Discussion Paper No. 11-049

Impacts of Parental Health on Children's Development of Personality Traits and Problem Behavior: Evidence from Parental Health Shocks

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Non-Technical Summary

Parental investments are crucial for the children's skill development, especially in the early years of the life-cycle. In this paper, we examine how parental health, which may cause variation in investments to children's skill formation, affects children's development of specific non-cognitive skills in Germany. Specifically, we observe how significant negative changes to parental health (shocks) occurring early in children's life affect children's personality traits and problem behavior measured when the children are approximately six years old.

Because of the potential endogeneity of parental health with respect to children's outcomes, we consider shocks to parental health as a more exogenous source of health variation rather than contemporary levels of health status. Thus, by using significant one period changes in the health variables rather than contemporary levels of health, we hope to identify effects of exogenous changes in health rather than endogenously determined poor health ratings or health deterioration. Our data-base, the "mother and child data" from the German Socio-Economic Panel (GSOEP), also allows controlling for a variety of variables reflecting the children's initial skill endowments (for instance birth weight, week of pregnancy at birth, birth order). Additionally, we conduct sensitivity tests across alternative shock definitions and estimate placebo regressions on future parental health shocks to demonstrate the robustness of our results and test our identification strategy.

Our results imply that maternal health shocks in early childhood significantly affect children's emotional symptoms, hyperactivity and neuroticism by the age of six. Paternal health seems to be less relevant for the development of these non-cognitive characteristics. However, we observe that paternal health shocks cause children to be more extraverted.

Das Wichtigste in Kürze

Der Einfluss der Eltern auf die Entwicklung der Fähigkeiten ihrer Kinder ist vor allem in den frühen Lebensjahren bedeutsam. In dieser Arbeit untersuchen wir, wie sich die Gesundheit der Eltern auf die Entwicklung der nicht-kognitiven Fähigkeiten ihrer Kinder auswirkt. Insbesondere beobachten wir signifikante Veränderungen der elterlichen Gesundheit, die während der ersten Lebensjahre der Kinder auftreten. Wir zeigen, wie diese plötzlichen gesundheitlichen Einschränkungen der Eltern die Persönlichkeitsentwicklung und das Problemverhalten der Kinder im Alter von etwa sechs Jahren beeinflussen. Angesichts der möglichen Endogenität der elterlichen Gesundheit in Hinblick auf die Fähigkeitsentwicklung der Kinder ist die Betrachtung der Veränderungen von Gesundheitsmaßen unseres Erachtens besser geeignet, um Wirkungen der elterlichen Gesundheit zu identifizieren, als die optionale Untersuchung des elterlichen Gesundheitsstatus zu einem bestimmten Zeitpunkt.

Die Analyse stützt sich auf die “Mutter-und-Kind”-Daten des Sozio-oekonomischen Panels (SOEP). Diese Daten ermöglichen es uns, mehrere Merkmale zu berücksichtigen, die die anfänglichen Entwicklungsbedingungen der Kinder beschreiben (z.B. das Geburtsgewicht, die Schwangerschaftswoche bei der Geburt, die Geburtsreihenfolge in Hinblick auf Geschwister). Zudem wird die Validität unserer Ergebnisse durch Sensitivitätstests und eine “Placebo-Regression” geprüft. Mittels der Placebo-Regression wird untersucht, inwieweit ein in der früheren Kindheit messbares Fähigkeitsmaß bereits mit den späteren Gesundheitsmaßen korreliert ist.

Unsere Ergebnisse implizieren, dass plötzliche gesundheitliche Einschränkungen der Mütter die Entwicklung emotionaler Symptome, der Hyperaktivität und des Neurotizismus ihrer Kinder signifikant und in negativem Sinne beeinflussen. Gleichsame gesundheitliche Einschränkungen der Väter scheinen für die Entwicklung der Kinder weniger relevant zu sein. Allerdings beobachten wir, dass die Kinder der betroffenen Väter extrovertierter sind.

Impacts of Parental Health on Children's Development of Personality Traits and Problem Behavior: Evidence from Parental Health Shocks

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Abstract: In this paper, we examine how parental health affects children's development of personality traits and problem behavior. Based on a German mother-and-child data base, we draw on observed parental health shocks as a more exogenous source of health variation to identify these effects and control for child and family characteristics including variables reflecting initial endowments observed at birth. At the age of six, we observe that maternal health shocks in early childhood have significant impacts on children's emotional symptoms, hyperactivity and neuroticism. Paternal health seems to be less relevant for the development of these non-cognitive characteristics. However, we observe that paternal health shocks cause children to be more extraverted.

JEL Classification: I00, J24, I10

Keywords: Human capital, health, personality traits, non-cognitive skills

Acknowledgements: We gratefully acknowledge support by the Leibniz Association within the project "Non-Cognitive Skills: Acquisition and Economic Consequences." We are grateful to Dave Ribar for very valuable comments. We are also grateful to participants of the Leibniz network conferences and to colleagues at the Centre for European Economic Research in Mannheim for fruitful discussions. We especially thank Verena Niepel, Frauke Peter, Patrick Puhani and C. Katharina Spieß for valuable comments and discussions of earlier versions of this work.

1 Introduction

Parental investments are crucial for the children's skill development, especially in the early years of the life-cycle. In this paper, we examine how parental health, which may cause variation in investments to children's skill formation, affects children's development of specific non-cognitive skills in Germany. Specifically, we observe how significant negative changes to parental health (shocks) occurring early in children's life affect children's personality traits and problem behavior measured when the children are approximately six years old.

Because of the potential endogeneity of parental health with respect to children's outcomes, we consider shocks to parental health as a more exogenous source of health variation rather than contemporary levels of health status. Thus, by using significant one period changes in the health variables rather than contemporary levels of health, we hope to identify exogenous changes in health rather than endogenously determined poor health ratings or health deterioration. Our data-base, the "mother and child data" from the German Socio-Economic Panel (GSOEP), also allows controlling for a variety of variables reflecting the children's initial skill endowments (for instance birth weight, week of pregnancy at birth, birth order). Additionally, we conduct sensitivity tests across alternative shock definitions and estimate placebo regressions on future parental health shocks to check the robustness of our results and test our identification strategy.

This paper stands in the tradition of recent empirical studies demonstrating the importance of early life events on human capital development. However, while the general importance of home investments in early life has been shown (e.g. Todd and Wolpin, 2007; Blomeyer et al., 2009), attempts to quantify the effects of commonly experienced household shocks are more limited. An exception is the literature studying the effects of changes in family structure on children's outcomes (cf. Ribar, 2004 for a review with a focus on marriage). For Germany, Berger et al. (2010) have recently presented evidence on changes in

family structure with a focus on children's non-cognitive development. In addition, their study considers changes in maternal employment, mental health and life satisfaction. They show that there are significant correlations between the observed characteristics and children's adaptive behavior and socio-emotional behavior. Similarly, Berger and Spieß (2011) examine the implication of maternal life satisfaction on children's non-cognitive outcomes in Germany. The results suggest that maternal life satisfaction positively affects children's verbal and socio-emotional skills. One further stream of the related literature studies parental death, which may be considered as the most extreme health shock (cf. Adda et al, 2011 for a recent paper based on Swedish data and for a review of existing evidence).

We assume that children's skills are formed via parental investments of time and resources early in children's life (cf. the technology of skill formation, Cunha et al., 2006). When a parent suffers from a negative health change, poor health alters constraints and, therefore, optimal behaviors of the parent. For example, a less healthy adult may be less productive in the labor market and receive reduced wages (Currie and Madrian, 1999), spend family wealth (Wu, 2003) and reduce non-labor income, or limit the number of hours she is capable of working. Poor parental health is therefore suggested to reduce a family's monetary budget constraint and, as normal goods, goods investments in child development.

Additionally, and more specific to the development of children's non-cognitive skills, poor parental health may depress the quality of parent-child relationships. Poor parental health, can reduce the productivity of time that parents spend with their children (Ruhm, 2004). These hypothesized changes negatively affect the level of time and goods investments in children.[1]

[1] The effect of poor parental health on children's outcomes is not definitively negative or significant. For instance, if the potential market time of a sick parent is reduced, the parent may be able to spend more time with children, contributing positively to skill development through additional, albeit smaller, marginal benefits of additional parent-child time. However, a thorough theoretical model is beyond the scope of this paper.

Among the previous studies, two papers shedding light on parental health limitations are of particular interest to our work.[2] Sun and Yao (2010) draw on a panel of rural Chinese households to analyze how parental health shocks impact school-aged children's educational attainment. The paper documents that parental health shocks especially harm elementary school children, while the effects turn insignificant for children in secondary school. Morefield (2010) examines the relationship between parental health limitations and child outcomes in the US. The study focuses on the onset of several specific health conditions and work limiting disabilities for either parent and their effects on children's achievement tests and problem behavior. According to this paper, parental health events during late childhood significantly increase children's problem behavior.[3] Additionally, Morefield shows that poor parental health is related to reductions in one measure of parental investment, the amount of time parents spend participating in activities with the child.

Our study is distinguished from these two studies in that we are able to consider a variety of non-cognitive outcomes in early childhood. Specifically, we investigate the effect of parental health shocks on children's socio-emotional skills (according to Goodman, 1997) and personality traits (i.e. the "Big Five" personality traits according to McCrae and Costa, 1987). To our knowledge, previous studies on parental health have not considered such key measures for non-cognitive skills. Furthermore, our data allow observing the early years of childhood from birth to the age of six. We assume that the considered non-cognitive skills are malleable for children of this age. Finally, our research differs from the existing studies on parental health shocks because we draw on German data. In Germany, the male breadwinner

[2] On the individual level, health shocks have been additionally shown to reduce wages (e.g. Currie and Madrian, 1999), draw down family wealth (Wu, 2003), and limit the labor force participation (Riphahn, 1999).

[3] Our work is also related to a number of previous studies that have examined the impact of maternal psychiatric illness, commonly depression or substance abuse, on children's outcomes. The results consistently show that children of depressed mothers fare worse than children of mothers who do not suffer depression on a wide range of outcomes including development of cognitive and motor skills (Petterson and Albers, 2001), number of problem behaviors (Frank and Meara, 2009), and increased anti-social behavior (Kim-Cohen et al., 2005). Farahati et al. (2003) find that parental psychiatric illness is associated with a significantly lower probability of high school graduation.

model is still dominant, and mothers are traditionally the primary caregivers for children (cf. for example Kunze, 2008). Therefore, we expect maternal health to be particularly important for the children's development.[4]

In fact, our results imply that maternal health shocks in early childhood significantly affect children's emotional symptoms, hyperactivity and neuroticism by the age of six. Paternal health seems to be less relevant for the development of these non-cognitive characteristics. However, we observe that paternal health shocks cause children to be more extraverted. The validity of our identification strategy is addressed in a falsification test. In this manner, we demonstrate that future parental health shocks are not correlated to an outcome measure we observe when children are approximately three years old, while past parental health shocks have a significant impact.

This paper proceeds as follows: Section 2 introduces the data and descriptive evidence before the identification strategy is discussed in Section 3. Section 4 presents the results together with robustness checks, and Section 5 concludes.

2 Data and Descriptive Evidence

Our empirical analysis is based on the German Socio-Economic Panel Study (GSOEP). The GSOEP is a representative annual panel study of private households in Germany, which has been conducted since 1984. The annual samples include information from about 20,000 adults from approximately 12,000 households. Importantly, the GSOEP gathers health related information from these adults from which we are able to identify health shocks. The most consistently fielded question, available in all years of the survey, asks the respondent to rate her satisfaction with her health on a scale between zero, completely dissatisfied, and ten,

[4] The data neither allow to distinguish different kinds of health shocks in detail nor to shed light on the corresponding time parents spend with their children. In theory, parental health shocks may even be beneficial for a child, for instance if a health shocked parent needs to drop out of the labor market and accordingly spends more time with his or her child.

completely satisfied. Another available question, only missing in 1990 and 1993, is the number of nights spent in the hospital during the previous year.[5]

We will use significant changes between survey rounds in these two GSOEP health questions to identify shocks to parental health, the respondent's level of health satisfaction, and the number of nights spent in the hospital during the year. By using significant one period *changes* in the health variables rather than movement below a "poor" health threshold, we hope to identify exogenous shocks rather than endogenously determined poor health ratings or health deterioration. This type of definition has been previously used in the Economics Literature. For instance, Riphahn (1999) uses a one period change of five points in health satisfaction in her examination of the effect health shocks on employment in the GSOEP. Hagan, Jones, and Rice (2009) and Schurer (2008), also using the GSOEP, identify health shocks in a similar manner to Riphahn (1999) but define the threshold change for a shock by observed variation in the variable rather than a subjective definition. Specifically, the authors define a health shock as a change in the health measure of interest from period t to period t+1 greater than x number of standard deviations of the health measure.[6] Although the number of standard deviations required to move for a health shock is subjectively defined, this measure incorporates information on the observed variation in the data to define a health shock. Thus, we follow Hagan, Jones, and Rice (2009) and Schurer (2008) and define health shocks in terms of year-on-year standard deviation changes of the respective measures.[7]

In our data, one standard deviation of the health satisfaction distribution corresponds to two points on the eleven point scale. For hospitalization, one standard deviation is related

[5] Other health measures include a new health limitation, new handicap, new chronic disease, health deterioration, sick-leave, sick-leave greater than 6 weeks, greater average days of sick-leave, any hospital visit, average number of hospital visits, average nights in the hospital, any medical care after a work accident, and any doctor visit in the previous 3 months.

[6] Schurer (2008) examined changes in health satisfaction, the number of nights spent in the hospital in the previous year, and the number of doctor visits in the previous three months. Hagan, Jones, and Rice (2009) examine changes in a constructed latent health index.

[7] Previous literature has not used a common definition of a health shock. This is primarily due to the varying information available across datasets used by researchers. There is, however, a common notion that researchers intend to capture with a health shock, i.e. a sudden, significant, and unexpected change in the stock of an individual's health. Based on the GSOEP, Schurer (2008) draws on the same measures that we use in our paper.

to six nights in hospital concerning the distribution for mothers and to four nights related to the distribution of fathers. We define a shock in health satisfaction as year-on-year decrease in health satisfaction of two or more standard deviations and a shock in the number of nights in the hospital as a year-on-year increase of one standard deviation.[8] Based on these two measures, we create four alternative shock definitions for the regressions in order to check the sensitivity of our results with respect to alternative measures: (1) a shock in health satisfaction *or* nights of hospitalization; (2) a shock in health satisfaction; (3) a shock in nights of hospitalization; and (4) a shock in both health satisfaction *and* nights of hospitalization.

In 2003, the GSOEP began collecting additional "mother and child data," information on new-born children (i.e. younger than 1.5 years) and their mothers in GSOEP households. After the first survey of newborns in 2003, the mother-child questioning was repeated when the children were about three years old (2-3 years) and again when they were about six years old (5-6 years). The repeated questioning allows observing the development of these children born to households which are part of the GSOEP sample. In order to consider the impact of parental health shocks for various years of childhood and thus to increase the number of observations for parental health shocks, we focus on the outcomes of the six-year-olds. The available sample of newborn children observed at age six contains 371 observations.

We draw on two different scales in order to measure non-cognitive skills at age six: a modified version of the Strength and Difficulties Questionnaire (SDQ) (Goodman, 1997), and assessment of the "Big Five" personality traits. Additionally, we examine a measure of the children's "adaptive skills" at age three, the Vineland Adaptive Behavior Scale.

The SDQ relates to mothers' assessments on children's socio-emotional skills. We follow Berger and Spieß (2011) in order to aggregate the items provided in the GSOEP. Thus,

[8] Because the data for nights spent in the hospital in the previous year are highly right skewed, a stricter shock definition of two standard deviations results in too few observations. Also note that our definition of maternal health shocks will usually not identify a maternal health shock if a young mother is hospitalized because of a further child-birth. According to Schneider and Henning (2008), German child-bearing mothers spend on average 2.8 days in hospital.

we show results for two different measures which are derived from the SDQ, children's socio-emotional behavior (SEB) and the pro-social behavior score. Specifically, the rating of pro-social behavior is based on the mothers' reports on the children's thoughtfulness, sharing and helpfulness. The SEB is based on the following four dimensions: emotional symptoms, conduct problems, hyperactivity/inattention, and peer relationships problems (in the sense of the child's popularity among peers). We also show results separately for each of these sub-scores. Higher z-scores express more problematic behavior. Furthermore, we generate a dummy variable for "normal behavior" from the SEB scores.[9] According to this definition, about two-thirds of children in our regression sample are considered to be "normal". Besides this indicator variable, all scores used in the regression analysis are standardized to z-scores.

Concerning the "Big Five" personality trait measures, we aggregate the standard five dimensions from the respective ten questions in the mother-child questionnaire. The five standard dimensions we consider are openness, conscientiousness, extraversion, agreeableness, and neuroticism. Each personality trait is based on the mean score from two specific questions on a 0 to 10 scale (cf. Weinert et al., 2007).[10]

As a final measure of children's skills we use the Vineland Adaptive Behavior Scale. Schmiade et al. (2008) summarize the use of the Vineland Scale in the GSOEP and the corresponding score which reflects the overall degree of the child's development. We use this aggregated z-score which is based on parental information concerning children's verbal skills, activities of daily living, motor skills, and social skills. However, the focus of our study is on the non-cognitive measures we observe for the six-year-olds.[11] The Vineland score is mainly used for robustness checks which require observing children's outcomes at a younger age.

[9] Children are considered to be "normal" if their underlying SEB-score, which may range from 0 to 40, is below or equal to13 in the GSOEP. See Berger and Spieß (2011) for definitions and the aggregation of the scores.
[10] To generate these scores, in a first step, we had to reverse the scales provided in the GSOEP data in order to obtain consistent measures.
[11] One reason why we do not focus on adaptive behavior is that the children in the GSOEP sample seem to be somewhat too old for the tested abilities (cf. Schmiade et al., 2008).

Tables 1 and 2 provide means of all outcome variables for the samples for which we observe the respective measures. The means are separately shown for children according to parental health satisfaction when the child is about six years old. Health satisfaction is based on parents' self-rated health on an eleven point scale. We consider parents to be of good health if they rate their own health as good (i.e. between 6 to 10 on the eleven point scale). We assume that parents are of bad health if they state that they are of intermediate or bad health (values 0 to 5 on the eleven point scale), corresponding to the lowest health quartile of the health satisfaction distribution. We exclude observations with missing observations for the background variables we will control for in our regression analysis. In Table 1, this leaves us with 332 observations of mothers (89% of the initial sample). In addition, we do not observe health satisfaction for four of these mothers.[12]

Table 1 suggests that children's development of socio-emotional skills benefits from living with healthy parents. The overall difficulty score is about 0.4 (0.3) standard deviations higher for children whose mothers (fathers) are in bad health. While 73 percent of children growing up with a healthy mother are rated to have a normal socio-emotional behavior, this is true for 58 percent of the children whose mothers suffer from bad health. A similar but somewhat less pronounced pattern is observed for fathers' health. While 72 percent of the healthy fathers have children with a normal behavior, 67 percent of the less healthy fathers' children fall into this category.

The individual scales of the SDQ suggest that having a less healthy father or mother is related to a higher emotional symptom score, a higher conduct problem score as well as a higher hyperactivity score. In contrast to a less favorable outcome for children with mothers of bad health, having a less healthy father seems to be related to fewer problems with peers. At the same time, the pro-social behavior score is somewhat lower for children whose mother or father is of bad health compared to children with a healthy father or mother.

[12] Information on these four mothers is still used in the regression analysis because we observe their health history after childbirth as well as the required child outcomes (cf. Section 3).

Table 1 also shows that we do not observe a father for all children (see the last column of Table 1). We generally consider the male adult person living in the household and being the mother's partner to be the father. According to this definition, 21 percent of the children are growing up without a father.[13]

Table 2 shows the means for the Big Five personality traits which are observed in the sample of the six year old children. The means suggest that having a mother of bad health is related on average to the children being less open, less conscientious, and less agreeable. The pattern is similar for children whose fathers suffer from bad health, but the differences are less pronounced in this group. Children are more neurotic if one of their parents (particularly the fathers) suffers from bad health. Children with a less healthy father also seem to be less extraverted.

In addition, Table 2 shows the mean Vineland scores informing on children's adaptive behavior at age three are included. There are no feasible differences in the adaptive behavior score at age 3. Note that information on personality traits is missing in many cases (about 33 percent), and, therefore, the sample is more restricted than for the other outcomes. Because of the reduced sample size, the findings on the personality traits have to be taken with a grain of salt. [14]

Together, Tables 1 and 2 suggest that parental health is related to children's non-cognitive outcomes. It seems that maternal health is more strongly related to the considered characteristics than paternal health. However, the descriptive evidence from the tables is not appropriate to detect a causal relationship between parental health and child outcomes. Parental human capital and child human capital are interrelated for instance via the genetic endowment and similar experiences made in life (such as environmental and living

[13] Our further analysis will not specifically focus on this group of children. However, the descriptive statistics suggest that children not growing up with a father also perform worse than children with a healthy father.

[14] Again with respect to some of the considered outcomes, children not living with a father perform worse than children living with a father. If there is no father living in the household, children are less open, less conscientious, less agreeable, and more neurotic than the average child.

conditions). In other words, if we observe less favorable non-cognitive outcomes for children whose parents suffer from bad health, this may be a direct effect of further, unobserved variables (for instance living conditions) instead of health. In Section 3, we therefore consider an identification strategy which is more appropriate in order to detect causal effects of parental health limitations.

3 Identification Strategy

In order to identify causal effects of parental health, we examine parental health shocks instead of current health levels. Parental health shocks are defined as year-on-year changes in parental health that exceed a specific threshold. By using significant one period *changes* in the health variables rather than movement below a "poor" health threshold, we hope to identify exogenous shocks rather than poor health ratings or health deterioration which is endogenous to child outcomes. In addition, all our regressions control for available variables that are considered to be related to the children's initial endowments. Specifically, we control for parental education and immigration background (all variables observed at the time of birth), children's gender, birth order, week of pregnancy at birth date, birth weight, and a second order polynomial of the age of the mother at birth.[15] Table A1 in the appendix provides an overview of the control variables together with their means and standard deviations.

We consider different specifications for parental health shocks related to two different variables informing on such shocks. First of all, we look at changes in parental health satisfaction. Secondly, we consider hospitalization, which is a more objective measure we observe in our data. Note that all shock indicators are based on the entire period of observation from childbirth until the age of about six years. This means that we observe health shocks for all parents who experience a correspondingly high year-on-year drop in health

[15] We additionally include age and age squared of the child at the time of observation in order to take into account that child outcomes are not observed at exactly the same age. We also include dummy variables for missing observation of parental education and migration background at birth.

satisfaction or hospitalization nights at least one time over the period of observation. The resulting frequency of health shocks according to the different definitions is shown in the respective tables in Section 4 when presenting the regression results (Tables 3 to 5). Generally, the frequency of maternal health shocks is higher than the frequency of paternal health shocks.[16] Since there are hardly any paternal health shocks according to the definition in specification 4, we do not control for fathers' health shocks in this specification. All other specifications include both maternal and paternal health shocks.

We also conduct robustness checks in order to challenge our identification strategy. If it is true that considering parental health shocks allows identifying causal effects of parental health, we would expect that parental health shocks affect future child outcomes while they are not correlated to past child outcomes given the other covariates in the model. If parental health shocks also seemed to affect past outcomes, this would point to an omitted variable bias or even a problem of reversed causality. We are able to conduct robustness checks along this line based on the Vineland score on adaptive behavior, which we measure for the three-year-olds. In a first robustness check, we regress the Vineland score on past (age 0-2/3) and future (age 2/3-6/7) health shocks and the same set of control variables that are included in our main regressions. In a second check, we regress adaptive behavior solely on future parental health shocks and the control variables ("placebo regressions"). The corresponding results show robustness for our estimates.

4 Results

Table 3 shows the estimated impact of parental health shocks on children's socio-emotional development. Only few of the estimated coefficients are statistically significant at the ten percent level of significance. This may be due to the relatively small sample size. However, interestingly, we still observe significant impacts related to the emotional problem score and

[16] Part of this difference is due to the fact that there are single-mothered households in our sample. According to Table 1, about 21 percent of the children are growing up without a father.

the hyperactivity score. Specifically, ceteris paribus children whose mothers experience a severe health shock (implying hospitalization as well as a relatively large change in health satisfaction) suffer from more emotional symptoms as the respective score increases about two thirds of a standard deviation. Also, experiencing any kind of observed maternal health shock increases the hyperactivity score by 0.26 standard deviations. The estimated point estimate is rather robust for the different health shock specifications (ranging from 0.20-0.35 standard deviations) even if it is not statistically significant in the third specification. If we use the strictest definition of health shocks (specification 4), the impact is even higher and amounts to 0.35 standard deviations.

Table 4 presents the regression results related to the "Big Five" personality traits. The results suggest that children whose fathers experienced a health shock are more extraverted. The effect is significant and amounts to about half a standard deviation if we consider any kind of health shock (specification 1). The significant estimate is even higher if we consider fathers who suffer from a shock in health satisfaction (specification 2) but smaller and not significant if we consider hospitalization shocks in specification 3. In addition, specification 3 suggests that paternal hospitalization shocks decrease children's neuroticism for about half a standard deviation. However, we do not find significant effects on neuroticism for the optional definitions of paternal health shocks.

For maternal health shocks, we find unfavorable impacts on child neuroticism across health shock specifications. Specification 1 suggests that maternal health shocks significantly increase children's neuroticism by 0.44 standard deviations. Specifications 2 to 4, which are based on fewer observations, also point to a positive impact on neuroticism (not statistically significant in specifications 2 and 4). Additionally, we observe that maternal hospitalization shocks imply that the children are less conscientious (0.41 standard deviations) and less agreeable (0.43 standard deviations).

The results for the Vineland Scale on adaptive behavior are shown in Table 5. Because this is an outcome we observe when the children are about three years old, we are also able to estimate how future health shocks (occurring when children are aged three to six) are correlated with this outcome. As indicated in Section 3, such "placebo regressions" challenge our identification strategy.

Table 5 shows that the past maternal health shocks negatively impact child adaptive behavior at age three. Specifications 1 to 3 suggest that the effect amounts to about one third of a standard deviation. The point estimate is higher in absolute size (-0.79) if we apply the strictest definition for maternal health shocks in specification 4. The estimated coefficients for paternal health shocks are not robust if we compare the different specifications and do not yield significant results except for specification 3, which suggests a positive relationship between paternal hospitalization and children's adaptive behavior. As before (when looking at some of the personality traits), this positive coefficient points to the interpretation that fathers' health shocks are related to a more favorable child development.

Evidence on the future health shocks is provided in the bottom panels of Table 5. The negative impact of past maternal health shocks on adaptive behavior is robust when future health shocks are included. Similarly, the positive effect for the paternal hospitalization shock remains. However, the results imply consistently that future health shocks are not significantly related to the children's adaptive behavior at age 3. This is true if both future health shocks and past health shocks are included in the regressions but also if only future health shocks are considered (placebo regressions). None of the health shock coefficients in the placebo regressions are statistically significant at the ten percent level of significance, and the point estimates for maternal health shocks are positive rather than negative. Therefore, we conclude that our identification strategy allows identifying more than mere correlations between parental health and children's non-cognitive skills.

5 Conclusions

Our work is in line with previous studies demonstrating the importance of parental investments into their children's skill formation process early in life. We interpret out findings as evidence that an involuntary change in parental investment due to a health shock has significant implications for the development of children's non-cognitive skills. Specifically, maternal health shocks affect emotional symptoms, hyperactivity and neuroticism. For maternal hospitalization, we also observe that children are less conscientious and less agreeable when observed at the age of approximately six years. The effects are less pronounced for paternal health shocks. Accordingly, we observe that children are more extraverted if their fathers suffer from a year-on-year drop in their health. In addition, children whose fathers suffer from hospitalization shocks seem to be less neurotic. The results suggest that fathers' health shocks may even be related to a more favorable child development.

The specific importance of maternal health for children's favorable development is likely to be caused by the fact that the mother is the traditional child caregiver in the German family. If maternal health causes a decrease in the potential time and resources a mother can invest into her child's development, this will have significant effects in the absence of an alternative child caregiver. In light of this interpretation, our results suggest that there is scope to introduce measures that support mothers affected by illnesses in order to reduce the observed negative effects on child development. To this end, additional support by external caregivers or more flexible working times for sick mothers' partners in order to care for the family may be effective measures. However, it is beyond the scope of our empirical analysis to evaluate such measures. Such evaluation clearly requires further empirical research.

References

Adda, J., A. Björklund and H. Holmlund (2011*): The Role of Mothers and Fathers in Providing Skills: Evidence from Parental Deaths*, IZA Discussion Paper, 5425.

Almond, D. and J. Currie (2011): Human Capital Development before Age Five, in: O. Ashenfelter and D. Card (eds.): *Handbook of Labor Economics, Volume 4b*, Elsevier, 2011, 1315-1486.

Berger, E.M. and C.K. Spieß (2011): Maternal Life Satisfaction and Child Outcomes: Are They Related?, *Journal of Economic Psychology*, 1, 142-158.

Berger, E.M., F. Peter and C.K. Spieß (2010): Wie hängen familiale Veränderungen und das mütterliche Wohlbefinden mit der frühkindlichen Entwicklung zusammen?, *Vierteljahrsheft zur Wirtschaftsforschung*, 79, 27-44.

Blomeyer, D., K. Coneus, M. Laucht, and F. Pfeiffer (2009): Initial Risk Matrix, Home Resources, Ability Development and Children's Achievement, *Journal of the European Economic Association*, 7(2-3), 638-648.

Cunha, F., J.J. Heckman, L. Lochner and D.V. Masterov (2006): Interpreting the Evidence on Life Cycle Skill Formation, in A. Hanushek and F. Welch (eds.): *Handbook of the Economics of Education*, North-Holland.

Currie, J. and B.C. Madrian (1999): Health, Health Insurance and the Labor Market, in O. Ashenfelter and R. Layard (eds.): *Handbook of Labor Economics*, North-Holland.

Ettner, S.L. (1995): The impact of 'parent care' on female labor supply decisions, *Demography*, 32, 63-80.

Farahati, F., D.E. Marcotte and V. Wilcox-Gok (2003): The Effects of Parents' Psychiatric Disorders on Children's High School Dropout, *Economics of Education Review*, 22, 167-178.

Frank, R.G. and E. Meara (2009): *The Effect of Maternal Depression and Substance Abuse on Child Human Capital Development*, NBER Working Paper Series, 15314.

Goodman, R (1997): The Strengths and Difficulties Questionnaire: A Research Note, *Journal of Child Psychology and Psychiatry*, 38, 581-586.

Heckman, J.J., J. Stixrud and S. Urzua. (2006): The Effects of Cognitive and Noncognitive Abilities on Labor Market Outcomes and Social Behavior, *Journal of Labor Economics*, 24, 411-482.

Kim-Cohen, J., T.E. Moffit, A. Taylor, S. Pawlby and A. Caspi (2005): Maternal Depression and Children's Antisocial Behavior, *Archives of General Psychiatry*, 62, 173-181.

Kunze, A. (2008): Career Interruptions of Women, and Child Care Systems - An International Comparison, in K.-D. Henke (ed.): Frühkindliche Bildung und Betreuung - Reformen aus ökonomischer, pädagogischer und psychologischer Perspektive, Europäische Schriften zu Staat und Wirtschaft 23, Nomos.

McCrae, R.R. and P.T. Costa (1987): Validation of the Five-Factor Model of Personality Across Instruments and Observers, *Journal of Personality and Social Psychology*, 52, 81-90.

Morefield, B. (2010): *Parental Health Events and Children's Skill Development*, Working Papers 10-11, University of North Carolina at Greensboro, Department of Economics.

Petterson, S.M. and A.B. Albers (2001): Effects of Poverty and Maternal Depression on Early Child Development, *Child Development*, 72, 1794-1813.

Riphahn, R.T. (1999). "Income and Employment Effects of Health Shocks A Test for the German Welfare State." *Journal of Population Economics*, 12(3), 363-389.

Schmiade, N., C.K. Spieß and W. Tietze (2008): *Zur Erhebung des adaptiven Verhaltens von zwei- und dreijährigen Kindern im Sozio-oekonomische Panel (SOEP),* SOEPpapers on Multidisciplinary Panel Data Research, 116.

Schneider, H. (2008): Natürliche Geburt oder Wunsch -Sectio, *Der Gynäkologe*, 41, 36-41.

Schurer, S. (2008): Discrete Heterogeneity in the Impact of Health Shocks on Labour Market Outcomes, *Melbourne Institute Working Paper Series,*19.

Sun, A. and Y. Yao (2010): Health Shocks and Children's School Attainments in Rural China, Economics of Education Review, 29, 375-382.

Todd, P. E., & Wolpin, K. I. (2007). "The Production of Cognitive Achievement in Children: Home, School, and Racial Test Score Gaps." *Journal of Human Capital, 1*(1), 91-136.

Weinert, S, J.B. Asendorpf, A. Beelmann. H. Doil, S. Frevert and A. Lohaus (2007): *Expertise zur Erfassung von psychologischen Personmerkmalen bei Kindern im Alter von fünf Jahren im Rahmen des SOEP*, DIW Data Documentation, 20.

Wu, S. (2003). "The Effects of Health Events on the Economic Status of Married Couples." *Journal of Human Resources, 38*(1), 219-230.

Tables

Table 1: Parental health satisfaction and children's socio-emotional behavior (Age 6)

Variable	Mother: "good health"	Mother: "bad health"	Father: "good health"	Father: "bad health"	No father in household
Overall difficulty score	-0.1299*	0.2992	-0.1109*	0.1543	0.1709
	(0.0609)	(0.1120)	(0.0678)	(0.1124)	(0.1312)
Normal behavior indicator	0.7258*	0.5833	0.7150	0.6667	0.6056
	(0.0284)	(0.0541)	(0.0309)	(0.0667)	(0.0584)
Emotional symptoms	-0.0545*	0.0710	-0.0937	0.1919	0.0985
	(0.0623)	(0.1160)	(0.0689)	(0.1319)	(0.1258)
Conduct problems	-0.1271*	0.2803	-0.1013	0.1073	0.1366
	(0.0583)	(0.1191)	(0.0657)	(0.1300)	(0.1283)
Hyperactivity	-0.1327*	0.3505	-0.0664	0.1341	0.0867
	(0.0603)	(0.1132)	(0.0681)	(0.1340)	(0.1223)
Peer relationship problems	-0.0581	0.0832	-0.0512	-0.1016	0.1286
	(0.0650)	(0.0993)	(0.0669)	(0.1262)	(0.1300)
Pro-social behavior	0.0826*	-0.1961	0.0110	0.0610	-0.0562
	(0.0620)	(0.1044)	(0.0669)	(0.1275)	(0.1224)
Observations	248	84	214	51	71

Note: Means (and standard errors) of the respective variables. * marks the significant difference between a parent in good and a parent in bad health at the 5 percent level.
Source: Mother and child data of the German Socio-Economic Panel Study (GSOEP). Own calculations.

Table 2: Parental health satisfaction and children's personality traits and adaptive behavior

Variable	Mother: "good health"	Mother: "bad health"	Father: "good health"	Father: "bad health"	No father in household
Openness	0.0721	-0.1621	0.0265	-0.0458	-0.0562
(Age 6)	(0.0692)	(0.1201)	(0.0743)	(0.1492)	(0.1382)
Conscientiousness	0.0862*	-0.2664	0.0616	-0.0236	-0.2378
(Age 6)	(0.0708)	(0.1495)	(0.0812)	(0.1744)	(0.1418)
Extraversion	-0.0231	0.0232	-0.0182	-0.2088	0.1037
(Age 6)	(0.0699)	(0.1406)	(0.0766)	(0.1753)	(0.1377)
Agreeableness	0.0782*	-0.3561	0.0763	-0.2654	-0.2148
(Age 6)	(0.0658)	(0.1617)	(0.0796)	(0.1470)	(0.1479)
Neuroticism	-0.0628*	0.2524	-0.0570*	0.3992	0.0286
(Age 6)	(0.0782)	(0.1328)	(0.0784)	(0.1628)	(0.13485)
Adaptive Behavior	0.0068	-0.0376	-0.0297	-0.0016	0.0272
(Vineland, Age 3)	(0.0626)	(0.1077)	(0.0733)	(0.1187)	(0.1060)
Observations (Age 6, Big Five)	183	63	161	35	54
Observations (Age 3, Vineland)	250	84	214	50	73

Note: Means (and standard errors) of the respective variables. * marks the significant difference between a parent in good and a parent in bad health at the 5 percent level.
Source: Mother and child data of the German Socio-Economic Panel Study (GSOEP). Own calculations.

Table 3: Impact of parental health shocks on children's socio-emotional development (Age 6)

Specifications		(1) any shock	(2) shock in health satis-faction (2 s.d.)	(3) shock in hospi-talization (1 s.d.)	(4) shock in satis-faction & hospi-talization
Overall difficulty score	Mother	0.19	0.17	0.22	0.33
		(0.16)	(0.17)	(0.18)	(0.24)
	Father	0.11	-0.07	0.26	n.i.
		(0.19)	(0.23)	(0.25)	
Normal behavior indicator	Mother	-0.05	-0.03	-0.12	-0.21
		(0.08)	(0.08)	(0.09)	(0.15)
	Father	-0.10	0.00	-0.17	n.i.
		(0.09)	(0.11)	(0.13)	
Emotional symptoms	Mother	0.17	0.25	0.26	0.69*
		(0.19)	(0.20)	(0.25)	(0.42)
	Father	0.25	0.25	0.09	n.i.
		(0.24)	(0.37)	(0.27)	
Conduct problems	Mother	0.09	0.05	0.01	-0.15
		(0.13)	(0.14)	(0.16)	(0.22)
	Father	-0.02	-0.26	0.25	n.i.
		(0.16)	(0.19)	(0.22)	
Hyperactivity	Mother	0.26**	0.29**	0.20	0.35*
		(0.12)	(0.13)	(0.15)	(0.20)
	Father	0.04	-0.14	0.22	n.i.
		(0.16)	(0.17)	(0.24)	
Peer relationship problems	Mother	-0.04	-0.22	0.15	-0.07
		(0.16)	(0.15)	(0.17)	(0.20)
	Father	0.00	-0.05	0.17	n.i.
		(0.16)	(0.19)	(0.22)	
Pro-social behavior	Mother	0.02	0.01	0.04	0.04
		(0.15)	(0.16)	(0.17)	(0.24)
	Father	0.01	-0.05	0.11	n.i.
		(0.21)	(0.31)	(0.19)	
Observations		332	332	332	332
# maternal shocks		146	82	93	29
# paternal shocks		47	37	45	(3)

Note: Coefficients (standard errors) from weighted regressions using the GSOEP cross-section weights. * Significant at the ten percent level of significance. ** Significant at the five percent level. *** Significant at the one percent level. s.d. = standard deviation. n.i. = not included. All regressions control for parental education and immigrant background, children's gender, birth order, week of pregnancy at birth date, birth weight, a second order polynomial of the age of the mother at childbirth and a second order polynomial of the children's age at time of observation.

Source: Mother and child data of the German Socio-Economic Panel Study (GSOEP). Own calculations.

Table 4: Impact of parental health shocks on personality traits

Specifications		(1) any shock	(2) shock in health satis-faction (2 s.d.)	(3) shock in hospi-talization (1 s.d.)	(4) shock in satis-faction & hospi-talization
Openness (Age 6)	Mother	-0.01	0.00	-0.08	-0.11
		(0.20)	(0.21)	(0.20)	(0.33)
	Father	-0.06	0.07	-0.16	n.i.
		(0.23)	(0.31)	(0.23)	
Conscientiousness (Age 6)	Mother	0.07	0.25	-0.41*	-0.44
		(0.23)	(0.23)	(0.25)	(0.31)
	Father	-0.18	-0.02	-0.27	n.i.
		(0.24)	(0.31)	(0.26)	
Extraversion (Age 6)	Mother	-0.23	-0.27	-0.08	-0.05
		(0.17)	(0.20)	(0.22)	(0.37)
	Father	0.54***	0.66***	0.30	n.i.
		(0.17)	(0.22)	(0.21)	
Agreeableness (Age 6)	Mother	-0.24	-0.07	-0.43**	-0.32
		(0.19)	(0.21)	(0.21)	(0.28)
	Father	0.19	0.37	-0.04	n.i.
		(0.16)	(0.19)	(0.19)	
Neuroticism (Age 6)	Mother	0.44**	0.18	0.53**	0.44
		(0.19)	(0.21)	(0.23)	(0.45)
	Father	-0.01	0.46	-0.49**	n.i.
		(0.28)	(0.43)	(0.25)	
Observations (Age 6, Big Five)		247	247	247	247
# shocks mother		109	61	66	18
# shocks father		59	24	37	(2)

Note: Coefficients (standard errors) from weighted regressions using the GSOEP cross-section weights. * Significant at the ten percent level of significance. ** Significant at the five percent level. *** Significant at the one percent level. s.d. = standard deviation. n.i. = not included. All regressions control for parental education and immigrant background, children's gender, birth order, week of pregnancy at birth date, birth weight, a second order polynomial of the age of the mother at childbirth and a second order polynomial of the children's age at time of observation.

Source: Mother and child data of the German Socio-Economic Panel Study (GSOEP). Own calculations.

Table 5: Impact of parental health shocks on adaptive behavior and robustness checks

Specifications		(1) any shock	(2) shock in health satis-faction (2 s.d.)	(3) shock in hospi-talization (1 s.d.)	(4) shock in satis-faction & hospi-talization
Effects of past parental health shocks at age 3					
Past health shocks	Mother	-0.29**	-0.27	-0.34*	-0.79**
	(age 0-3)	(0.15)	(0.20)	(0.18)	(0.37)
	Father	0.12	-0.09	0.39*	n.i.
	(age 0-3)	(0.19)	(0.28)	(0.23)	
Robustness check 1: Effects of past and future parental health shocks at age 3					
Past health shocks	Mother	-0.28*	-0.26	-0.33*	-0.79**
	(age 0-3)	(0.15)	(0.21)	(0.19)	(0.37)
	Father	0.13	-0.08	0.40*	0.23
	(age 0-3)	(0.19)	(0.28)	(0.23)	(0.26)
Future health shocks	Mother	0.05	0.09	0.10	n.i.
	(age 3-6)	(0.17)	(0.19)	(0.22)	
	Father	0.05	0.06	0.15	n.i.
	(age 3-6)	(0.17)	(0.18)	(0.25)	
Robustness check 2: Effects of future health shocks at age 3 (Placebo regressions)					
Future health shocks	Mother	0.15	0.13	0.21	0.24
	(age 3-6)	(0.17)	(0.18)	(0.22)	(0.27)
	Father	0.04	0.08	0.03	n.i.
	(age 3-6)	(0.16)	(0.18)	(0.26)	
Observations		333	333	333	333
# maternal shocks (age 0-3)		94	38	70	14
# paternal shocks (age 0-3)		43	19	26	(2)
# maternal shocks (age 3-6)		56	44	27	15
# paternal shocks (age 3-6)		38	21	20	(3)

Note: Coefficients (standard errors) from weighted regressions using the GSOEP cross-section weights. * Significant at the ten percent level of significance. ** Significant at the five percent level. *** Significant at the one percent level. s.d. = standard deviation. n.i. = not included. All regressions control for parental education and immigrant background, children's gender, birth order, week of pregnancy at birth date, birth weight, a second order polynomial of the age of the mother at childbirth and a second order polynomial of the children's age at time of observation.

Source: Mother and child data of the German Socio-Economic Panel Study (GSOEP). Own calculations.

Appendix

Table A1: Means (standard deviations) of control variables included in the regression analysis

	Socio-emotional development sample	Personality traits sample	Adaptive behavior sample
Tertiary education of parents indicator (observed at birth)	0.54 (0.50)	0.52 (0.50)	0.54 (0.50)
Missing indicator for parental education	0.07 (0.25)	0.09 (0.29)	0.08 (0.27)
Parental migration background indicator (observed at birth)	0.15 (0.36)	0.16 (0.37)	0.14 (0.35)
Missing indicator for parental migration background	0.07 (0.25)	0.07 (0.25)	0.08 (0.26)
Gender: male indicator	0.50 (0.51)	0.50 (0.50)	0.50 (0.50)
Age of child (in months, last measurement point)	69.33 (3.91)	69.21 (4.01)	69.33 (3.95)
Age of child squared	4821.22 (543.68)	4806.70 (557.54)	4822.25 (550.27)
Birth order: first born indicator	0.42 (0.49)	0.44 (0.50)	0.44 (0.50)
Age of mother at birth	30.69 (5.20)	30.51 (0.28)	30.63 (5.25)
Age of mother at birth squared	968.96 (320.87)	958.83 (322.58)	965.33 (323.03)
Week of pregnancy at childbirth	39.23 (2.25)	39.16 (2.39)	39.21 (2.34)
Birth weight of child (in g)	3349.67 (565.30)	3330.30 (571.49)	3334.41 (578.47)
# Observations	332	247	333

Source: Mother and child data of the German Socio-Economic Panel Study (GSOEP). Own calculations.