and the year of observation t, the joint inclusion of γ_{fa} and τ_t excludes birth cohort effects as confounding factors (Black et al., 2018). Analogously, including γ_{fa} fixes the birth cohort of parents. Since parental age is a linear combination of their birth cohort and the year of observation t, the joint inclusion of γ_{fa} and τ_t excludes parental age effects as confounding factors (McGrath et al., 2014).

Third, I replace the observed wage difference in households, w^{Δ}_{ifat}, with the lagged difference in potential wages $\hat{w}^{\Delta}_{ifat-1}$. Observed wages are an endogenous proxy variable for the labor market incentives of mothers and fathers as parents may adjust their labor supply in response to the development of their children. Using potential wages along the lines of Bartik (1991) that reflect wage variation due to local labor demand instead of endogenous parental labor supply decisions addresses such concerns.[21]

Lastly, I include time-varying individual level controls X'_{ifat}. In my baseline specification X'_{ifat} consists only of $\hat{w}^{\Sigma}_{ifat-1}(= \hat{w}^{m}_{ifat-1} + \hat{w}^{p}_{ifat-1})$, i.e. the joint wage shock to mothers and fathers. Including $\hat{w}^{\Sigma}_{ifat-1}$ allows me to separate changes in the relative wages available to mothers and fathers from general shocks that affect the two partners simultaneously. In section 5.4 I show that my results are robust to richer specifications of X'_{ifat}.

Identifying Assumptions. Recently, the formal properties of shift-share designs have received increased attention in the methodological literature (Adão et al., 2019; Borusyak et al., 2019; Goldsmith-Pinkham et al., 2020; Jaeger et al., 2018). Exogenous variation in shift-share designs can originate from the exogenous assignments of the "shifters", i.e. term (2)

[21]Shift-Share (or Bartik) designs have become widely adopted in the literature strands on household decision-making (Anderberg et al., 2015; Autor et al., 2019; Bertrand et al., 2015; Bruins, 2017; Schaller, 2016; Shenhav, 2020) and child development (Agostinelli and Sorrenti, 2018; Aizer, 2010; Lindo et al., 2018; Page et al., 2019).

of equation (3), or the "shares", i.e. term (1) of equation (3).[22] In this work I follow the interpretation suggested by Goldsmith-Pinkham et al. (2020) and discuss my identifying assumptions in terms of exogenously assigned sector shares in the base year 1995. In light of this interpretation, the construction of potential wages is reminiscent of a difference-in-differences design where term (2) of equation (3) defines the treatment and term (1) of equation (3) the treatment assignment. In analogy to the standard difference-in-differences design, my identifying assumption can be stated as follows:

$$\begin{aligned} &Cov\left(\epsilon_{ifat}, \frac{E^{oj}_{ger,1995}}{E_{ger,1995}} | \gamma_{fa}, \tau_t, X'_{ifat}\right) = 0, \\ &\forall\ (o,j) \in J \times O, \\ &\forall\ t \geq 1995 + 10. \end{aligned} \tag{6}$$

In words: Conditional on the set of controls, the group-specific sector shares in 1995 need to be uncorrelated to the residuals of estimation equation (5). Note that i) the set of controls includes family times child age fixed effects, and that ii) the base year 1995 precedes the core time window of my investigation (2005–2017) by 10 years. Hence, the identifying assumption implies that group-specific industry shares in 1995 need to be uncorrelated to intra-family *changes* in the outcome of interest that lag the base year by at least a decade.

Evidence on Identifying Assumptions. I assess the plausibility of the discussed identifying assumptions in three steps. First, I illustrate the effects of the within-sibling FE design. For the sake of illustration, I draw a sample of sibling pairs from the core sample and partition them into a "high-shock" and a "low-shock" group depending on whether their value of $\hat{w}^{\Delta}_{ifat-1}$ exceeds the one of their sibling.[23] Panel (a) of Table 3 compares the resulting groups in terms of

[22] Find in the following a restatement of equation (3) for easy reference:

$$\hat{w}_{gert} = \sum_j \sum_o \underbrace{\frac{E^{oj}_{ger,1995}}{E_{ger,1995}}}_{(1)} \times \underbrace{w^{oj}_{t,-r}}_{(2)}.$$

[23] Note that this restriction to sibling pairs is implemented for illustrating the identification in terms of treatment and control groups. In Table S.8 I run the same test on the entire sample using regression analyses.

their individual characteristics. While both groups are comparable in many dimensions, there are statistically significant differences in terms of characteristics that are related to within-family cohort effects such as birth year, birth rank and parental age. However, as suggested in the discussion above, these differences vanish once I account for time fixed effects τ_t. Panel (b) of Table 3 compares the groups in terms of their exposure to differential labor market incentives for their parents. By construction the "high-shock" group is exposed to a significantly smaller gap in the potential wages of their parents. Importantly and in contrast to the sibling characteristics listed in Panel (a) these differences persist even when controlling for time fixed effects τ_t. The remaining intra-family differences in potential wages provide the identifying variation on which I base my estimates.

Second, I use the shift-share wages as a proxy for the labor market incentives of mothers and fathers. While the true potential wages for mothers and fathers are unobserved, I can validate this proxy by comparing it to the actual wages realized by mothers and fathers in the analysis sample. In Figure 4 I show the residual correspondence between potential wages and actual wages after accounting for family times child age fixed effects and collecting the data in centile bins of the respective potential wage variable. There is a strong correlation between intra-family changes in potential and observed wages which gives credence to the assumption that the shift-share wages are good proxies for the actual labor market opportunities available to mothers and fathers.

Third, given the identification assumption stated in equation (6), the group-specific exposure to a particular sector in the base year can be interpreted as an instrument for the endogenous variable of interest. Hence, in my case the identification relies on $J \times O$ (14×27) instruments. To clarify the identification that underlies a particular shift-share design Goldsmith-Pinkham et al. (2020) propose a decomposition of the resulting estimates into just-identified instrumental variable coefficients and the corresponding "Rotemberg Weights". The latter indicate the importance of the individual sector shares for potential biases in the aggregate estimate. Tables A.1 and A.2 show the Rotemberg weights for the top ten industry times

Conditional on γ_{fa} and τ_t, $\hat{w}^{\Delta}_{ifat-1}$ does predict none of the 10 child characteristics at a significance level of 10%. Hence, the conclusions described in the main body of the text remain unaffected.

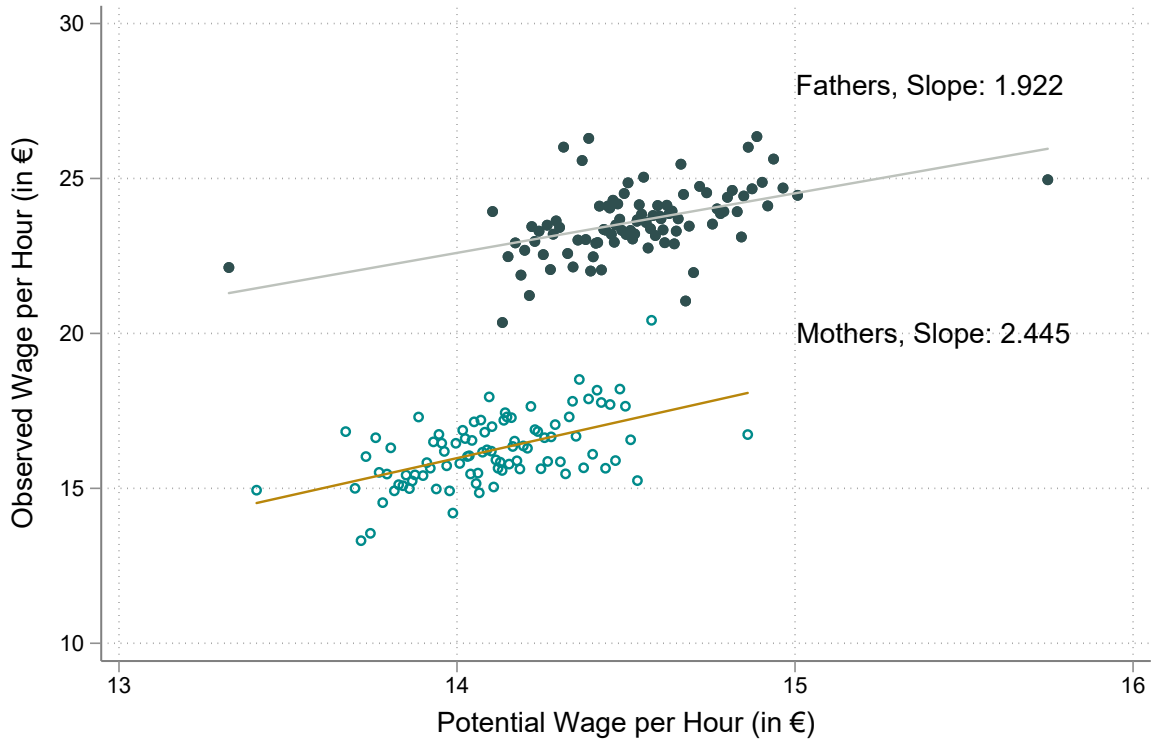
Table 3 – Within-Family Variation of Characteristics by Treatment Status

		Sibling × Child Age FE Only			Sibling × Child Age FE + Year FE		
	N	Low Shock	High Shock	Δ	Low Shock	High Shock	Δ
Panel (a): Sibling Characteristics							
Female	4,960	0.451	0.478	0.027* (0.059)	0.458	0.480	0.022 (0.200)
Migration Background	4,960	0.016	0.014	-0.002 (0.273)	0.011	0.012	0.001 (0.783)
Birth Year	4,960	2003.266	2004.064	0.798*** (0.000)	2004.463	2004.463	-0.000 (0.999)
Birth Rank	4,960	1.571	1.809	0.238*** (0.000)	1.922	1.926	0.004 (0.761)
# of Siblings	4,960	1.847	1.846	-0.001 (0.532)	1.844	1.845	0.001 (0.699)
Birth Height (cm)	2,010	50.655	50.779	0.124 (0.220)	50.768	50.817	0.049 (0.680)
Birth Weight (kg)	2,022	3.238	3.271	0.033* (0.068)	3.262	3.279	0.017 (0.427)
Breastfed	1,810	0.912	0.904	-0.008 (0.317)	0.915	0.905	-0.010 (0.273)
Age Mother	4,960	37.826	38.624	0.798*** (0.000)	39.023	39.023	0.000 (1.000)
Age Father	4,960	41.000	41.798	0.798*** (0.000)	42.197	42.197	-0.000 (1.000)
Panel (b): Treatment Variables							
Parental Wage Gap	4,960	-0.630	-0.494	0.136*** (0.000)	-0.628	-0.493	0.135*** (0.000)
Wage Mother	4,960	14.038	14.089	0.051*** (0.000)	14.057	14.095	0.038*** (0.000)
Wage Father	4,960	14.668	14.582	-0.086*** (0.000)	14.685	14.588	-0.097*** (0.000)

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This table shows differences in sibling characteristics conditional on different control variables. Siblings are allocated to the *High Shock* (*Low Shock*) sample if they are subject to a higher (lower) value of $\hat{w}^{\Delta}_{ifat-1}(= \hat{w}^{m}_{ifat-1} - \hat{w}^{p}_{ifat-1})$ than their sibling counterpart. The left-hand panel controls for sibling times child age fixed effects γ_{fa}. The right-hand panel additionally controls for year fixed effects τ_t. For the sake of illustration the sample is restricted to sibling pairs. In Table S.8 I present analogous tests while allowing for larger sibling groups. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level.

occupation cells by gender. For women most of the variation is accounted for by teachers and social workers employed in the educational sector ($\approx 31\%$) followed by sales occupations in

Figure 4 – Correlation of Within-Family Changes in Potential and Observed Wages



Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This figure shows the relationship between within-family changes in potential wages and within-family changes in observed wages by parental gender. It is constructed from the core sample described in Table 2 by partialling out the sibling times child age fixed effect γ_{fa} from actual wages and potential wages, respectively. The data is collapsed to gender-specific centile bins such that each data point reflects the average actual and potential wage within a centile bin of the gender-specific potential wage distribution.

retail ($\approx 6\%$) and cleaning and facility management occupations in the human health services industry ($\approx 5\%$). For men, the Rotemberg weights are much more dispersed across sectors with each of the top ten sectors accounting for less than ten but more than three percent. Most of the variation is accounted for by teachers and social workers employed in the educational sector ($\approx 10\%$), construction and civil engineering ($\approx 7\%$), as well as technical occupations in manufacturing ($\approx 7\%$). The importance of school teachers for the wage development of both women and men mirrors results for the US in the 1980–2010 period (Shenhav, 2020). In general, the distribution of the Rotemberg weights suggests a low sensitivity of my estimates to violations in the identification assumption for specific industry-occupation cells. The only notable exception is the importance of the school teacher category for the wage development of women. Hence, the causal interpretation of my results would be threatened if – conditional

on controls – the region-and education-specific employment share of school teachers among women in base year 1995 would correlate with any features that predict intra-family variation in the outcomes of interest after the year 2005.

5 RESULTS

I present the results of my analysis in three steps. First, I will present parental labor market responses towards the differential changes in labor market incentives across mothers and fathers. Second, I will present the childcare responses of these parents. In the third step, I present the reduced-form causal estimates of gender convergence in labor market incentives on the Big Five personality traits of the children in the affected families. Throughout the analysis, all coefficients represent responses to €1 increases in the respective wage variable. Columns indexed by Σ always indicate sums across mothers and father, while columns indexed by Δ always represent the difference between mothers and fathers.

5.1 Labor Market Response

Table 4 displays the labor market response of households to changes in the relative wages of mothers and fathers as well as the ensuing effects on household earnings. Panel (a) separates the effects by wage shocks to mothers and fathers. Note that the point estimates for the effects on total household labor supply (earnings) and the intra-household difference in parental labor supply (earnings) represent the horizontal sum and difference across the labor supply (earnings) effects on mothers and fathers, respectively.

Both mothers and fathers have a positive own-wage elasticity of labor supply. Conditional on the potential wage of their partner, mothers (fathers) respond to a €1 increase in their potential hourly wage by increasing their time in the labor market by 0.749 (0.450) hours per day. Thus, consistent with Bargain et al. (2014) the labor supply of partnered men in Germany is approximately two thirds as sensitive to variation in their own wages as the labor supply of women. To the contrary, men and women tend to respond asymmetrically to wage shocks of their partners. While mothers tend to reduce their labor supply in response to positive

Table 4 – Parental Wage Gaps and Labor Market Responses

	Work Hours				Earnings			
	Mother	Father	Σ	Δ	Mother	Father	Σ	Δ
Panel (a): Wages by Parent								
Wage Mother	0.749***	0.246	0.995**	0.504	5.209***	1.218	6.427**	3.990**
	(0.260)	(0.333)	(0.463)	(0.378)	(1.523)	(1.663)	(2.607)	(1.837)
Wage Father	-0.157	0.450**	0.292	-0.607**	-0.974**	1.557	0.583	-2.531**
	(0.097)	(0.220)	(0.228)	(0.252)	(0.384)	(1.074)	(1.166)	(1.116)
Panel (b): Parental Wage Gap								
Parental Wage Gap			0.351	0.555**			2.922**	3.261***
			(0.269)	(0.242)			(1.366)	(0.953)
Sibling × Age FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
N	6,070	6,070	6,070	6,070	6,070	6,070	6,070	6,070
DV Mean	2.966	8.352	11.317	-5.386	12.473	51.227	63.701	-38.754
DV SD	3.045	2.985	4.309	4.219	18.729	45.386	50.596	47.554

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. All coefficients are estimated on the core sample described in Table 2. All regressions in Panel (b) control for $\hat{w}^{\Sigma}_{ifat-1}$ – the aggregate labor demand shock for family f in year $t-1$. The coefficient on the parental wage gap can thus be interpreted as a test of coefficient equality across maternal wages ($\hat{w}^{m}_{ifat-1}$) and paternal wages ($\hat{w}^{p}_{ifat-1}$), see Panel (a). Work hours are measured in hours per day. Earnings are measured in thousand € per year. Σ indicates the sum across parental outcomes. Δ indicates the difference between maternal and paternal outcomes. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The last two rows of the table list the mean and the standard deviation of the dependent variable that is displayed in the table header.

wage shocks of their partners, fathers respond positively – even though the latter effects are imprecisely estimated.[24] In combination, these responses have the effect that increases in maternal wages have a strong and statistically significant positive effect on household's total hours of work, while increases in paternal wages have a strong and statistically significant positive effect on the intra-household gender gap in hours worked: Conditional on paternal wages, a € 1 increase in the potential wages of mothers leads parents to increase their combined labor supply by $0.995 (= 0.749 + 0.246)$ hours per day. Conditional on maternal wages, a € 1 increase in the potential wages of fathers increases the gap between maternal and paternal

[24] However, formally testing the equality of coefficients on $\hat{w}^{m}_{ijat-1}$ and $\hat{w}^{p}_{ijat-1}$ for both maternal and paternal labor supply, I can rule out a symmetric response of maternal work hours to her own and her partner's wage shocks at a statistical significance level of below 1%. To the contrary, I cannot rule out a symmetric response for fathers at any conventional level of statistical significance.

labor supply by $0.607(= 0.157 + 0.450)$ hours per day.

These labor supply responses are reflected in the availability of monetary resources and their distribution within households. Conditional on paternal wages, a €1 increase in the potential wages of mothers leads to an increase of joint labor market earnings by €$6,427(=$ €$5,209 +$ €$1,218)$ per year, while a €1 increase in the potential wages of fathers increases the intra-family earnings gap between mothers and fathers by €$2,531(= 974 +$ €$1,557)$ per annum.

Panel (b) summarizes the differential effect of wage shocks to mothers and fathers on household's working hours and earnings. I follow the specification of equation (5) and control for the combined wage shock $\hat{w}^{\Sigma}_{ifat-1}$ in order to separate the effect of changes in the relative wages available to mothers and fathers from general shocks that affect the two partners simultaneously. As a consequence, the point estimates on the parental wage gap $\hat{w}^{\Delta}_{ifat-1}$ amount to half the difference between the effects of maternal wages and paternal wages estimated in Panel (a). Furthermore, the coefficients can be interpreted as an F-test of whether wage shocks incurred by mothers and fathers have the same impact on the outcome of interest.[25] There is a statistically significant difference in the effect of maternal and paternal wage shocks on the parental gap in labor supply – however, there is no such differential effect on the total labor supply of households. In terms of earnings, a €1 decrease in the parental gender wage gap increases household resources from labor market earnings by €$2,922(= 1/2($€$6,427 +$ €$583))$ per year and decreases intra-household inequality by €$3,261(= 1/2($€$3,990 +$ €$2,531))$ per year. Relative wage gains of mothers thus translate into an increase of monetary resources at the household level and a corresponding increase in the total amount of monetary resources controlled by mothers. Both shifts may have a positive effect on the child development as monetary resources are an important input factor for the production of skills (e.g. Akee et al., 2018; Løken et al., 2012) and women tend to devote a higher share of their monetary resources to their children (e.g. Lundberg et al., 1997).

[25] To see this, note that I estimate $y = \beta_1 x_1 + \beta_2 x_2 + \epsilon$ in Panel (a) and $y = \gamma_1(x_1 - x_2) + \gamma_2(x_1 + x_2) + \eta$ in Panel (b). Hence, $1/2(\beta_1 - \beta_2) = \gamma_1$ and $\gamma_1 = 0 \iff \beta_1 = \beta_2$.

5.2 Childcare Response

Table 5 displays how households adjust their childcare arrangements in response to changes in the relative wages of mothers and fathers.

Table 5 – Parental Wage Gaps and Childcare Responses

	Parental Childcare				Non-Parental Childcare		
	Mother	Father	Σ	Δ	Any	Formal	Informal
Panel (a): Wages by Parent							
Wage Mother	0.087	0.079	0.166	0.008	-0.025	-0.067	0.113**
	(0.326)	(0.302)	(0.390)	(0.493)	(0.056)	(0.056)	(0.051)
Wage Father	0.549***	0.121	0.669**	0.428**	-0.056**	-0.047**	-0.049
	(0.204)	(0.127)	(0.265)	(0.212)	(0.026)	(0.019)	(0.035)
Panel (b): Parental Wage Gap							
Parental Wage Gap			-0.252	-0.210	0.016	-0.010	0.081***
			(0.238)	(0.283)	(0.032)	(0.031)	(0.031)
Sibling × Age FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
N	6,070	6,070	6,070	6,070	4,298	4,298	4,298
DV Mean	6.497	1.989	8.486	4.508	0.650	0.579	0.264
DV SD	4.621	2.308	5.689	4.582	0.477	0.494	0.441

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. All coefficients are estimated on the core sample described in Table 2. All regressions in Panel (b) control for $\hat{w}^{\Sigma}_{ifat-1}$ – the aggregate labor demand shock for family f in year $t-1$. The coefficient on the parental wage gap can thus be interpreted as a test of coefficient equality across maternal wages ($\hat{w}^{m}_{ifat-1}$) and paternal wages ($\hat{w}^{p}_{ifat-1}$), see Panel (a). Parental childcare hours are measured in hours per day. Non-parental childcare is measured as a binary variable indicating whether parents use the respective care arrangement. Σ indicates the sum across parental outcomes. Δ indicates the difference between maternal and paternal outcomes. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The last two rows of the table list the mean and the standard deviation of the dependent variable that is displayed in the table header.

Panel (a) again shows a clear asymmetry between mothers and fathers. In line with their decrease of daily labor hours, mothers increase their childcare provision by 0.549 hours per day in response to a €1 increase in the hourly potential wages of their partner. This effect translates into an increase of 0.669 hours/day that the child is cared for at home, whereas there is 5.6 percentage point decrease in the probability that the family uses any non-parental

care providers on a regular basis. The latter effect is especially driven by a 4.7 percentage point decrease in the use of formal care providers.

In contrast, changes in the potential wage of mothers do not lead to adjustments in the time that mothers care for their children. At first glance this finding seems to be at odds with the strong own-wage elasticity of maternal labor supply (0.749 hours/day, see Table 4). However, the analysis of Hsin and Felfe (2014) suggests that working mothers in the US are successful in protecting their time with children – especially in those activities that are conducive to child development. In Appendix Figure S.1 I provide descriptive evidence based on German time use diaries that support this explanation. The figure compares the share of mothers and fathers involved in particular activities at each time of the day across the survey waves 2001/02 and 2012/13. Over time, there is an increasing share of mothers who report to be in employment during the business hours of the day and a corresponding decrease in the share of mothers who report to have their child present during these hours. However, from 2001/02 to 2012/13 there also is an increase in the share of mothers who report to spend time with their child in the early morning, afternoon and evening hours. This suggests that mothers compensate their absence during the work day by increasing interactions before and after work.[26]

Panel (b) translates these (non-)responses into the aggregate effect of the parental wage gap. In view of the attenuated response of households to changes in maternal wages, there is no statistically significant effect of changes in the parental wage gap on the intra-household provision of childcare. However, a 1€ decrease in the parental wage gap leads to an 8.1 percentage point increase in the reliance on informal care providers. This shift may have a negative effect on the development of the affected children as informal childcare arrangements tend to be of lower quality than maternal care provision (e.g. Datta Gupta and Simonsen, 2010).

[26]Furthermore, at no point of the day is there a decrease in the share of the mothers who report childcare to be their primary activity. If anything, there is a slight increase in the hours devoted to "intensive" childcare during the morning and afternoon hours. Appendix Figure S.2 shows that these upward shifts are driven by increases in personal care activities in the morning and increases of play and sports activities in the afternoon.

5.3 Socio-emotional Skills of Children

The previous sections have shown that increases in the relative wages of mothers lead to i) an increase of household financial resources, ii) an increase in the share of financial resources controlled by mothers and iii) an increase in the child's exposure to informal care arrangements. Table 6 shows how these changes at the household level affect the socio-emotional development of children. As previously, I separate by maternal and paternal wages in Panel (a) before

Table 6 – The Effect of Parental Wage Gaps on the Socio-emotional Skills of Children

	Openness	Conscient-ousness	Extra-version	Agree-ableness	Neuroticism
Panel (a): Wages by Parent					
Wage Mother	-0.176*	0.075	-0.033	-0.085	0.170
	(0.103)	(0.121)	(0.104)	(0.094)	(0.140)
Wage Father	-0.021	0.021	-0.074	-0.007	0.022
	(0.060)	(0.046)	(0.061)	(0.056)	(0.107)
Panel (b): Parental Wage Gap					
Parental Wage Gap	-0.078	0.027	0.020	-0.039	0.074
	(0.061)	(0.067)	(0.061)	(0.057)	(0.092)
Sibling × Age FE	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
N	5,999	6,049	6,039	6,032	4,346
DV Mean	0.026	0.055	-0.022	0.002	-0.028
DV SD	0.954	0.955	0.988	0.977	0.973

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. All coefficients are estimated on the core sample described in Table 2. All regressions in Panel (b) control for $\hat{w}^{\Sigma}_{ifat-1}$ – the aggregate labor demand shock for family f in year $t-1$. The coefficient on the parental wage gap can thus be interpreted as a test of coefficient equality across maternal wages ($\hat{w}^{m}_{ifat-1}$) and paternal wages ($\hat{w}^{p}_{ifat-1}$), see Panel (a). Short descriptions for each Big Five personality trait are provided in Table S.6. The Big Five personality traits are measured using the questionnaire batteries displayed in Table S.7. Dimension-specific responses are added and standardized to have $\mathcal{N} = (0, 1)$ for each age group. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The last two rows of the table list the mean and the standard deviation of the dependent variable that is displayed in the table header.

translating these effects into the aggregate impact of changes in the parental wage gap in Panel (b).

First, with the exception of a marginally significant negative effect on children's openness, increases in maternal wages do not have a statistically significant effect on changes in any of the Big Five personality traits. This null finding may be explained by the different margins of household adjustments and their countervailing effects on child development. On the one hand, mothers respond to increases in their potential wages by spending more time outside the home and tend to replace their time with informal care providers. This substitution may have detrimental effects on children since informal childcare providers are oftentimes of lower quality than either maternal or center-based childcare (Datta Gupta and Simonsen, 2010). On the other hand, they do not adjust the total amount of time they spend with their children. Furthermore, the total amount of monetary resources in the household increases. Thus, as in Agostinelli and Sorrenti (2018) and Nicoletti et al. (2020), the effects of household's adjustment towards changes in maternal labor market incentives are not aligned and therefore attenuate the aggregate affect towards zero.

Second, increases in paternal wages do not have a statistically significant effect on changes in any of the Big Five personality traits. Wage increases of fathers lead to an increased involvement of mothers as the primary caretaker by substituting away from formal childcare providers. This substitution may have positive effects on children if the quality of maternal care dominates its alternatives. However, formal childcare in Germany tends to be of high quality (e.g. Felfe and Lalive, 2018) which may cushion the associated gains of children. Furthermore, the relative wage gains of fathers do not have a discernible effect on total household resources. Thus, changes in paternal wage incentives lead to small adjustments in the quality and quantity of resources devoted to children attenuating the aggregate effect towards zero.

In sum, I find no evidence that changes in the parental wage gap have an impact on the socio-emotional development of children. To assess the precision of these null effects, I benchmark my estimates against the effect sizes found in other studies. In particular, I restrict this comparison to the preferred estimates from other (quasi-)experimental studies that take any dimension of the Big Five inventory as the outcome of interest and reject the null hypothesis of a zero effect at a statistical significance level of 5% or lower. Figure 5 shows

the results of this comparison.

Figure 5 – Assessment of Effect Precision by Comparison to Other Interventions

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This figure shows the point estimates from Table 6 as well as the associated confidence intervals in comparsion to effects sizes from interventions studied in the extant literature.

For the majority of comparisons, I can comfortably exclude at the conventional levels of statistical significance that a €1 change in the relative wages of mothers and fathers affects child personality at a magnitude comparable to the effects found in the benchmark interventions. For example, Akee et al. (2018) find that an unconditional cash transfer program worth $\$3,500$ per annum, decreased neuroticism in children of the Eastern Band of Cherokee Indians by 0.381 SD. The lower bound of the 99% confidence interval on a €1 decrease of the parental wage gap, yields an effect of 0.162 SD, i.e. less than half of the aforementioned effect. Note that both interventions are broadly comparable in terms of their effects on total household resources since I have shown previously that a €1 decrease in the intra-family gap of hourly wages wage leads to a €$2,922$ increase of annual family earnings (Table

4). Other interventions are harder to compare in terms of the nature of the treatment. For example, Alan et al. (2019) show that 12-week à 2 hours/week curriculum intervention increased conscientousness in Turkish high-school students by 0.345 SD.[27] For a €1 decrease in the intra-family gap of hourly wages, I can exclude effects on conscientousness that are larger than 0.199 SD at a statistical confidence level of 99%.

In general, these comparisons suggest that the absence of evidence for a link between the wage convergence of mothers and fathers and children's socio-emotional skill development is not an artifact of lacking precision. To the contrary, my estimates are precise enough to comfortably exclude effects sizes that have been found with respect to other interventions in the extant literature. The only effects that consistently fall within the confidence bands of my estimates are the birth order effects estimated by Black et al. (2018). However, while these birth order effects are very precisely estimated, they are rather small in magnitude. Therefore, they do not threaten the conclusion that changes in the relative wages of mothers and fathers have a negligible effect on the socio-emotional skill development of their children.

5.4 Robustness

For each of the outcomes discussed above I conduct three sets of robustness checks, the results of which are displayed in Tables B.3–B.11 of the Appendix. First, I re-estimate all models under alternative constructions of the shift-share instruments (Tables B.3–B.5). Second, I re-estimate all models using different specifications for the set of control variables X'_{ifat} (Tables B.6–B.8). Lastly, I re-estimate all models under alternating sample restrictions (Tables B.9–B.11).

Alternative Shift-Share Instruments. In the baseline, I impute daily wages above the social security contribution limit by wage draws from a truncated log-normal distribution (Gartner, 2005). My results do not change if leaving the censored wages unchanged or uniformly replacing them with 150% of the social security contribution cap – an imputation technique commonly employed for top coded incomes in the Current Population Survey (CPS) (Autor

[27] To be precise Alan et al. (2019) refer to the concept of grit, which, however, is highly related to conscientousness (Duckworth et al., 2007).

et al., 2008; Shenhav, 2020). They are also unaffected when replacing the MZ variable for working hours in a typical work week with a variable that refers to working hours in the week that precedes the MZ data collection.

Shenhav (2020) proposes to extend the shift-share instrument by an updating term that accounts for intra-industry shifts in the occupation structure over time. Including this updating term has no discernible effect on my results. In contrast, using the most basic approach to the calculation of shift-share wages, where sectors are defined by industry instead of industry-occupation cells, leads to sizable divergences in point estimates and a simultaneous trebling of standard errors. This decrease in precision is driven by a reduction of the sector cells from $576(= 27 \times 14)$ to 14. Such a reduced sectoral partition is too coarse to yield meaningful predictions for the group-specific wage development in Germany.

Lastly, the results are also robust to specifying the parental wage gap in terms of differences of log wages. While this transformation changes the interpretation of the coefficients, the relationships by-and-large hold at their previously estimated levels of statistical significance.

Additional Controls. In the baseline, I only control for economic shocks that affect the wage development of both partners, $\hat{w}^{\Sigma}_{ifat-1}$. However, my results remain unaffected when expanding X'_{ifat} by measures for the sibling's birth rank, migration background, the number of kids in the household, and the sibling's gender. This observation gives credence to the assumption that the assignment of wage shocks is orthogonal to intra-family variation in sibling characteristics.

The baseline estimates furthermore assume i) that families do not sort selectively into CZ across the time span of the sibling comparison, and ii) that parents do not selectively acquire additional education across the time span of the sibling comparison. As points of departure both assumptions are plausible. First, there is little residential movement across CZs among German families. Second, I focus on families with at least two children and who therefore most likely have finished their educational biographies. Indeed, only 3.1% of my sample are affected by intra-sibling variation in the CZ of residence or the educational status of their parents. However, to test both assumptions formally, I include vectors of CZ fixed effects as

well as maternal and paternal education fixed effects in the set of control variables. My results remain unaffected.

Lastly, since 1996 every German family with children aged 3–6 has a legal entitlement for a place in publicly subsidized childcare. By 2013 this right had been expanded to children aged one year and older. Both legal provisions have led to massive expansions of public childcare that were characterized by strong regional heterogeneity in the speed of expansion. My identification would be threatened if the intra-family variation in potential wages would correlate with intra-family changes in the availability of public childcare slots. To address this concern I expand my baseline specification by adding separate controls for the CZ- and year-specific share of children aged 0–3 and 3–6 that attend publicly subsidized childcare.[28] The number of observations reduces slightly due to the non-availability of administrative data on childcare slots in the years 2005 and 2006. The results, however, remain unchanged.

Alternative Sample Restrictions. The baseline estimates are derived from a sample of stable families where I allow for changes in the partner of mothers as long as this partner is constant for the time period of the sibling comparison. Focusing on biological parents only reduces the sample by 238 observations but does not alter the results. Similarly, my results remain unaffected when restricting the sample to married parents only.

My sample shrinks significantly by list-wise deleting entries without information on the child's Big Five personality traits. While this restriction is necessary for the investigation of socio-emotional skills, I can estimate the parental labor market response and the household's childcare response on a validation sample that has more than four time the size of my core data sample ($N = 28,380$). However, even in this expanded sample the results remain comparable to my baseline estimates.

[28]Demand for public childcare strongly exceeds its supply. Actual enrollment therefore is a suitable proxy for the availability of childcare slots (Felfe and Lalive, 2018). See Figure S.3 for an overview map that displays the regional heterogeneity in the speed of childcare expansion.

5.5 Heterogeneity

The average effects presented thus far may mask i) heterogeneity in the way households react to changes in relative wage incentives, and ii) differences in the effects of these allocation decisions across children with different characteristics. For example, the stylized model presented in section 2 suggests that parental beliefs and norms may insulate investments into children from economic incentives (see also Ichino et al., 2020). Furthermore, it is well-documented that children have a differential sensitivity towards parental investments, for example depending on their age (Del Boca et al., 2017) and gender (Bertrand and Pan, 2013).

In the following, I study the existence of heterogeneous effects across child and parental characteristics by estimating the following model:

$$\begin{aligned} Y_{ifat} = \alpha &+ \beta \hat{w}^{\Delta}_{ifat-1} + \psi \hat{w}^{\Sigma}_{ifat-1} \\ &+ \beta^H (\hat{w}^{\Delta}_{ifat-1} \times I^H) + \psi^H (\hat{w}^{\Sigma}_{ifat-1} \times I^H) \\ &+ \gamma_{fa} + \tau_t + X'_{ifat}\delta + \epsilon_{ifat}, \end{aligned} \tag{7}$$

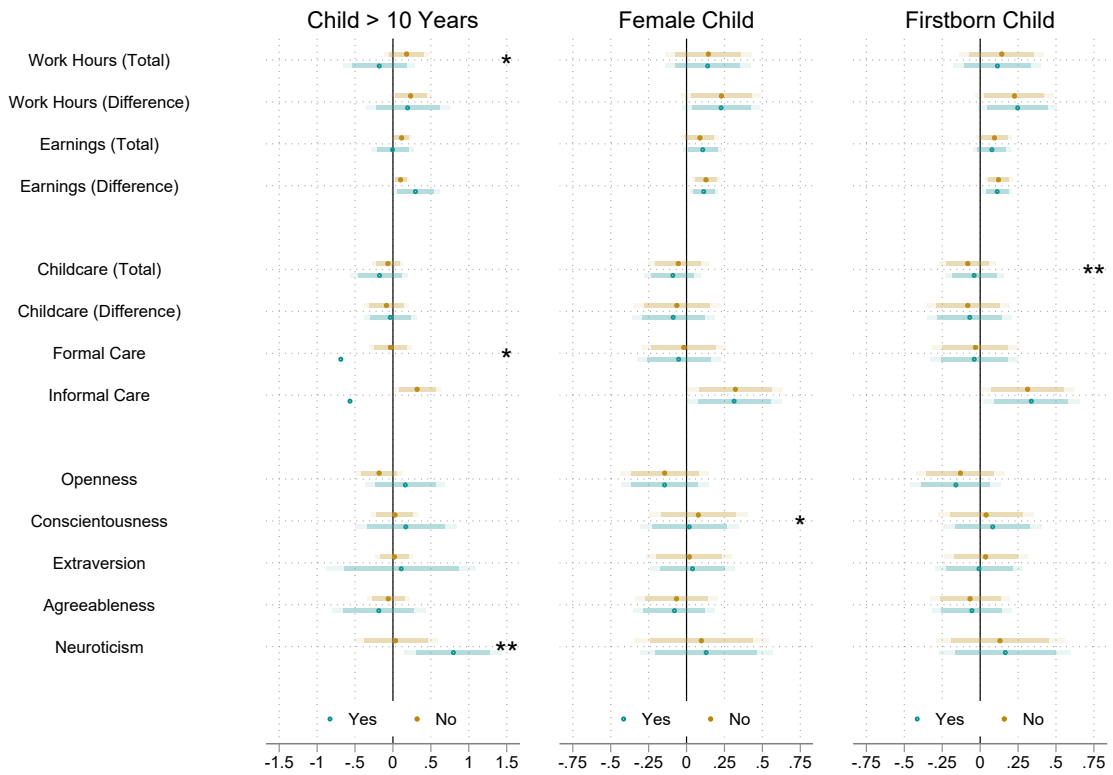
where I^H indicates a binary indicator variable in heterogeneity dimension H.

Figures 6 and 7 summarize the results of this heterogeneity analysis. In particular, for each outcome I plot the marginal effects of increases in $\hat{w}^{\Delta}_{ifat-1}$ as well as the corresponding confidence bands by group characteristic. These marginal effects indicate whether increases in $\hat{w}^{\Delta}_{ifat-1}$ yield a group-specific effect that is statistically different from zero. Furthermore, I add significance stars for the parameter β^H to indicate whether effects across groups are statistically significant from each other. To facilitate the graphical representation I standardize all outcome and wage shock variables to have mean zero and standard deviation one.

Child Characteristics. Figure 6 shows heterogeneous effects of maternal and paternal wage shocks by child age ($\lesseqgtr 10$ years), sex and birth order.

Kleven et al. (2019) show that women stabilize their labor force attachment at older child ages. Consistent with this observation, the effect of changes in the parental wage gap on total

Figure 6 – Effect Heterogeneity across Child Characteristics



Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ). **Note:** Own calculations. This figure shows heterogeneous effects of the parental gap in potential wages ($\hat{w}^{\Delta}_{ifat-1}$) across a selected set of child characteristics. Each data point shows the marginal effect of $\hat{w}^{\Delta}_{ifat-1}$ estimated from equation (7) for the binary characteristic indicated in the subfigure header. The dark and light shaded bars indicate the 95% and 99% confidence interval, respectively. In the leftmost panel, confidence intervals on *Formal Care* and *Informal Care* are omitted for better visualization. Stars indicate the statistical significance level of the interaction coefficient β^{H} from equation (7). All outcome variables as well as $\hat{w}^{\Delta}_{ifat-1}$ and $\hat{w}^{\Sigma}_{ifat-1}$ are standardized to have $\mathcal{N} = (0, 1)$. All coefficients are estimated on the core sample described in Table 2. Standard errors are clustered at the family level. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

household labor supply is less pronounced if children are ten years of age and older. In the German school system age ten marks the transition from primary to secondary school. From this age on, there is no widely available formal childcare option and it is plausible that informal childcare arrangements decrease in importance as children grow into adolescents. Consistent with this fact, the previously detected increase in the use of informal child care arrangements is exclusively driven by children aged ten years and younger.[29]

Apart from these child age effects, however, household's adjustments to changes in their relative labor market incentives do not vary strongly with the characteristics of their child. In particular, parental responses are by-and-large consistent regardless of whether the child is

[29]Since the use of childcare above age ten is infrequent, the respective coefficients are noisily estimated and I omit the corresponding confidence bands from the graphical representation to increase its visual clarity.

male or female and whether the child is the firstborn or a higher-order sibling.

Similarly, there is little heterogeneity in the way parental wage shocks affect the socio-emotional skill development of their children. Decreases in the parental wage gap lead to a slightly stronger increase in conscientousness if the child is male. The marginal effect, however, remains indistinguishable from zero. Furthermore, there is a stronger increase in neuroticism if the child is ten years and older. However, this is the only subgroup for which I detect a non-zero marginal effect of decreasing parental wage gaps on children's socio-emotional skills. Otherwise the null effect of decreases in the parental wage gap on children's personality persists for all Big Five dimensions across all three child characteristics.

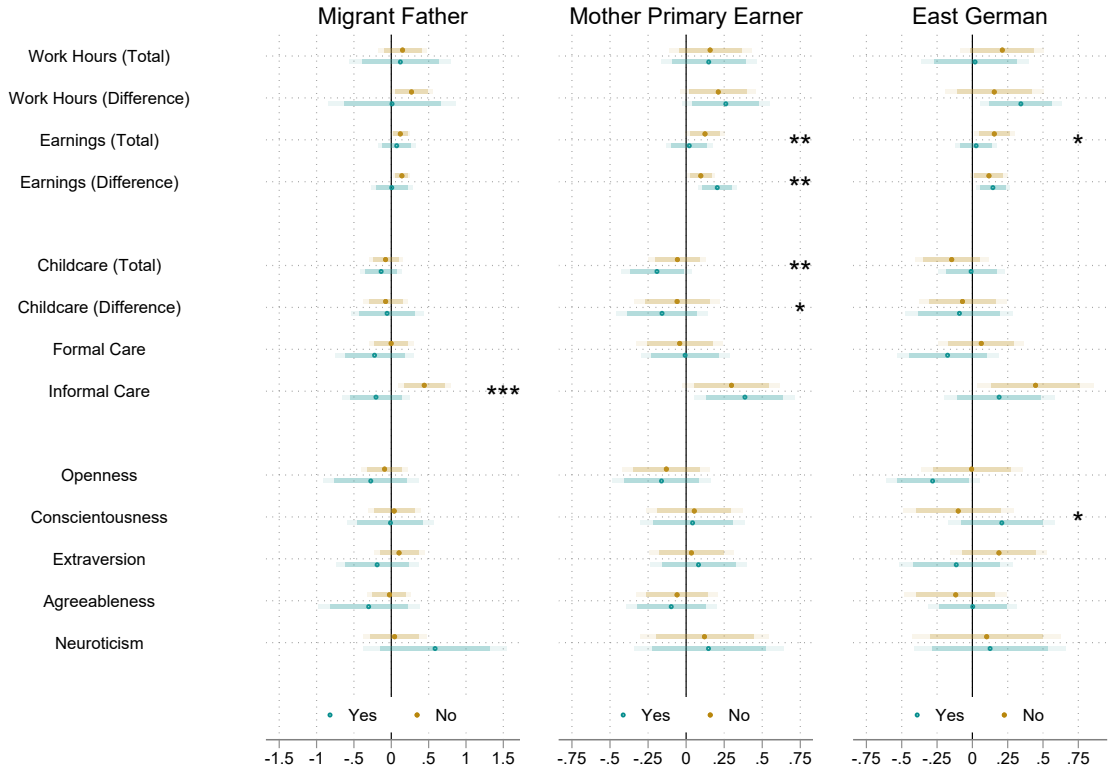
Parental Characteristics. A more diverse picture emerges for differences in parental characteristics. Figure 7 shows heterogeneous effects of maternal and paternal wage shocks by paternal migration background, by whether the mother was the household's primary earner in year $t-1$, or whether the family resides in the Eastern part of Germany. Each of these characteristics may be interpreted as a proxy variable for gender identity norms.

Consistent with this interpretation, we observe that parental differences in labor hours and earnings react less to decreasing parental wage gaps if the father has a migration background. As a consequence, these families need to rely less on the use of informal care arrangements in response to such shocks.

In households in which the mother represents the primary earner, gender identity norms may be less binding. Consistent with this hypothesis, these households seem to react stronger in line with economic incentives: A decrease in the parental wage gap leads to a stronger decrease in the parental earnings difference, and a stronger decrease in both total care provision and the gender difference in parental care.

The regional patterns of gender gaps and gender norms displayed in Figures 1 and 2 suggest that Eastern and Western German families react differently to gendered changes in labor market incentives. Indeed, for Eastern German families decreases in the parental wage gap lead to a statistically significant decrease in the parental difference of hours worked. This is not the case for Western German families. In contrast, Western German families respond to

Figure 7 – Effect Heterogeneity across Parental Characteristics



Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This figure shows heterogeneous effects of the parental gap in potential wages ($\hat{w}^{\Delta}_{ifat-1}$) across a selected set of parental characteristics. Each data point shows the marginal effect of $\hat{w}^{\Delta}_{ifat-1}$ estimated from equation (7) for the binary characteristic indicated in the subfigure header. The dark and light shaded bars indicate the 95% and 99% confidence interval, respectively. Stars indicate the statistical significance level of the interaction coefficient β^{H} from equation (7). All outcome variables as well as $\hat{w}^{\Delta}_{ifat-1}$ and $\hat{w}^{\Sigma}_{ifat-1}$ are standardized to have $\mathcal{N} = (0, 1)$. All coefficients are estimated on the core sample described in Table 2. Standard errors are clustered at the family level. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

decreases in the parental wage gap by a stronger increase in total hours of work. This suggests, that these households are characterized by a more positive paternal labor supply response to the wage increases of mothers. Furthermore, we observe that the increasing use of informal care arrangements is more strongly driven by Western German families which reflects the wider availability of formal childcare in the Eastern part of Germany.

In general, these results are consistent with Ichino et al. (2020) who show that Swedish couples react less strongly to changes in the net-of-tax wage rate if they belong to a group that adheres to more traditional gender norms. However, in spite of the differential responses of these households to their relative labor market incentives, there is little heterogeneity in the way parental wage shocks affect the socio-emotional development of children. The slight decrease

in openness observed in Table 6 is driven by Eastern German children. Furthermore, decreases in the parental wage gap lead to a slightly stronger increase in conscientousness if the child is from an Eastern German family. The marginal effect, however, remains indistinguishable from zero.

6 CONCLUSION

In this paper I study the effect of converging parental wages on the socio-emotional development of their children. Thereby, I connect the literature branches on intra-household decision-making and child development. While the former has extensively studied household responses to changes in the gender wage gap (e.g. Eckstein et al., 2019; Knowles, 2012), the latter has focused on parental inputs and their effect on child development (e.g. Agostinelli and Sorrenti, 2018; Nicoletti et al., 2020).

I find that relative wage gains of mothers *increase* i) household's total financial resources, ii) the share of financial resources controlled by mothers, and iii) the use of informal care providers. To the contrary, I find *no effects* on i) the total hours of care provided by parents and ii) the share of parental care provided by mothers or fathers. Drawing on time-use data, I provide suggestive evidence that the latter effects are explained by mothers that compensate children for their increased absence during the business hours with increased attention in the morning and the afternoon after they return from work. In sum, I find no effects of converging parental wages on the socio-emotional skill development of their children as measured by the Big Five inventory. These null effects are estimated precisely enough to comfortably exclude the effect sizes of various interventions analyzed in the existing literature at the conventional levels of statistical significance.

Fostering gender equality and promoting the development of children are both prominent goals of family policy that are oftentimes thought to be in conflict with each other. The evidence presented in this paper suggests that increasing gender equality in the labor market does not have to come at the cost of child development. Yet, there are a number of qualifications that should be borne in mind. First, Germany provides childcare institutions that are of rela-

tively high quality. Similar investigations in country contexts in which there is a larger quality gap between maternal care and its alternatives may lead to different conclusions. Second, mothers increase their labor market participation while maintaining their time investments into children. Such a "second shift" (Hochschild and Machung, 1990) of unpaid work may impose additional strain on mothers. Thus, resolving the trade-off between gender equality in the labor market and child development may actually come at the cost of adverse affects on maternal mental and physical health. An in-depth investigation such effects, however, is left for future research.

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A ROTEMBERG WEIGHTS

Table A.1 – Top 10 Rotemberg Weights, Mothers

Occupation/Industry	Rotemberg Weights		Coefficient	
	α_{io}	Share in %	β_{io}	95% CI
Teachers & Social Care Workers in Education	0.41	30.96%	2.52	[-1.00,6.00]
Sales Occ. in Wholesale and Retail	0.08	6.00%	7.83	[3.00,15.00]
Facility Management in Human Health Services	0.06	4.70%	4.99	[2.00,8.00]
Financial Services in Finance and Insurance	0.06	4.36%	-6.35	[-24.00,6.00]
Facility Management in Information, Communication, Business Services	0.05	4.08%	3.92	[0.00,7.00]
Facility Management in Public Administration	0.05	3.46%	5.97	[2.50,9.50]
Facility Management in Education	0.03	2.62%	7.07	[4.00,10.50]
Textile & Leather Processing in Manufacturing: Food/Textiles/Other	0.03	2.23%	7.16	[4.00,12.50]
Sales Occ. in Manufacturing: Food/Textiles/Other	0.03	1.98%	7.75	[3.00,17.00]
Logistics Occ. in Wholesale and Retail	0.02	1.88%	5.84	[3.00,9.00]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This table shows the 10 industry-occupation cells with the highest Rotemberg weights for mothers. The Rotemberg weights, α_{io}, are calculated on the core sample described in Table 2 using the programming routine provided by Goldsmith-Pinkham et al. (2020). The share of each Rotemberg weight is calculated by dividing α_{io} with $\sum_i \sum_o [\alpha_{io} | \alpha_{io} \geq 0]$. β_{io} reflects the coefficient on $\hat{w}^m_{ifat-1}$ from a just-identified 2SLS regression of maternal labor income on $\hat{w}^m_{ifat-1}$ while controlling for sibling times child age fixed effects γ_{fa} and year fixed effects τ_t. $\hat{w}^m_{ifat-1}$ is instrumented with the group-specficic sector share in base year 1995 ($E^{oj}_{ger,1995}/E_{ger,1995}$). The associated confidence interval is the weak instrument robust confidence interval based on the method of Chernozhukov and Hansen (2008) over the range $-30 - 30$.

Table A.2 – Top 10 Rotemberg Weights, Fathers

Occupation/Industry	Rotemberg Weights		Coefficient	
	α_{io}	Share in %	β_{io}	95% CI
Teachers & Social Care Workers in Education	0.12	9.53%	2.18	[-2.00,6.50]
Building Construction in Construction	0.09	6.72%	2.93	[-2.50,9.00]
Engineering Occ. in Manufacturing: Electronics/Vehicles/Machinery	0.08	6.64%	-2.93	[-14.00,7.00]
Logistics Occ. in Transportation and Storage	0.06	4.32%	3.59	[-1.00,9.00]
Business Adminsistration in Manufacturing: Electronics/Vehicles/Machinery	0.05	4.25%	-0.12	[-5.50,5.00]
Logistics Occ. in Wholesale and Retail	0.05	4.07%	3.05	[-1.50,8.00]
Building Services in Construction	0.05	4.02%	2.48	[-3.50,9.00]
Purchasing & Trading in Manufacturing: Electronics/Vehicles/Machinery	0.05	3.76%	2.71	[-6.50,12.50]
Financial Services in Finance and Insurance	0.05	3.69%	-3.57	[-30.00,16.50]
Interior Construction in Construction	0.04	3.01%	1.58	[-3.50,7.00]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This table shows the 10 industry-occupation cells with the highest Rotemberg weights for fathers. The Rotemberg weights, α_{io}, are calculated on the core sample described in Table 2 using the programming routine provided by Goldsmith-Pinkham et al. (2020). The share of each Rotemberg weight is calculated by dividing α_{io} with $\sum_i \sum_o [\alpha_{io}|\alpha_{io} \geq 0]$. β_{io} reflects the coefficient on $\hat{w}^p_{ifat-1}$ from a just-identified 2SLS regression of maternal labor income on $\hat{w}^p_{ifat-1}$ while controlling for sibling times child age fixed effects γ_{fa} and year fixed effects τ_t. $\hat{w}^p_{ifat-1}$ is instrumented with the group-specficic sector share in base year 1995 ($E^{oj}_{ger,1995}/E_{ger,1995}$). The associated confidence interval is the weak instrument robust confidence interval based on the method of Chernozhukov and Hansen (2008) over the range $-30 - 30$.

B ROBUSTNESS

B.1 Alternative Labor Demand Shocks

Table B.3 – Robustness Checks Labor Market Response: Alternative Labor Demand Shocks

	Labor Hours (Σ)	Labor Hours (Δ)	Earnings (Σ)	Earnings (Δ)
Panel (a): Baseline Effect				
Parental Wage Gap	0.351	0.555**	2.922**	3.261***
	(0.269)	(0.242)	(1.366)	(0.953)
	[6,070]	[6,070]	[6,070]	[6,070]
Panel (b): Robustness Checks				
Censored Wages (SIAB)	0.418	0.759**	4.211**	4.045***
	(0.318)	(0.303)	(1.690)	(1.226)
	[6,070]	[6,070]	[6,070]	[6,070]
CPS Imputation (SIAB)	0.369	0.595**	3.082**	3.457***
	(0.273)	(0.248)	(1.386)	(0.969)
	[6,070]	[6,070]	[6,070]	[6,070]
Hours Last Week (MZ)	0.323	0.493**	2.423**	3.043***
	(0.232)	(0.211)	(1.186)	(0.840)
	[6,070]	[6,070]	[6,070]	[6,070]
Updating Shenhav (2020)	0.340	0.562**	2.950**	3.387***
	(0.269)	(0.242)	(1.358)	(0.948)
	[6,070]	[6,070]	[6,070]	[6,070]
No Occupation	-0.516	1.503**	2.688	7.467**
	(0.730)	(0.619)	(3.805)	(3.254)
	[6,070]	[6,070]	[6,070]	[6,070]
Log Parental Wage Gap	4.816	8.044**	31.167	44.130***
	(3.870)	(3.482)	(19.203)	(13.233)
	[6,070]	[6,070]	[6,070]	[6,070]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Work hours are measured in hours per day. Earnings are measured in thousand € per year. Σ indicates the sum across parental outcomes. Δ indicates the difference between maternal and paternal outcomes. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

Table B.4 – Robustness Checks Childcare Response: Alternative Labor Demand Shocks

	Childcare Hours (Σ)	Childcare Hours (Δ)	Non-parental Care	Formal Care	Informal Care
Panel (a): Baseline Effect					
Parental Wage Gap	-0.252	-0.210	0.016	-0.010	0.081***
	(0.238)	(0.283)	(0.032)	(0.031)	(0.031)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
Panel (b): Robustness Checks					
Censored Wages (SIAB)	-0.327	-0.259	0.029	-0.005	0.098**
	(0.314)	(0.358)	(0.041)	(0.038)	(0.039)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
CPS Imputation (SIAB)	-0.273	-0.220	0.017	-0.009	0.080**
	(0.246)	(0.289)	(0.033)	(0.031)	(0.032)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
Hours Last Week (MZ)	-0.225	-0.134	0.017	-0.005	0.065**
	(0.202)	(0.238)	(0.028)	(0.027)	(0.027)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
Updating Shenhav (2020)	-0.258	-0.193	0.014	-0.012	0.081***
	(0.227)	(0.270)	(0.032)	(0.030)	(0.031)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
No Occupation	-1.352*	-0.732	-0.061	-0.111	0.134
	(0.810)	(0.787)	(0.107)	(0.093)	(0.090)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
Log Parental Wage Gap	-3.815	-2.713	0.195	-0.131	1.128**
	(3.533)	(4.169)	(0.471)	(0.455)	(0.442)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Parental childcare hours are measured in hours per day. Non-parental childcare is measured as a binary variable indicating whether parents use the respective care arrangement. Σ indicates the sum across parental outcomes. Δ indicates the difference between maternal and paternal outcomes. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

Table B.5 – Robustness Checks Socio-emotional Skill Development: Alternative Labor Demand Shocks

	Openness	Conscient-ousness	Extra-version	Agree-ableness	Neuroticism
Panel (a): Baseline Effect					
Parental Wage Gap	-0.078	0.027	0.020	-0.039	0.074
	(0.061)	(0.067)	(0.061)	(0.057)	(0.092)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]
Panel (b): Robustness Checks					
Censored Wages (SIAB)	-0.090	0.056	0.051	-0.040	0.086
	(0.078)	(0.082)	(0.080)	(0.074)	(0.114)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]
CPS Imputation (SIAB)	-0.076	0.028	0.032	-0.035	0.071
	(0.063)	(0.068)	(0.063)	(0.059)	(0.094)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]
Hours Last Week (MZ)	-0.046	0.032	0.029	-0.025	0.050
	(0.056)	(0.057)	(0.054)	(0.050)	(0.080)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]
Updating Shenhav (2020)	-0.077	0.027	0.015	-0.043	0.079
	(0.061)	(0.067)	(0.061)	(0.057)	(0.091)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]
No Occupation	-0.003	0.223	-0.104	0.109	0.162
	(0.192)	(0.195)	(0.194)	(0.162)	(0.264)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]
Log Parental Wage Gap	-1.259	0.315	-0.021	-0.400	1.295
	(0.840)	(0.944)	(0.840)	(0.780)	(1.264)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Short descriptions for each Big Five personality trait are provided in Table S.6. The Big Five personality traits are measured using the questionnaire batteries displayed in Table S.7. Dimension-specific responses are added and standardized to have $\mathcal{N} = (0, 1)$ for each age group. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

B.2 Alternative Control Variables

Table B.6 – Robustness Checks Labor Market Response: Additional Controls

	Labor Hours (Σ)	Labor Hours (Δ)	Earnings (Σ)	Earnings (Δ)
Panel (a): Baseline Effect				
Parental Wage Gap	0.351	0.555**	2.922**	3.261***
	(0.269)	(0.242)	(1.366)	(0.953)
	[6,070]	[6,070]	[6,070]	[6,070]
Panel (b): Robustness Checks				
Additional Child Controls	0.300	0.559**	2.784**	3.017***
	(0.276)	(0.239)	(1.390)	(0.916)
	[6,070]	[6,070]	[6,070]	[6,070]
CZ & Parental Education FE	0.080	0.821**	3.675**	3.938***
	(0.337)	(0.323)	(1.529)	(1.371)
	[6,070]	[6,070]	[6,070]	[6,070]
Childcare Availability	0.392	0.602**	2.913**	3.538***
	(0.268)	(0.250)	(1.387)	(0.967)
	[5,747]	[5,747]	[5,747]	[5,747]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Work hours are measured in hours per day. Earnings are measured in thousand € per year. Σ indicates the sum across parental outcomes. Δ indicates the difference between maternal and paternal outcomes. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

Table B.7 – Robustness Checks Childcare Response: Additional Controls

	Childcare Hours (Σ)	Childcare Hours (Δ)	Non-parental Care	Formal Care	Informal Care
Panel (a): Baseline Effect					
Parental Wage Gap	-0.252	-0.210	0.016	-0.010	0.081***
	(0.238)	(0.283)	(0.032)	(0.031)	(0.031)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
Panel (b): Robustness Checks					
Additional Child Controls	-0.203	-0.197	0.014	-0.015	0.081***
	(0.208)	(0.273)	(0.032)	(0.030)	(0.031)
	[6,070]	[6,070]	[4,297]	[4,297]	[4,297]
CZ & Parental Education FE	-0.023	-0.240	-0.007	-0.043	0.088***
	(0.411)	(0.357)	(0.031)	(0.033)	(0.032)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
Childcare Availability	-0.240	-0.127	0.008	-0.016	0.080**
	(0.248)	(0.289)	(0.033)	(0.031)	(0.032)
	[5,747]	[5,747]	[4,159]	[4,159]	[4,159]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Parental childcare hours are measured in hours per day. Non-parental childcare is measured as a binary variable indicating whether parents use the respective care arrangement. Σ indicates the sum across parental outcomes. Δ indicates the difference between maternal and paternal outcomes. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

Table B.8 – Robustness Checks Socio-emotional Skill Development: Additional Controls

	Openness	Conscient-ousness	Extra-version	Agree-ableness	Neuroticism
Panel (a): Baseline Effect					
Parental Wage Gap	-0.078	0.027	0.020	-0.039	0.074
	(0.061)	(0.067)	(0.061)	(0.057)	(0.092)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]
Panel (b): Robustness Checks					
Additional Child Controls	-0.076	0.034	0.026	-0.024	0.070
	(0.060)	(0.066)	(0.061)	(0.057)	(0.095)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,344]
CZ & Parental Education FE	-0.077	0.082	-0.037	-0.039	0.115
	(0.077)	(0.089)	(0.088)	(0.079)	(0.095)
	[5,999]	[6,049]	[6,039]	[6,032]	[4,346]
Childcare Availability	-0.093	0.024	0.040	-0.032	0.071
	(0.064)	(0.070)	(0.062)	(0.058)	(0.095)
	[5,680]	[5,726]	[5,716]	[5,709]	[4,233]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Short descriptions for each Big Five personality trait are provided in Table S.6. The Big Five personality traits are measured using the questionnaire batteries displayed in Table S.7. Dimension-specific responses are added and standardized to have $\mathcal{N} = (0, 1)$ for each age group. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

B.3 Alternative Sample Restrictions

Table B.9 – Robustness Checks Labor Market Response: Alternative Sample Restrictions

	Labor Hours (Σ)	Labor Hours (Δ)	Earnings (Σ)	Earnings (Δ)
Panel (a): Baseline Effect				
Parental Wage Gap	0.351	0.555**	2.922**	3.261***
	(0.269)	(0.242)	(1.366)	(0.953)
	[6,070]	[6,070]	[6,070]	[6,070]
Panel (b): Robustness Checks				
Biological Parents Only	0.365	0.573**	2.962**	3.188***
	(0.271)	(0.242)	(1.378)	(0.958)
	[5,832]	[5,832]	[5,832]	[5,832]
Married Parents Only	0.359	0.487*	2.935*	3.300***
	(0.299)	(0.267)	(1.507)	(1.019)
	[5,622]	[5,622]	[5,622]	[5,622]
Validation Sample	0.393*	0.170	1.806**	2.199***
	(0.214)	(0.240)	(0.752)	(0.800)
	[28,380]	[28,380]	[28,380]	[28,380]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Work hours are measured in hours per day. Earnings are measured in thousand € per year. Σ indicates the sum across parental outcomes. Δ indicates the difference between maternal and paternal outcomes. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

Table B.10 – Robustness Checks Childcare Response: Alternative Sample Restrictions

	Childcare Hours (Σ)	Childcare Hours (Δ)	Non-parental Care	Formal Care	Informal Care
Panel (a): Baseline Effect					
Parental Wage Gap	-0.252	-0.210	0.016	-0.010	0.081***
	(0.238)	(0.283)	(0.032)	(0.031)	(0.031)
	[6,070]	[6,070]	[4,298]	[4,298]	[4,298]
Panel (b): Robustness Checks					
Biological Parents Only	-0.231	-0.163	0.013	-0.012	0.081***
	(0.237)	(0.284)	(0.032)	(0.031)	(0.031)
	[5,832]	[5,832]	[4,190]	[4,190]	[4,190]
Married Parents Only	-0.213	-0.157	0.035	0.008	0.077**
	(0.258)	(0.303)	(0.036)	(0.035)	(0.033)
	[5,622]	[5,622]	[3,966]	[3,966]	[3,966]
Validation Sample	0.093	0.196	0.032	0.023	0.042**
	(0.170)	(0.264)	(0.021)	(0.021)	(0.017)
	[28,380]	[28,380]	[24,238]	[24,238]	[24,238]

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Parental childcare hours are measured in hours per day. Non-parental childcare is measured as a binary variable indicating whether parents use the respective care arrangement. Σ indicates the sum across parental outcomes. Δ indicates the difference between maternal and paternal outcomes. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

Table B.11 – Robustness Checks Socio-emotional Skill Development: Alternative Sample Restrictions

	Openness	Conscient-ousness	Extra-version	Agree-ableness	Neuroticism
Panel (a): Baseline Effect					
Parental Wage Gap	-0.078 (0.061) [5,999]	0.027 (0.067) [6,049]	0.020 (0.061) [6,039]	-0.039 (0.057) [6,032]	0.074 (0.092) [4,346]
Panel (b): Robustness Checks					
Biological Parents Only	-0.087 (0.061) [5,767]	0.022 (0.067) [5,814]	0.022 (0.061) [5,804]	-0.047 (0.058) [5,799]	0.078 (0.092) [4,121]
Married Parents Only	-0.045 (0.065) [5,555]	0.039 (0.070) [5,606]	0.047 (0.067) [5,593]	-0.017 (0.059) [5,589]	0.067 (0.097) [4,099]
Validation Sample	–	–	–	–	–

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. Short descriptions for each Big Five personality trait are provided in Table S.6. The Big Five personality traits are measured using the questionnaire batteries displayed in Table S.7. Dimension-specific responses are added and standardized to have $\mathcal{N} = (0, 1)$ for each age group. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level. The number of observations is indicated in brackets.

The Parental Wage Gap and the Development of Socio-emotional Skills in Children

Paul Hufe

Supplementary Material

September 15, 2020

A ADDITIONAL TABLES

Table S.1 – Comparison GSOEP and GTUS, Work and Childcare Hours per Day in 2001/02 and 2012/13

	GSOEP		GTUS	
	2001/02	2012/13	2001/02	2012/13
Mother				
Work Hours/Day	3.1	3.1	3.0	3.7
Childcare Hours/Day	5.8	5.6	5.0	5.6
Intensive Childcare Hours/Day	.	.	2.4	2.7
Father				
Work Hours/Day	7.9	6.7	7.3	7.3
Childcare Hours/Day	1.5	1.8	2.2	2.6
Intensive Childcare Hours/Day	.	.	0.9	1.1

Data: German Socio-economic Panel (GSOEP), German Time-Use Study (GTUS).
Note: Own calculations. This table compares working time and childcare time variables across the GSOEP and the GTUS. The samples include two-parent households aged 18–63 with at least one resident child aged 2–17. Work hours and childcare hours are measured in hours per day. The analysis is based on week days Monday through Friday only. *Childcare Hours/Day* in the GTUS capture any activity with the child present. *Intensive Childcare Hours/Day* capture any time when respondents refer to childcare as their primary activity.

Table S.2 – Industry Employment Shares by Education and Sex, 1995

	Male			Female		
	Low	Inter–mediate	High	Low	Inter–mediate	High
Agriculture/Mining/Utilities	6.1	4.6	3.2	1.5	1.7	1.5
Manufacturing: Food/Textiles/Other	11.0	8.4	4.5	12.9	7.3	3.3
Manufacturing: Raw Materials/Metals/Chemicals	19.1	11.5	7.8	9.0	3.6	3.5
Manufacturing: Electronics/Vehicles/Machinery	12.0	12.5	13.7	10.5	4.1	3.3
Construction	13.5	19.1	6.4	1.4	2.9	2.3
Wholesale and Retail	9.3	13.7	10.1	12.3	20.8	11.7
Transportation and Storage	6.6	7.3	3.2	2.0	3.7	2.1
Accommodation and Food Services	4.7	1.9	1.0	6.6	3.6	1.5
Information, Communication, Business Services	8.4	8.4	20.3	11.6	10.8	17.8
Finance and Insurance	0.6	2.4	6.1	2.7	4.4	7.0
Public Administration	4.3	4.8	6.1	8.2	9.9	10.3
Education	0.6	0.9	6.2	3.5	3.9	12.2
Human Health Services	1.7	2.5	7.1	13.1	17.8	17.7
Other	2.1	2.0	4.3	4.7	5.5	5.7

Data: Sample of Integrated Labour Market Biographies (SIAB).
Note: Own calculations. This table shows the employment share of each industry among employees aged 18–63 in 1995 by sex and education. Education is classified as follows – lower secondary degree without tertiary education (*Low*), lower secondary degree with vocational training or higher secondary degree without vocational training (*Intermediate*), university qualification (*High*).

Table S.3 – Occupation Employment Shares by Education and Sex, 1995

	Male			Female		
	Low	Inter–mediate	High	Low	Inter–mediate	High
Raw Material & Plastic Processing	7.7	2.6	0.4	3.4	0.6	0.1
Metal Processing	13.9	8.1	1.4	4.4	0.7	0.2
Machine-Building Occ.	3.7	7.4	6.2	2.5	0.6	0.4
Engineering Occ.	5.0	14.2	17.2	6.1	3.0	3.6
Food Processing	5.1	3.0	0.5	9.2	2.6	0.4
Construction Planning	0.1	0.6	5.9	0.0	0.1	1.6
Building Construction	13.0	10.0	1.1	0.4	0.4	0.1
Logistics Occ.	22.4	14.9	3.7	9.0	4.0	1.2
Facility Management	5.4	2.9	0.8	24.1	4.3	0.7
Sales Occ.	1.4	2.5	1.5	6.4	13.8	2.5
Business Adminsistration	2.2	8.5	22.4	10.3	33.4	34.8
Financial Services	0.2	1.9	5.0	1.2	3.2	5.9
Doctors Assistants	0.0	0.0	0.2	0.6	4.3	1.9
Nursing Occ	0.6	1.7	3.3	4.2	14.3	13.7
Medical Care Occ.	0.0	0.2	3.9	0.1	1.6	8.0
Teachers & Social Care Workers	0.2	0.5	7.1	4.6	2.2	12.3

Data: Sample of Integrated Labour Market Biographies (SIAB).
Note: Own calculations. This table shows the employment share of each occupation among employees aged 18–63 in 1995 by sex and education. Education is classified as follows – lower secondary degree without tertiary education (*Low*), lower secondary degree with vocational training or higher secondary degree without vocational training (*Intermediate*), university qualification (*High*).

Table S.4 – Comparison SIAB and MZ, Socio-demographics by Year

	1995		2005		2015	
	SIAB	MZ	SIAB	MZ	SIAB	MZ
Age, Average in Employed Population						
Age	38.4	38.4	40.3	39.9	41.9	41.9
Female, Employment Share in %						
Male	57.4	55.1	55.4	52.5	53.7	53.4
Female	42.6	44.9	44.6	47.5	46.3	46.6
Education, Employment Share in %						
Low	10.9	13.1	8.0	12.7	6.4	9.7
Intermediate	72.8	67.4	68.1	62.2	60.2	58.4
High	16.3	19.5	23.9	25.0	33.4	31.8
Federal State, Employment Share in %						
Schleswig-Holstein	2.9	3.3	3.0	3.5	3.0	2.9
Saarland	1.3	1.1	1.3	1.1	1.2	1.1
Berlin	4.7	4.3	4.0	3.8	4.3	3.8
Brandenburg	3.3	3.5	2.7	3.3	2.6	3.2
Mecklenburg-Vorpommern	2.3	2.5	1.9	2.0	1.8	1.8
Sachsen	6.1	6.2	5.2	5.7	5.1	5.1
Sachsen-Anhalt	3.6	3.7	2.9	3.3	2.6	2.9
Thüringen	3.2	3.6	2.7	3.1	2.7	2.9
Hamburg	2.7	2.0	2.9	2.1	3.0	1.8
Niedersachsen	8.0	8.4	8.3	7.8	8.6	10.1
Bremen	1.3	0.8	1.2	0.7	1.3	0.7
Nordrhein-Westfalen	20.5	19.9	21.2	19.6	20.6	19.2
Hessen	7.5	7.1	8.0	7.8	7.8	7.8
Rheinland-Pfalz	4.1	4.9	4.3	4.9	4.3	4.7
Baden-Württemberg	13.2	13.1	14.2	14.0	14.1	14.0
Bayern	15.1	15.6	16.3	17.2	17.0	17.7

Data: Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This table shows the socio-demographic composition of the SIAB and the MZ in the years 1995, 2005 and 2015. All statistics are calculated on the sample of employees aged 18–63. The MZ is restricted to match the sample characteristics of the SIAB by excluding the marginally employed (<10h/week), civil servants, and self-employed individuals. Education is classified as follows – lower secondary degree without tertiary education (*Low*), lower secondary degree with vocational training or higher secondary degree without vocational training (*Intermediate*), university qualification (*High*).

Table S.5 – Comparison SIAB and MZ, Employment Structure by Year

	1995		2005		2015	
	SIAB	MZ	SIAB	MZ	SIAB	MZ
Occupation: Employment Share in %						
Agriculture/Mining/Utilities	3.3	5.0	2.7	3.9	2.3	2.9
Finance and Insurance	3.6	4.1	3.7	4.2	3.1	3.6
Public Administration	7.0	6.9	6.0	5.8	5.2	5.5
Education	3.2	3.9	3.5	4.3	3.7	4.5
Human Health Services	9.1	9.4	11.6	12.3	13.2	11.4
Other	3.7	4.7	4.0	5.0	3.8	3.9
Manufacturing: Food/Textiles/Other	7.7	9.1	6.2	6.8	5.2	6.1
Manufacturing: Raw Materials/Metals/Chemicals	8.5	9.2	7.6	7.6	6.6	6.6
Manufacturing: Electronics/Vehicles/Machinery	9.3	8.9	9.4	10.2	8.5	11.1
Construction	10.6	10.2	6.4	6.6	5.5	6.9
Wholesale and Retail	15.1	14.6	14.8	14.7	14.1	15.5
Transportation and Storage	5.1	4.5	5.4	4.7	5.4	5.4
Accommodation and Food Services	2.7	2.3	3.0	3.0	3.4	3.4
Information, Communication, Business Services	11.1	7.2	15.7	10.7	20.0	13.3
Industry: Employment Share in %						
Agriculture/Forestry/Farming/Gardening	2.1	2.3	1.6	1.8	1.4	1.7
Construction Planning	1.0	0.7	0.8	0.7	0.8	0.9
Building Construction	5.2	3.4	2.8	2.0	2.3	2.3
Interior Construction	1.9	1.7	1.3	1.2	1.2	1.3
Building Services	1.5	2.1	1.1	1.5	1.7	1.7
Natural Science Occ.	1.8	1.6	1.7	1.5	1.4	1.6
IT Occ.	1.0	1.2	1.9	2.1	2.2	2.7
Logistics Occ.	9.7	9.9	9.5	9.0	10.3	8.9
Facility Management	4.3	2.8	4.3	3.2	4.0	3.9
Purchasing & Trading	2.4	1.4	2.6	1.8	2.8	2.4
Sales Occ.	6.0	7.0	6.1	7.4	6.9	7.7
Raw Material & Plastic Processing	1.9	1.0	1.6	0.8	1.5	0.9
Tourism Services	1.5	1.8	1.8	2.6	2.4	2.5
Business Adminsistration	18.9	20.4	20.6	20.7	19.5	20.5
Financial Services	2.7	2.6	2.9	2.9	2.3	2.6
Doctors Assistants	1.5	1.5	1.8	1.9	1.9	1.7
Nursing Occ	6.5	7.5	8.4	9.3	10.0	7.9
Medical Care Occ.	1.5	1.6	2.0	2.2	2.6	2.2
Teachers & Social Care Workers	2.6	2.6	2.8	2.7	3.0	3.5
Artistic Occ.	0.9	0.9	0.9	1.1	1.0	1.1
Wood & Paper Processing	1.7	1.5	1.3	1.0	0.9	1.0
Media Design	0.9	0.8	0.8	0.7	0.7	0.7
Metal Processing	4.8	6.6	4.5	5.0	4.0	3.5
Machine-Building Occ.	4.3	4.5	4.3	4.7	4.3	5.4
Engineering Occ.	9.4	9.2	9.1	9.2	7.8	8.7
Textile & Leather Processing	1.0	1.0	0.6	0.6	0.4	0.4
Food Processing	2.9	2.2	2.8	2.3	2.6	2.4

Data: Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This table shows the employment structure of the SIAB and the MZ in the years 1995, 2005 and 2015. All statistics are calculated on the sample of employees aged 18–63. The MZ is restricted to match the sample characteristics of the SIAB by excluding the marginally employed (<10h/week), civil servants, and self-employed individuals.

Table S.6 – Definition of Big Five Dimensions

Dimension	Definition
Openness	... the tendency to be open to new aesthetic, cultural, or intellectual experiences.
Conscientousness	... the tendency to be organized, responsible, and hardworking.
Extraversion	... the tendency to be outgoing, gregarious, sociable, and openly expressive.
Agreeableness	... the tendency to act in a cooperative, unselfish manner.
Neuroticism	... a chronic level of emotional instability and proneness to psychological distress.

Note: Short Definitions from the APA Dictionary of Psychology.

Table S.7 – Big Five Scales in the GSOEP by Age Group

Age Group/ Likert Scale	Big Five Dimension	Questions
		How would you rank your child in comparison to other children of the same age? My child is ...
2-3 years	O	quick at learning new things - needs more time
11 point Likert	C	focused - easily distracted
	E	shy - outgoing
	A	obstinate - obedient
	N	–
		How would you rank your child in comparison to other children of the same age? My child is ...
5-6 years		
9-10 years	O	not that interested - hungry for knowledge
11 point Likert		understands quickly - needs more time
	C	tidy - untidy
		focused - easy to distract
	E	talkative - quiet
		withdrawn - sociable
	A	good-natured - irritable
		obstinate - compliant
	N	self-confident - insecure
		fearful - fearless
		People can have many different qualities – some are listed below. You will probably think that some of these are completely true of you whereas others are not at all. And with some of them, you might not be sure. I am someone who is ...
11-12 years		
13-15 years		
17 years		original, someone who comes up with new ideas
7 point Likert	O	someone who values artistic, aesthetic experiences
		imaginative
		eager for knowledge
		a thorough worker
	C	somewhat lazy
		effective and efficient in completing tasks
		communicative and talkative
	E	outgoing, sociable
		reserved
		sometimes a bit rude to others
	A	forgiving
		considerate and kind to others
		a worrier
	N	nervous
		relaxed, able to deal with stress

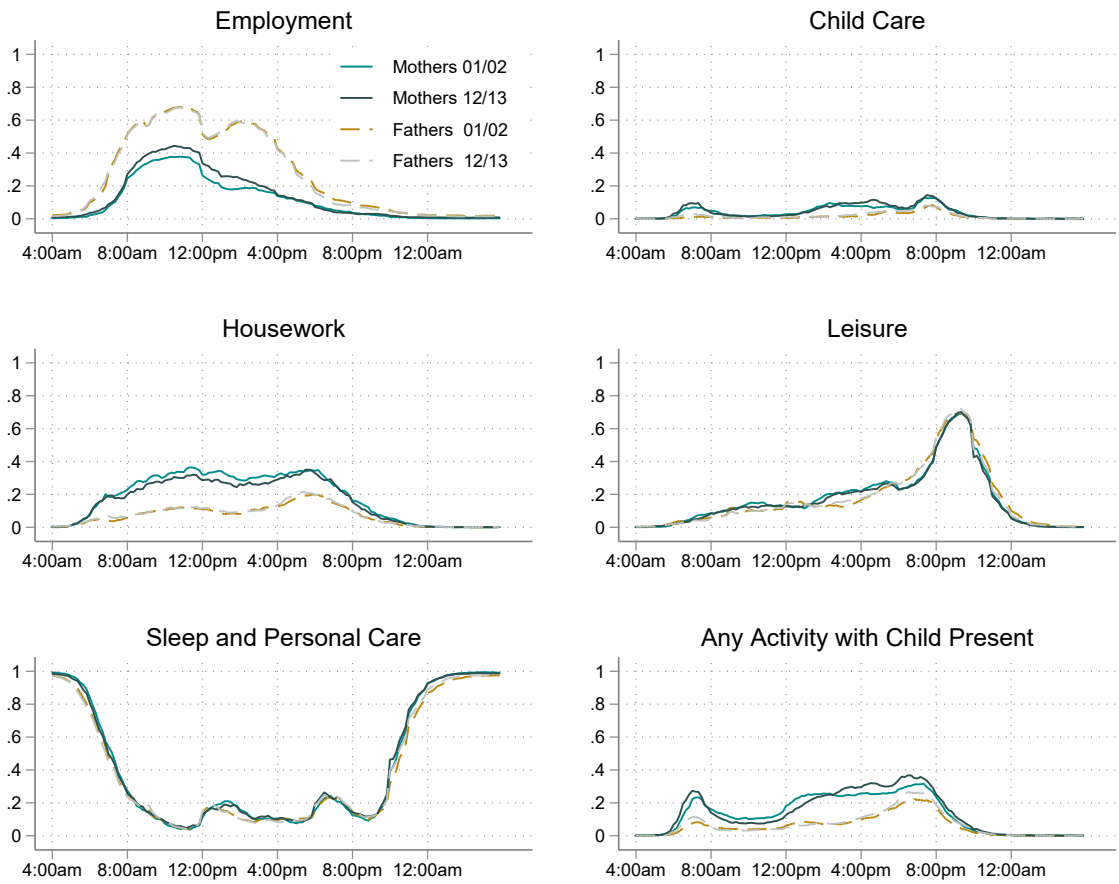
Table S.8 – Within-Family Correlation of Wage Shocks and Child Characteristics

Sibling Characteristic	N	Sibling × Child Age FE Only	Sibling × Child Age FE + Year FE
Female	6,070	0.026 (0.031)	0.022 (0.032)
Migration Background	6,070	0.003 (0.005)	0.007 (0.005)
Birth Year	6,070	0.847*** (0.133)	0.000 (0.000)
Birth Rank	6,070	0.275*** (0.052)	-0.003 (0.026)
# of Siblings	6,070	-0.002 (0.005)	-0.001 (0.005)
Birth Height (cm)	2,539	0.138 (0.213)	0.139 (0.215)
Birth Weight (kg)	2,553	0.020 (0.038)	0.012 (0.038)
Breastfed	2,341	-0.019 (0.017)	-0.017 (0.017)
Age Mother	6,070	0.847*** (0.133)	0.000 (0.000)
Age Father	6,070	0.847*** (0.133)	0.000 (0.000)

Data: German Socio-economic Panel (GSOEP), Sample of Integrated Labour Market Biographies (SIAB), Microcensus (MZ).
Note: Own calculations. This table shows correlations between $\hat{w}^{\Delta}_{ifat-1}(= \hat{w}^{m}_{ifat-1} - \hat{w}^{p}_{ifat-1})$ and sibling characteristics conditional on different control variables. The left-hand panel controls for sibling times child age fixed effects γ_{fa}, only. The right-hand panel additionally controls for year fixed effects, τ_t. Significance Levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered at the family level.

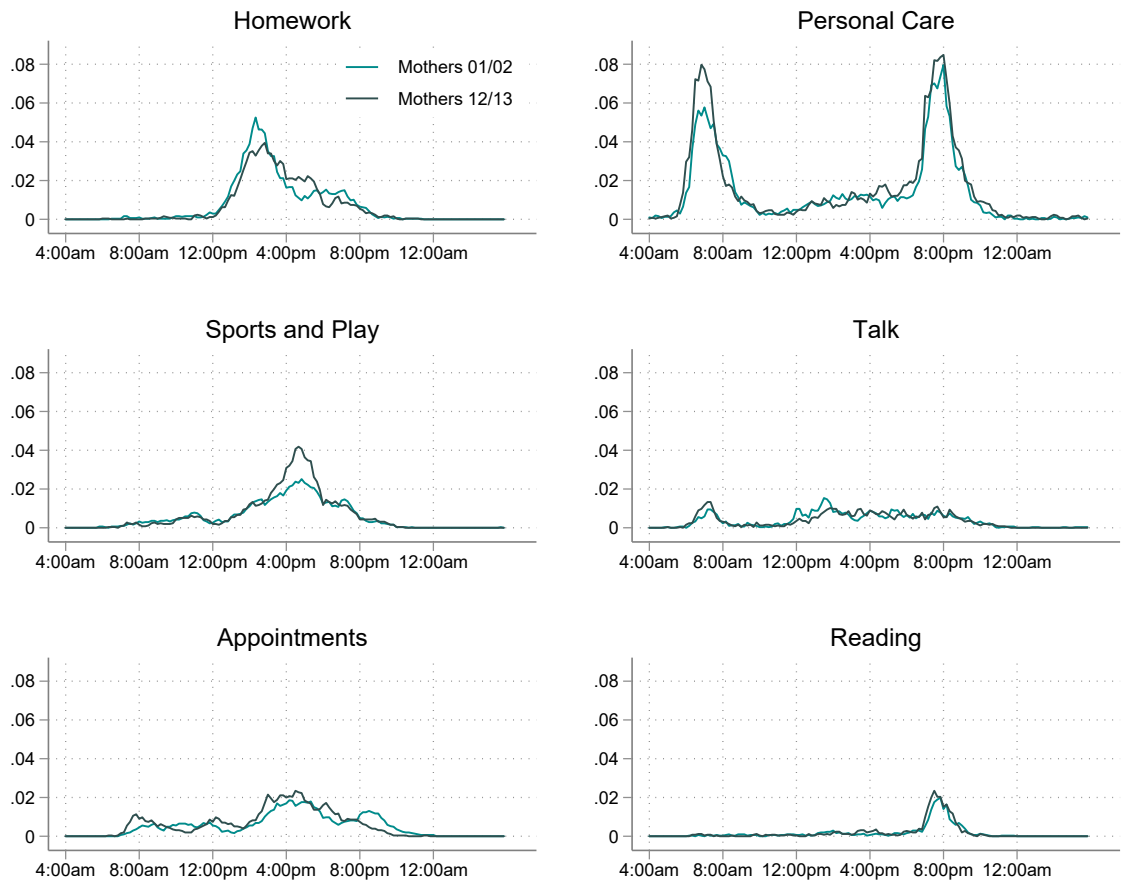
B ADDITIONAL FIGURES

Figure S.1 – Time-Use of Parents in Germany by Gender, 2001/02 and 2012/13



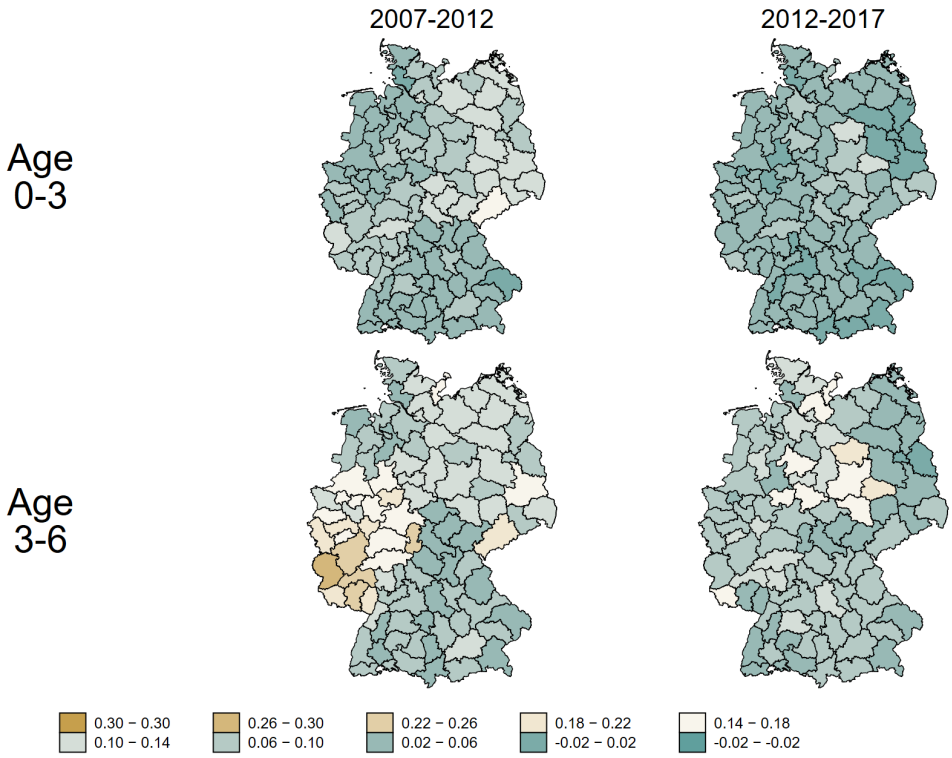
Data: German Time-Use Study (GTUS).
Note: Own calculations. This figure compares the share of mothers and fathers involved in a particular activity for each 10 minute time window of the day across the survey waves 2001/02 and 2012/13. The sample includes two-parent households aged 18–63 with at least one resident child aged 2–17 ($N = 3,065$ in 2001/02 and $N = 2,558$ in 2012/13). The analysis is based on week days Monday through Friday only. For each time of the day the shares across the first five panels sum to 100%. The panel titled *Any Activity with Child Present* represents the share of mothers and fathers who indicate the presence of one of their children in either of the activities represented on the first five panels.

Figure S.2 – Childcare Activities of Mothers in Germany, 2001/02 and 2012/13



Data: German Time-Use Study (GTUS).
Note: Own calculations. This figure compares the share of mothers involved in a particular childcare activity for each 10 minute time window of the day across the survey waves 2001/02 and 2012/13. The sample includes two-parent households aged 18–63 with at least one resident child aged 2–17 ($N = 3,065$ in 2001/02 and $N = 2,558$ in 2012/13). The analysis is based on week days Monday through Friday only.

Figure S.3 – Change in Full Day Childcare Availability by Child Age and Commuting Zone, 2007-2017



Data: Federal Statistical Office of Germany.
Note: Own calculations. This figure shows the change in the share of children attending full day childcare from 2007 to 2017 in five-year windows by child age and commuting zone. The 96 commuting zones are defined by the official territory definition of spatial planning regions of the Federal Office for Building and Regional Planning from 31.12.2017.