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Frauke Peter

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1 Introduction

"Educating the mind without educating the heart is no education at all"

– Aristotle

The quote captures an important part of today's research on human capital accumulation in Economics: ***A consistent promotion of non-cognitive skills matters as much as cognitive skills for success in life.*** Before I turn to the motivation for my research on children's non-cognitive skills and health, I briefly state how this dissertation utilizes the terms non-cognitive skills and health. This thesis perceives ***non-cognitive skills*** as a generic term enfolding traits that enable a person to communicate or interact with others, such as personality traits, socio-emotional behavior, locus of control, persistence, or motivation. This suggests that non-cognitive skills comprise personality traits, yet in the economic literature on non-cognitive skills, the term "personality traits" is sometimes used as synonym rather than as category of non-cognitive skills (see the literature review of non-cognitive skills in Economics by Brunello and Schlotter, 2011). This dissertation considers personality traits as part of the generic term non-cognitive skills throughout its chapters. With regards to health, this thesis infers the occurrence of illnesses, ear infection or eczema, during early childhood because both health measures are susceptible to environmental factors.

1.1 Motivation

In recent years, when studies started to establish the "importance of psychic costs" (see Heckman et al., 2006, p. 478) for school and labor market outcomes, economic

literature slowly began to study non-cognitive skills in addition to cognitive skills. The term "psychic costs" summarizes those costs of a transaction that may cause stress or unhappiness to a person. Thus, examining non-cognitive skills as "observable" psychic cost considerably complemented the literature on school and labor market success.

The economic literature has shown that non-cognitive skills are important predictors of later outcomes in life (for an overview see Brunello and Schlotter, 2011)[1]. Noble prize winner James J. Heckman and his coauthors, for example, find in an early study that non-cognitive abilities (motivation, persistence, and self-esteem) "affect the acquisition of skills, productivity in the market and a variety of behaviors" (Heckman et al., 2006, p. 478). Other studies by Heckman and coauthors (e.g., Almlund et al., 2011; Cunha and Heckman, 2007, 2008; Cunha et al., 2010) provide further insight on non-cognitive skills and their malleability. In general, the literature on non-cognitive skills in Economics demonstrates that cognitive outcomes, educational attainment, and labor market outcomes are affected by non-cognitive abilities at different stages in life, i.e., during early childhood, during adolescence, or in adulthood (see among others the studies by: Andersen et al., 2007; Blanden et al., 2007; Caliendo et al., 2010; Carneiro et al., 2007; Heineck and Anger, 2010; Schlotter, 2011; Wichert and Pohlmeier, 2010).

An interesting aspect of studying non-cognitive skills compared to cognitive skills is their malleability. The "technology of skill formation" developed by Cunha and Heckman (2007) states that "the productivity of parental investment is higher at later stages for noncognitive skills. This evidence is consistent with greater malleability of the prefrontal cortex governing socioemotional development into the early 20s, documented by Dahl (2004)." (Cunha and Heckman, 2007, p. 43).

[1]The chapters of this dissertation provide further discussions on this literature (see Section 2.1, 3.1 and 4.1 for that matter).

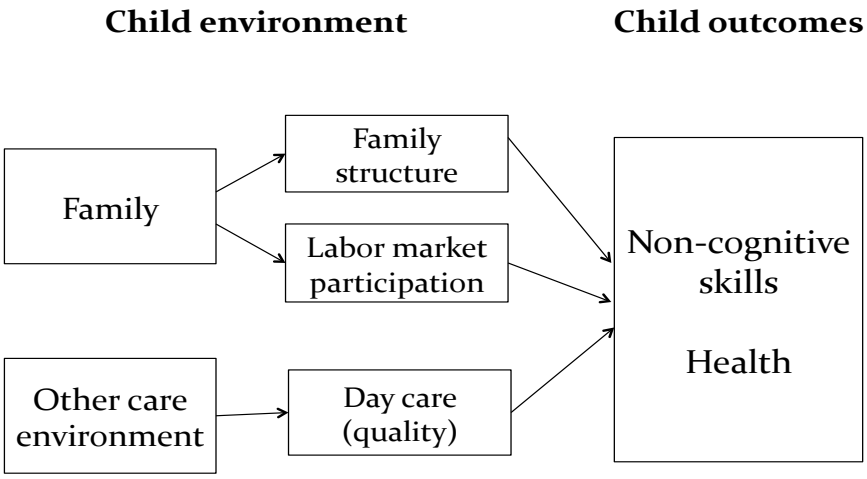
The analysis of non-cognitive development provides possible intervention points for policy makers, as these skills are receptive for remedies later in life. The comprehensive research agenda of this dissertation focuses on children's non-cognitive skill formation during childhood until adolescence in different important environmental circumstances, such as changes in maternal partnerships, maternal involuntary job loss, and day care attendance and structural quality. The aim of this thesis is to shed light on non-cognitive development, as previous studies demonstrate the relative importance of those traits, their susceptibility to environmental factors, and their malleability. In addition, children's health is examined, as early childhood health is a predictor of educational attainment later in life (see for example Conti et al., 2010) as well as of skill formation during childhood (see for example Almond and Currie, 2011; Currie, 2009).

Currie (2009) shows that child health affects future outcomes, as (1) a child's health status is likely to affect future health, which correlates with labor supply and productivity of an individual, and (2) child health can have effects on her/his acquisition of skills. The latter discusses Currie (2009) by referring to the study done by O'Connor et al. (2000), who study the development of Romanian orphans (see Currie, 2009, p. 100) and the former by summarizing the study by Smith (2007), who uses sibling fixed effect models and identifies that a better health status during childhood is related to higher income and more weeks worked (see Currie, 2009, p. 106). Such a positive effect of early childhood health on future outcomes is also identified by Conti et al. (2010).

The importance of the family for early child development has long been acknowledged. But family members face new challenges, as familiar structures and daily life changed considerably in the last two decades: divorce rates have increased, welfare dependency of families with children has aggravated, and

demand for social competencies and skills has risen. These social and economic changes also play a role in today's politics[2].

Figure 1.1: How children's environment relates to children's outcomes – summary of research agenda of this dissertation



Source: Own illustration.

In Figure 1.1 the research agenda of this dissertation is summarized. Children's environment comprises family and other care environments, e.g. day care institutions, and changes, dynamics, or quality in a child's surrounding are correlated with children's non-cognitive skills and health outcome. Children are likely to be exposed to changes in their environment today. Not only have divorces

[2]For example "Europe 2020" or the "European Reference Framework. Key Competencies for Lifelong Learning" of the European Commission (2007, 2009).

in families with under-aged children remained to be a large share of divorces in recent years[3], but also remarriages represent a relatively high share of marriages in Germany: In 2010, 62,010 of 382,047 marriages in Germany are remarriages (16.2 per cent) and 246,052 are first-time marriages (Statistisches Bundesamt, 2012*b*). Thus, family environments are likely to play the major role during childhood and adverse surroundings are likely to affect children's outcomes. Another potential factor relating the family environment to children's outcomes is maternal involuntary job loss in this thesis. Maternal labor market participation in families with minor children has risen in recent years[4], so that under-aged children have a higher chance of experiencing maternal involuntary job loss. Exposure to such a shock might affect children's household situation which is linked to children's development. The influence of socioeconomic factors, e.g low income, on child outcomes have led to the development of different intervention programs targeting children from disadvantaged backgrounds, e.g. among others the *Perry Preschool Program* is widely known and has been evaluated extensively[5]. Although the Perry Preschool Program aimed at improving cognitive skills of disadvantaged children, researchers, examining data from the Perry Preschool Program, have shown how important and susceptible non-cognitive skills have been to the Perry Preschool Program, especially for outcomes later in life of these disadvantaged children (for example Cunha et al., 2010; Heckman et al., 2010, 2006). Yet, although non-cognitive skills are important, studies examining these traits as early outcome measures of children are less represented in the literature. Thus, this dissertation contributes to the existing studies in Economics by investigating the relationship

[3]In 2002, out of 202,214 divorces in Germany 101,830 divorces were in families with under-aged children compared to 2008 91,455 divorces in families with minor children out of 187,027 divorces in Germany (Statistisches Bundesamt, 2012*a*).
[4]In 2012, 60.5 per cent of mothers with children aged 3-5 were employed and 72 per cent of mothers with children aged 10-14 (Keller et al., 2012).
[5]The listed studies are only an abstract of the literature: Belfield et al. (2006); Heckman et al. (2010); Schweinhart et al. (2005).

between family environments as well as between other care environments and non-cognitive skills of young children and adolescents.

In my empirical studies I investigate three non-cognitive outcome measures assessed at age five/six and at age seventeen: ***socio-emotional behavior, locus of control,*** and ***personality traits***. The ***socio-emotional behavior*** describes a child's behavior in terms of relationships with peers or of emotional problems at age five/six. The Strength and Difficulties Questionnaire (SDQ) developed by Goodman (1997) is used to collect information on socio-emotional behavior of preschoolers. ***Locus of control*** is a concept provided by Rotter (1966). This non-cognitive measure captures whether an individual believes that life depends on one's own actions (internal locus of control) or whether an individual believes that life depends on others or fate (external locus of control). For adolescents this concept is measured at age seventeen, an age at which adolescents most likely determine their further path in life. ***Personality traits*** are investigated for preschool children as well as for adolescents in this dissertation. For adolescents personality traits are described by a Five Factor Model (McCrae and Costa, 1996, 1999). This model characterizes an individual's personality by five dimensions: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Personality traits for younger children are measurable from the age of four onwards (see Asendorpf et al., 2007). Personality traits, that I use in my analyses of preschool children, are based on the "Fünf Faktoren Fragebogen für Kinder" (five factor questionnaire for children) developed by Asendorpf and van Aken (2003). Before age four a child's behavior is assessed and therefore, I utilize the term "personality characteristics" for simplification when referring to preschool children, as for children at age three the measured characteristics rather depict a child's temperament.

Apart from these three non-cognitive skills, I examine ***changes in children's***

health, as childhood health is likely to affect future outcomes, such as educational attainment later in life (see for example Conti et al., 2010) or acquisition of skills (see for example Almond and Currie, 2011; Currie, 2009). In order to infer children's health, I examine whether children suffer from ear infection or atopic eczema. Both illnesses are known to be susceptible to environmental factors and to eventually impede a child's development (e.g. Bradley and NICHD Early Child Care Research Network, 2003; Burchinal et al., 2000; Chen, 2012; Rovers, 2008; Winskel, 2006).

Carneiro and Heckman (2003) have shown that the family environment is of particular importance for children's development. The dissertation therefore investigates changes in children's home environment (family) captured by family structure changes and maternal involuntary job loss and other care environments (day care institution) described by day care quality in reference to changes in children's health and personality characteristics. Children's non-cognitive development is closely linked to the family environment, as parents are the first and often most influential entity to help their children to acquire these soft skills. Yet, children are not only exposed to their family during early childhood. In Germany, day care provision for children below the age of three is a priority[6]. But the extension of day care provision for children under the age of three is still underway. Apart from day care for the very young, children have guaranteed voluntary access to day care starting at age three[7]. Thus during early childhood, at least between age three and age six, most children attend day care in Germany.

Potential influences of changes in children's environment are captured by family instability and involuntary job loss. I focus on maternal partnership transitions

[6]See the German law § *24a Abs. 5 SGB VIII über den Stand des Ausbaus für ein bedarfsgerechtes Angebot an Kindertagesbetreuung für Kinder unter drei Jahren*.
[7]Since 1996 exists a claim for a part-time spot in a day care institution §24 SGB VIII.

and on maternal job losses, since mothers are still the main caregivers in Germany and changes experienced by mothers might be more closely related to children's skills. In addition, in case of separation of both parents, most children stay with their mothers rather than with their fathers. There exists a vast literature that concentrates on family structure and child outcomes (e.g., Ermisch et al., 2004; Francesconi et al., 2010). But family structure, e.g. divorce or single parenthood, captures only a specific transition. In today's society partnership transitions are regarded as dynamic process, i.e., as a "series of partnerships" as Cherlin (2009) discusses in his book "The marriage-go-around" comparing partnership sequences to a carousel ("merry-go-round").

Apart from sequential partnership transitions, children might be exposed to parental job loss. Mothers might perceive a job loss differently than fathers, as most mothers are second earners in Germany. Thus, a job loss might be related to mothers' emotional well-being, as mothers' labor market participation depend on preferences other than earning income.[8]

Day care attendance and its effect on children's non-cognitive skills have already been examined in the economic literature (e.g., Datta Gupta and Simonsen, 2010, 2011; Schlotter, 2009). This thesis argues that day care quality is important to explain the direction of potential influences of day care attendance on children's outcome.

The aim of this dissertation is to provide research results which allow policy makers to understand children's non-cognitive development as well as children's health outcomes. In particular this dissertation focuses on two distinct aspects of children's life: the family and early childhood education outside

[8]See for example the studies by Coelli (2011); Huff-Stevens and Schaller (2011); Kalil and Ziol-Guest (2008).

the home. The thesis contributes to the fields of family economics and of economics of education. By examining children's non-cognitive skills and health my dissertation combines Family and Education Economics: Whereas family instability, maternal involuntary job loss and child health are related to Family Economics, day care (quality) and non-cognitive skills are closely linked to Economics of Education.

Family Economics has long studied how family background affects opportunities of children. Among these studies family structure and its effect on children's educational attainment have been widely discussed[9]. Moreover, a vast literature on children's health, mainly inferring premature birth or low birth weight and its potential effect on future outcomes, has emerged (see among others the studies by Almond and Currie, 2011; Currie, 2009; Currie and Hotz, 2004; Gordon et al., 2007). But also overall health measures during childhood are assessed (see for example Conti et al., 2010; Currie, 2009). Yet, the literature is rather silent about health investigated as early childhood outcome and its relation with day care (quality) for that matter. The labor force participation of mothers related to child well-being is another important aspect studied in Family Economics[10], which has become more and more apparent in recent years due to a rise in maternal labor force participation. But the risk of job loss faced by mothers and its potential influence on children's non-cognitive skills has been scarcely assessed so far.

Human capital accumulation and education production functions are issues attributed to Education Economics. The "technology of skill formation" proposed by Cunha and Heckman (2007, 2008) extended the classical model on human

[9]See for example the works by Björklund and Sundstrom (2006); Ermisch and Francesconi (2001); Ermisch et al. (2004); Francesconi et al. (2010). For an in depth discussion of the literature see Chapter 2 of this thesis.

[10]Berger et al. (2005); Han and Waldfogel (2009); Ruhm (2000, 2004, 2008, 2009); Waldfogel et al. (2002) are just a few examples of the issue.

capital by Gary Becker, by explicitly accounting for cognitive and non-cognitive skills. Another aspect of Economics of Education is the educational environment which supports child development, e.g. day care institutions, class size etc. (see for example work by Bauchmüller et al., 2011; Schlotter, 2011; Schlotter and Wössmann, 2010; Schütz, 2009). This dissertation sheds light on both issues in Education Economics by examining non-cognitive skills as early childhood outcome and by inferring the quality of other care environments related to non-cognitive skills and children's health development.

1.2 Outline of the thesis

This thesis consists of three chapters, which each examining empirically potential factors influencing children's non-cognitive skills and health in Germany.

In **Chapter 2**, I analyze family instability and its effect on children's non-cognitive skills. Compared to family structure, family instability accounts for sequential family experiences during childhood and provides more than a snapshot of children's living arrangements. In the economic literature so far studies concentrate on specific transitions, such as parental separation or single parent households (e.g., Björklund and Sundstrom, 2006; Del Bono et al., 2007; Ermisch et al., 2004; Francesconi et al., 2010, 2008; Mahler and Winkelmann, 2004). But family structure changes can also be regarded as a dynamic process. The studies investigating family instability are mainly based on US data. They differ in terms of outcome measures and in terms of their definition of family instability. Brown (2006) for example differentiates between married and cohabiting partnerships, as the latter are perceived to be less stable. Sun and Li (2011) examine three types of disrupted families and Hill et al. (2001) apply a sequential approach of

family structure events[11]. In my study family instability is defined as maternal partner change from one year to the next. A yearly change does not capture changes occurring in-between, but I argue that maternal partnership transitions happening on a monthly interval during the year are rare. I distinguish between instabilities taking place at different childhood stages and the results indicate that experiences of maternal partnership transitions early in life (from birth through age six) determine not only early child outcomes but also non-cognitive skills at age seventeen.

Chapter 3 aims at identifying a potential causal effect of maternal involuntary job loss on children's non-cognitive skills using propensity score matching. The economic literature has shown that job loss of adults causes a considerable fall in income, persistence of unemployment, health, or divorce (see for example Charles and Stephens, 2004; Eliason and Storrie, 2009; Rege et al., 2009). Negative consequences of job loss of the adult are most likely to spread to their children. But these potential effects of job loss on children have been chiefly investigated for academic achievement, for health, or for earnings (see for instance the following studies: Huff-Stevens and Schaller, 2011; Lindo, 2011; Oreopoulos et al., 2008; Rege et al., 2011). In addition, maternal involuntary job loss opposed to fathers' job loss has been less examined. The identification of an effect of maternal job loss on children's non-cognitive skills depends indirectly on maternal employment decisions. In order to account for this selection bias, I utilize propensity score methods, since the heterogeneity of mothers who experience a job loss compared to those who keep their job can most likely be observed. The results in Chapter 3 of this thesis indicate that children whose mothers experience an involuntary job loss, i.e., displacement by plant closure or by dismissals by employer, are more likely to have socio-behavioral problems and very importantly are less likely to

[11] For a more in depth discussion see Section 2.2 of Chapter 2.

believe in self-determination.

In **Chapter 4**, I investigate potential causal effects of day care attendance and day care quality on changes in children's outcomes using a conditional difference-in-differences matching approach. Other than in the previous chapters, changes in children's outcomes are assumed to be related to day care environments. Participation in day care between age three and age six can be regarded as early investment in children's human capital accumulation and quality of institutional environments matters alongside family environments. Day care facilities vary in terms of their structural quality captured by (1) *child-staff-ratios*, (2) *share of children not speaking German at home*, (3) *group size*, or by (4) *share of educational level of staff*. All of which can influence child development in different ways. In contrast to Chapter 2 and Chapter 3, this chapter of the thesis analyzes differences in children's outcome between age three and age six, meaning children's skill levels at age three are subtracted from those at age six. The economic literature is rather silent about the relationship between day care (quality) and changes in children's personality characteristics and health (e.g., Bauchmüller et al., 2011; Datta Gupta and Simonsen, 2010; Loeb et al., 2007). These studies focus on "static" outcomes, either on cognitive skills, e.g. language test scores, or on non-cognitive skills, e.g. socio-emotional behavior, and its relation to day care (quality), without regarding children's health. The estimates of day care quality on changes in children's outcomes suggest that the *child-staff-ratio* is an important structural quality indicator: Children's chances of suffering from ear infections or atopic eczema are increased if they attend a day care institution at age four with a large number of children per teacher, i.e., a higher child-staff-ratio. Moreover, children's ability to concentrate significantly decreases if children attend a day care institution at age four full-time.

Chapter 5 concludes and provides an outlook on further research.

1.3 Methodology

The three chapters of this dissertation use data from the German Socio-Economic Panel Study (SOEP) to examine changes in children's environment as well as in children's outcomes. The German Socio-Economic Panel Study[12] is a household survey that collects data since 1984. In addition to the SOEP, Chapter 4 utilizes regional data on the structural quality of day care from the *statistics on child and youth welfare* ("Kinder- und Jugendhilfestatistik")[13]. The statistics on child and youth welfare comprises data of official statistics, such as the statistic of children and employees in day care institutions[14]. In Chapter 4, I therefore match survey data (SOEP) with official data on children and employees in day care institutions from the statistics on child and youth welfare (Kinder- und Jugendhilfestatistik).

The richness of the SOEP provides an ideal data set to analyze children's non-cognitive development with regards to their environment. Different questionnaires are used to inquire household-specific, individual-specific, child-specific, or biographical information. The mother-child-questionnaires, which have been implemented in 2003, address child-specific and mother-specific issues at different childhood stages (see Schupp et al., 2008; Siedler et al., 2009). The youth questionnaire[15] surveys adolescents who have turned seventeen and collects information on youth-specific issues, such as schooling, grades, family relationships, networks, and non-cognitive skills since 2000[16].

[12]For more information about SOEP see Wagner et al. (2007).
[13]The regional data is provided by the statistical office (Statistisches Bundesamt). The quality indicators are from the statistics on children and employees in day care institutions edited at the "Dortmunder Arbeitsstelle Kinder- und Jugendhilfestatistik" (Statistisches Bundesamt, 2011).
[14]For an empirical overview of the *statistic of children and employees in day care institutions* see the study by Hüsken (2011).
[15]For more information on the youth-specific questionnaire see Frick and Lohmann (2010).
[16]Please see the Sections 2.3., 3.3., and 4.3 of Chapter 2, 3, and 4 respectively for a more in depth presentation of the used questionnaires.

Beside providing age-specific data, the German Socio-Economic Panel Study includes vast information on individual and household characteristics. The SOEP accumulates information on current or past household composition, on employment history, on personality traits of adults, on family background, on place of residence, and on day care usage among others. This richness is apart from its longitudinal framework a distinct feature of the SOEP. Both features enable the application of econometric estimation strategies that eliminate time-invariant unobserved heterogeneity, selection bias, and estimate changes in children's outcome. Time-invariant unobserved heterogeneity distorts not only the analyses of family instability and children's non-cognitive development (see Chapter 2), but also the relationship between day care attendance/day care quality and children's outcomes (see Chapter 4). All three chapters benefit from the longitudinal framework as well as from the richness of the SOEP, since different childhood stages, dynamic outcomes, sequential partnerships, and employment patterns are investigated.

While the SOEP is a rich and representative household panel providing longitudinal information of households since 1984, the information used in this dissertation has been surveyed since 2003 for young children and since 2000 for adolescents. Thus, using micro survey data results in shortcomings for this thesis, e.g. small sample size or child outcomes that are not available for longitudinal or dynamic analyses. Could these disadvantages have been avoided by using different data sets? My answer to this question is clearly *no*, which I explain in the following paragraph.

In Germany different data sets containing information on household characteristics, family dynamics, and child development beside the SOEP exist: Pairfam, Mikrozensus and DJI Kinderpanel. However, all three data sets lack specific information needed for the empirical analyses of this dissertation. Pairfam

("Panel Analysis of Intimate Relationships and Family Dynamics") for example has started in 2008 and surveys way of lives of families and partnerships[17]. Yet, in 2009 a first cross section was available, which cannot be used to account for unobserved heterogeneity distorting the analysis of family instability and child development. In addition, Pairfam comprises non-cognitive skills of children only since 2010 (since the 2^{nd} wave of Pairfam). Furthermore, the Mikrozensus is not based on a longitudinal design, meaning that in each year a certain number of households is surveyed with regard to family, household, and individual characteristics, but these households are not necessarily the same households as in the previous year[18]. Thus, a researcher can use pooled cross-sections to overcome the disadvantage of cross-sectional analysis, but without detailed and most importantly without repeated household-specific information. For the analyses of this thesis this implies that the employment history of mothers (Chapter 3) or maternal partnership sequences (Chapter 2) could not have been identified. Finally, this thesis could not base its analyses on the DJI Kinderpanel, as this data set is also not as comprehensive when it comes to family background or employment history as the SOEP data. In addition, although the DJI Kinderpanel is a longitudinal data set which contains vast information on child development, e.g. non-cognitive skills, grades in primary school, etc., it surveys families with children between age five and age twelve.[19].

Apart from individual data (SOEP), I use regional data on structural day care quality in Chapter 4. The statistics on child and youth welfare comprises data that is collected yearly since 2006 and consists of different information such as on children and employees in day care institutions. The data is collected on the

[17]See the homepage of Pairfam for further information: http://www.pairfam.de/.
[18]On the website of the Statistisches Bundesamt an overview of the Mikrozensus is provided: https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/Bevoelkerung/Mikrozensus.html.
[19]See the description of the DJI Kinderpanel by Alt et al. (2004) for an in depth overview.

youth welfare office level and is edited by the DJI (Deutsches Jugendinstitut) at the Technical University of Dortmund. This regional data allows me to benefit from information on day care institutions, which is exogenous to the used child outcome measures.

The empirical papers presented in Chapter 2, 3, and 4 identify potential causal effects based on family fixed effect models, propensity score matching, and conditional difference-in-differences matching. All econometric strategies utilized in this dissertation aim at identifying a causal relationship between children's outcomes and the explanatory variables of interest, i.e., maternal partnership transitions, maternal involuntary job loss, or day care (quality). Since the empirical work of this dissertation is based on the German Socio-Economic Panel Study, quasi-experimental methods are applied. The choice of methods are not new to the literature, yet propensity score matching and conditional difference-in-differences matching are originally applied in a different research context[20]. Compared to other econometric methods, such as instrumental variable approach, difference-in-differences, or a natural experiment approach, the applied methods are not restricted to compliers of specific instruments or reforms, and they allow to relate child outcomes, which are not available longitudinally, to dynamic events, e.g. family instability during childhood. At the same time family fixed effects and conditional difference-in-differences account for unobserved heterogeneity as well. Furthermore, propensity score matching and conditional difference-in-differences both correct selection bias, which distorts the estimation of maternal involuntary job loss on child outcomes and of day care (quality) on child outcomes, which none of the other methods permit. Another advantage of both propensity score methods is the "replication" of an experimental study[21], as

[20] See Section 3.4 of Chapter 3 and Section 4.4 of Chapter 4 for an in depth discussion of both methods.

[21] An experimental study is often seen as the "best" research design for causal evaluations (Schlotter

based on the propensity score a "random sample" can be obtained. The specifics of each empirical strategy used in this dissertation and their resulting estimates are discussed in detail in each chapter.

1.4 Main findings

Chapter 2 shows that sequential partnership transitions of mothers are correlated with preschoolers' socio-emotional behavior. I find that differences in family instability increase the social-behavioral difficulties. Preschoolers who experience multiple partnership changes have a higher Total Difficulties Score compared to children who experience no change in their family structure. The coefficient of multiple transitions is also stronger correlated with preschoolers' socio-emotional behavior than single transitions, namely divorce/separation or a new partner. Non-cognitive skills of adolescents are negatively correlated with maternal partner changes throughout childhood. Early childhood occurrences of family instability persist, as adolescents' external locus of control is negatively associated with multiple partnership changes from birth through the age of six.

However, linear models cannot account for unobserved heterogeneity, i.e., families with certain unobserved characteristics might be more likely to experience family instability and those unobservables might influence children's non-cognitive skills at the same time. First, I include maternal personality traits in my models and then I examine family fixed effect models in the adolescence sample. The influence of multiple partnership changes on children's non-cognitive skills, either measured at age five/six or at age seventeen, persists. The family fixed effects model allows to compare differences in family instability between siblings which eliminates any

et al., 2011).

time-invariant unobservables. Both approaches, including maternal personality traits and sibling differences, confirm the results obtained in the linear models. Thus, sequential partnership transitions are affecting children's non-cognitive skills in a "causal" way – at least as far as a family fixed effect model and its restrictions allow for it. On the one hand, family fixed effect models confine results to children with siblings, and on the other hand sibling differences cannot control for child-specific factors, such as the cognitive ability of the child, which might influence family instability. Moreover, the findings in Chapter 2 suggest that the stress theory is strongly linked to children's non-cognitive skills, yet further research is needed to identify whether social control theory, stress theory or both are linking family instability and non-cognitive development.

In **Chapter 3** short-term effects of maternal involuntary job loss on children's non-cognitive skills are estimated using a quasi-experimental approach. The estimation strategy uses propensity score methods to address selection bias and to identify a potential causal effect of job loss on non-cognitive skills of children at age five/six and of youngsters at age seventeen. Propensity score matching allows to obtain a balanced sample of children in which treated and untreated children do not differ with regards to observable characteristics, as maternal job loss depends on preferences and maternal background which may bias the initial relationship. Within this simulated random sample preschoolers whose mothers lose their job are more likely to have socio-emotional problems compared to children whose mothers continue to work. In the adolescence sample propensity score matching suggests that youngsters whose mother experience an involuntary job loss are less likely to believe in self-determination, i.e., they are less motivated or striving for success.

Maternal involuntary job loss has negative effects on children's non-cognitive skills and thus may impede children's progress in school or on the labor market.

The findings in Chapter 3 suggest that further research is necessary to disentangle potential influences of maternal job loss on child outcomes, as maternal job loss can be beneficial for cognitive outcomes (see the study by Rege et al., 2011), but are negatively correlated with children's non-cognitive outcomes. The evidence indicates that mothers' stress or frustration due to a displacement affects socio-emotional behavior of preschoolers and internal locus of control of adolescents. An increase in socio-behavioral problems of preschool children could be due to "mediocre quality" of mother-child activities. The potential mechanisms linking maternal involuntary job loss and children's non-cognitive skills can only be inferred in a limited way. But, children might benefit if mothers received support to be able to cope with discouragement after a disruption of employment.

The results of conditional difference-in-differences matching of day care attendance and quality are discussed in **Chapter 4**. The estimation strategy exploits differences in children's outcomes over time and over treatment, i.e., day care attendance at the age of four. The results show that day care attendance at age four itself is not significantly correlated with changes in children's health and changes in their personality characteristics. But the inclusion of structural quality indicators in the analyses explains part of the variation in children's differences. For children who attend day care at the age of four, structural quality of day care institutions is correlated with changes in children's health and with changes in their ability to concentrate. The *child-staff-ratio* significantly increases children's chances of illnesses, e.g. ear infections and atopic eczema. Thus if a child experiences more children per teacher the likelihood of suffering from ear infection at age six increases compared to age three. The results for children's ability to concentrate, which describes part of children's personality dimension "Conscientiousness", render the following relationships: A higher *share of children*

not speaking German at home significantly decreases children's ability to concentrate. Yet, the inclusion of *share of child population aged 3-6 with foreign nationality on the county level* renders the coefficient of *share of children not speaking German at home* insignificant in the analysis of changes in the ability to concentrate.

Beside these findings with regards to day care quality, this chapter contributes by shedding light on the causal relationship of day care attendance as well as of amount of time spent in day care and dynamic child outcomes, i.e., changes in health and personality characteristics from age three through age six. The assessed treatment – day care attendance at age four – is not significantly associated with changes in children's outcomes, however early treatment or changes in other child outcomes may render different results. Yet, full-time attendance at age four is significantly correlated with changes in children's health and personality characteristics: If children spend a full day in a day care institution their likelihood of suffering from ear infection or atopic eczema marginally increases, and full-time attendance significantly decreases children's ability to concentrate. The estimation strategy in this chapter provides a useful tool to causally examine the effect of day care (quality) on dynamic child outcomes. Structural quality of day care centers should not be neglected, as it describes an important part of children's environment and early human capital accumulation. However, the choice of treatment (day care attendance at age four) limits the estimations to a specific group of children and the findings are restricted to short-term changes, i.e., between age three and age six. Thus, further research should also consider changes in outcomes in a wider time frame, as children might be able to catch up in the long run.

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2 Family instability and non-cognitive skills - how are they related? Evidence from preschoolers and adolescents*

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2.1 Introduction

A number of studies have examined the impact of family structure on children's educational outcomes. However, less is known about the influence of family instability, meaning multiple family disruptions, on children's outcomes. Yet family dissolutions have increased in recent years and with it the probability of re-partnering has become more likely (see for example Cherlin, 2009). Investigating the impact of family instability on children's development thus becomes increasingly important. Moreover the literature on child development shows that family related factors forming a child's environment are of particular importance (for instance Carneiro and Heckman, 2003).

Studies have shown that children develop cognitive and non-cognitive skills during the skill formation process at different childhood stages. Both skills are already pronounced during early childhood, whereas non-cognitive skills are more malleable at a later stage in a person's life (Cunha and Heckman, 2007), thus they are more receptive to remedies if children were exposed to adverse environments (Cunha et al., 2010). Although non-cognitive skills are important traits developed over the life cycle, studies examining these skills as early outcome measures of children are less represented in the literature (see Chapter 1). Thus, this chapter aims at adding some information on the relationship between family environments and non-cognitive skills of children and adolescents.

Non-cognitive skills are skills describing a person's emotional maturity and her/his social skills, i.e. abilities that are necessary to communicate and interact with other people. For example motivation, socio-emotional regulation or personality factors can be summarized as non-cognitive skills (see Heckman, 2008). The economic literature on non-cognitive skills suggests that these skills

are associated with other outcomes, such as labor market outcomes in adulthood (e.g., Blanden et al., 2007; Carneiro et al., 2007; Heineck and Anger, 2010; Wichert and Pohlmeier, 2010).

In this chapter we investigate the potential impact of family instability captured as maternal partnership transitions, on children's non-cognitive skills. We focus on changes in respect to parents - rather than siblings or other persons in the household - as parents are first and foremost those capable of assisting their children to acquire non-cognitive skills; they are the main attachment figures (Cunha et al., 2006). On the one hand we concentrate on short-term associations, when we analyze non-cognitive skills of preschoolers (see Carneiro and Heckman, 2003; Cunha and Heckman, 2007). On the other hand, we focus on long term relations by including adolescents in our analysis: We are able to depict how variations in a child's family environment throughout childhood are related to children's non-cognitive skills as adolescents.

There is a vast literature that concentrates on the relationship between family structures and child outcomes (e.g., Del Bono et al., 2007; Ermisch et al., 2004; Francesconi et al., 2010, 2008; Mahler and Winkelmann, 2004) providing only a snapshot of children's living arrangements, and revealing little about family experiences during childhood. But as Brown (2010) points out in her study, todays children are exposed to a "variety of family structures, some of which are more stable than others, it is important that researchers explicitly take account of the dynamics of family living arrangements across childhood" (Brown, 2010, p. 1066). Family stability is as important for child well-being as family structure and has both immediate and long-term benefits for children (for a literature overview see Section 2.2 of this chapter). Along these lines, this chapter focuses on the impact of family instability for preschool children during their early years on non-cognitive skills. For adolescents we observe instabilities during early childhood as well as

during middle and late childhood observing maternal partnership transitions until the children turn seventeen. We relate these transitions to their non-cognitive skills measured when they are adolescents (at age seventeen).

In this chapter family instability is depicted by multiple transitions in maternal partnerships in order to analyze if children whose mothers have unstable partnerships have different outcomes than children who live with mothers who do not separate or newly cohabit. We focus on changes related to the mother, as mothers are still the main caregivers of children and moreover, in case of separation of both parents, most children stay with their mothers rather than with their fathers. We use German data and analyze different samples for children during early childhood and for adolescents. We consider maternal partnership stability by including the number of transitions in maternal partnerships and the types of partnership changes, i.e. separation, new partner or both. Hence, in this chapter we aim at determining potential factors affecting non-cognitive skills which distinguishes our study from a number of other studies that mainly focus on educational attainment or cognitive skills and how one-time family events determine these traits (see Björklund and Sundstrom, 2006; Ermisch and Francesconi, 2001; Ermisch et al., 2004; Ver Ploeg, 2002).

This chapter complements the existing literature by investigating dynamic family instability and its potential effect on children's non-cognitive skills. The literature has so far provided scarce evidence on how sequential partnership transitions of mothers are linked to children's non-cognitive outcomes. We aim at shedding light on possible distortions influencing these particular outcomes.

The remaining chapter is structured as follows: Section 2.2 discusses the related literature. In Section 2.3 the data is described and Section 2.4 outlines the empirical strategy. In Section 2.5 the findings are presented and Section 2.6 concludes.

2.2 Related literature

As noted, there are a few studies focusing on family instability. There exist more studies that concentrate on specific transitions such as parental separation (Björklund and Sundstrom, 2006; Ermisch and Francesconi, 2001). Thus, more often research on child well-being and household composition views family structure to be rather static, hence to be a one-time event. However, the experience of maternal partnership transitions can also be regarded as a dynamic process, as a "series of partnerships" (Cherlin, 2009).

Most of the studies focusing on family instability and child outcomes are based on US data. They differ by the definition of instability and the outcome measures used. The study by Brown (2006) differentiates between family structure and family transitions. She explicitly distinguishes between married partnerships and cohabiting partnerships, as the latter is perceived to be less stable. Relating different family transitions to adolescent outcomes, the author finds that the types of transitions (single to two-parent household or vice versa) do not affect delinquency at the age of fourteen differently.

Another study using US data tests existing theories in order to disentangle possible influences of changes in parental environment on children's outcomes, such as completed schooling and premarital birth, later in life (Hill et al., 2001). Applying a sequential approach to family structure events, Hill et al. (2001) find that changes are important, that timing of experience matters and that the influence can vary by outcomes. In their most recent study Sun and Li (2011) use the ECLS-K data to analyze the effect of three types of disrupted families. They differentiate between non-disrupted two-biological-parent, non-disrupted stepparent households and disrupted households. The outcomes they measure are

mathematics and reading performances, in particular the growth curves of these cognitive skills from kindergarten through fifth grade. They find that children of non-disrupted families make greater progress than those of the reference groups.

There are other studies based on US data that are more comparable with our analysis since they use some outcome measures on behavior, which are similar - but not identical - to our measures of non-cognitive skills. Among them is the study by Osborne and McLanahan (2007) who use data from the Fragile Families Studies to examine the effect of mothers' partnership changes on behavioral problems, measured as aggressive behavior and depressed behavior. The authors find a positive link between the number of transitions experienced and problematic behavior. A later study by Fomby and Osborne (2008) based on the same data set, using children's externalizing behavior problems as outcome measure, argues that experiencing repeated formation and dissolution of household composition could influence children's behavioral development. Yet, it might be that the exposure to frequent conflict between parents and their partners might undermine children's development rather than the experience of disruption.

Fomby and Cherlin (2007) use data from the National Longitudinal Study of Youth (NLSY) and its mother-child supplement (CNLSY) analyzing cognitive and non-cognitive measures. They show that children's cognitive test scores are negatively correlated with the number of partner changes, and also with living the first four years in a single mother household. Further, the externalizing behavior of white children is negatively associated with multiple changes. Magnuson and Berger (2009) show that children's behavioral problems increase if they experience more than one transition in their family structure. Also using data from the NLSY, they do not just focus on instability of family environments, but they also differentiate whether a child transits into a single mother or a social

father household during middle childhood. As outcome measures they focus on mathematics and reading recognition sub tests of the Peabody Individual Achievement Test. The total score on the Behavior Problems Index is used to assess children's behavior problems. Overall, Magnuson and Berger (2009) find a negative association between family structure states (time spend in single mother household) and transitions for children's behavioral outcome rather than for achievement from age six until the age of twelve.

There are only a few studies applying sequential analysis of family structure states examining child outcomes that use European data. One of these few studies is a study using Danish data, which estimates the effect of divorce and remarriage on socio-emotional behavior of children at the age of seven (Andersen et al., 2007). The authors show that experiencing a divorce early in life worsens child development in the short-run. They also find that if a separation is followed by remarriage children's behavioral problems increase compared to the one time event. Also using Danish data, Würtz-Rasmussen (2009) estimates the effect of family structure changes on children's health outcomes. She concludes that children who encounter family instability have worse health outcomes than children from stable backgrounds. We note that the literature more and more addresses the importance of measuring family instability sequentially, but only few papers relate these sequences to non-cognitive skills for that matter. And this particular relationship is pursued in this chapter.

2.2.1 Mechanisms: how family instability could correlate with children's skills

In principle the relationship of family instability and non-cognitive skills could be the result of two causal relationships. First one might argue that family instability

influences child outcomes. Second it could be that child outcomes affect the stability of the family life, which could lead to a parental separation.

Different theories, such as stress theory or social control theory, explain how changes in family environments affect child development (for such an overview, see e.g., Hill et al., 2001). Stress theory states that family reorganization, following parental separation or new partnering, which imposes stress on parents and children, results in alteration of emotional bonds that might encourage problematic behavior of children (Fomby and Cherlin, 2007; Sweeney, 2007). Besides these direct effects there might exist more indirect ones. In fact, the separation of a family might decrease household income which in turn causes further stress for the parent who is taking care of the children. In social control theory, adult supervision and monitoring of children is considered as important means to restrain children from negative behavior. According to this theory "number and types of adults overseeing children" (Hill et al., 2001, p. 274) are most crucial for safeguarding children.

However, this does not mean that more adults are automatically improving the supervision of the child. The relationship, and thus the "type of the adult", is important as well, as the theory implies that "the more distant the relationship of the adult to the child, the weaker the social control" (Hill et al., 2001, p. 274). Thus child outcomes might be negatively affected if multiple transitions are experienced during childhood. A higher number of maternal partnership transitions will most likely impose disruption on children's bonds with their parents (see, for an example, Sweeney, 2007). Thus, preschool children might face socio-emotional difficulties, e.g., problems with peers or family members, whereas adolescents might rather believe that life depends on fate or others.

Yet, it is difficult to distinguish effects of family structure transitions originating

from stress among family members, from new adults living in the household, or from indirect influences, e.g., household income or parental education, without precise and comprehensive measures of all mediating factors for the entire childhood period. This is true for the analyses of this chapter as well, since we cannot entirely distinguish between possible mechanisms, although we control for a variety of potential factors.

Another potential causal relationship between family instability and non-cognitive skills of children could induce parental separation because of children's non-cognitive skills. However, we argue that this "reverse" direction might be less plausible given the skill measures we use. In case of our preschool sample we claim that the empirical incidence for socio-emotional problems of a preschooler causing a "partner change" is assumed to be very small if not non-existing. This particular child outcome measure is not a measure for clinically severe problems. Moreover, the non-cognitive skills measured in our adolescent sample are much less prone to reverse causality, as the skills observed in this sample are *by themselves* neither negative nor positive. Thus we assume that it is a rather scarce or non-existent event that causes partners to separate due to the personality or the locus of control of their adolescent child[1].

2.3 Data

For our empirical analysis we use data from the German Socio-Economic Panel Study (SOEP). The SOEP started in 1984 and is an annual representative household panel[2]. In 2003, the SOEP introduced a series of mother-child questionnaires to

[1]Besides our data do not allow us to test this hypothesis, as our dependent variables are only measured at one point in time: Meaning that we do not have any non-cognitive measures before maternal partner changes are observed.
[2]For more information about SOEP, see Wagner et al. (2007).

survey the development of children from birth onwards. In 2008, a questionnaire surveying the development and family life of preschool children was introduced[3]. In addition to information on the early years of child development, SOEP also includes youth-specific questions starting in 2000. The so-called youth questionnaire surveys adolescents who have turned seventeen and are therefore old enough to respond by themselves. Furthermore, information on non-cognitive skills, such as personality traits and on locus of control is collected[4].

In our analyses we use data obtained from the questionnaire for mothers with preschoolers for our early childhood sample and from the youth questionnaire for our adolescence sample. We include personal and household-specific data to control for socio-economic characteristics after the birth of the child. For our analyses we restrict the samples to children who have not experienced a death of a father or mother, and, in the case of our adolescence sample, who are seventeen, and for whom complete maternal partnership information from birth until the age of five/six or seventeen is available. The period $t = 0$ indicates the period when the child is newborn and maternal partner information can be observed as the "initial condition" of family composition. Maternal partner changes over time are then gradually observed every year up to period $t = 6$, i.e. when the child is five to six years old. The preschoolers sample for $t = 6$ comprises *431* observations, primarily regarding the mother and the child.

For the adolescence sample we define four different observation periods: The first observation period begins at $t = 0$ hence at child's birth and maternal partner information can be obtained as the "initial condition" for adolescents. Similar to maternal partner changes for early childhood we then take every year up to period

[3]For more information about the mother-child questionnaires in SOEP, see Schupp et al. (2008); Siedler et al. (2009).
[4]For more information about the youth questionnaire in SOEP, see Frick and Lohmann (2010).

$t = 17$, i.e. when the children answer the youth questionnaire. The sample consists of *726* observations, comprising all childhood stages and information primarily regarding the adolescents and the mother. In a second step we consider maternal partner transitions only from $t = 0$ until $t = 6$ in order to relate changes during early childhood to later childhood outcomes. A third stage comprises only maternal partner changes experienced during middle childhood, from $t = 6$ until $t = 10$. Our final childhood stage for adolescents defines maternal partnership changes from age ten ($t = 10$) until the age of seventeen ($t = 17$). This late childhood stage enables us to infer whether transitions experienced later in life are more strongly correlated with adolescents' outcomes than those changes experienced early in life. Thus, maternal partner changes and early childhood are examined for periods $t = 0$ until $t = 6$ and transitions for adolescents are observed for periods $t = 0$ until $t = 17$ as well as for early, middle and late childhood periods.

2.3.1 Family instability

With respect to the independent variables, our key explanatory factors are those describing maternal partnership stability. We focus on the number of transitions by implicitly accounting for the types of changes experienced. Because mothers are still the main caregivers of children in most cases, we are more likely to obtain information for biological mothers than fathers in our data set. We, thus, rely on maternal information regarding household structure. In terms of the father we assume that the male household member observed at the time of birth of the child is the biological father. Any other observed male household member surveyed in a child's family at a later period is either a social father or a new life partner of the child's mother.

We define a change in partners by identifying either a transition from one partner

to a *different* partner (two parent to two parent household), a transition to a *new* partner (lone parent to two parent household) or a transition to *no* partner (two parent to single parent household) of a child's mother from one year to the next. It can occur due to separation without divorce, separation with divorce, new partners moving in, being newly married or due to cohabitation. Thus a family structure change is any relationship change of the mother that a child experiences. Since we use yearly information, we cannot account for changes occurring between our observations, but we argue that maternal partnership transitions occurring on a monthly interval during the year are rare. We do not distinguish between married or cohabiting families. We compare these children to children whose mothers live in stable relationships over the entire observation period. These stable relationships include single parenthood.

From the obtained partner changes we construct dummy variables as well as an ordinal measure comprising the number of transitions experienced. We observe a maximum of three changes in the household composition for children aged five or six during the entire observation period. For children aged seventeen we identify up to five changes in maternal partnerships for the complete childhood period. Transitions are coded into two dummy variables depicting one change or multiple changes (two or more changes). In order to analyze all possible correlations of maternal partner changes with non-cognitive outcomes of children, we examine the number of changes and types of changes separately (for a descriptive overview see Table A.2.1 and A.2.2 in Appendix).

2.3.2 Non-cognitive skills

We use well-established measures of children's non-cognitive skills as our dependent variables: *socio-emotional behavior* for preschool children; *locus of control*

and *personality traits* for adolescents.

Non-cognitive skill measures of preschoolers

Within the SOEP a modified version of the Strength and Difficulties Questionnaire (SDQ), proposed by Goodman (1997), is used to collect information on the ***socio-emotional behavior*** of preschool children. The socio-emotional behavior is gathered through 17 items over five separate dimensions: Emotional Symptoms, Conduct Problems, Hyperactivity/Inattention, Peer Relationship Problems, and Prosocial Behavior. Given these first four dimensions of the SDQ a Total Difficulties Score can be calculated. This score spans from 0 to 40, resulting in a negative outcome the higher the score.

A child can be classified into different categories of behavior: normal, borderline or abnormal depending on its score of socio-emotional behavior. Here, we construct a binary variable "abnormal" taking on the value 1 if the Total Difficulties Score is above 17 and the value 0 if the Total Difficulties Score is between 0 and 16. The Prosocial Behavior Score ranges from 0 to 10 and indicates a positive outcome the higher a child's score. Although mothers assess children's behavior, the construction of the measure attenuates potential bias of mothers rating their children. This measure of socio-emotional behavior has been applied in many other studies (see for example Andersen et al., 2007; Ermisch, 2008).

Distinguishing preschoolers' non-cognitive skills by experience of family instability from birth through age five/six allows us to descriptively infer potential correlations of maternal partnership transitions and children's socio-emotional behavior. In Table 2.1 we depict preschoolers' socio-emotional behavior, their prosocial behavior, and different categories of behavior differentiated by exposure to family instability. Children whose mothers change their partner from birth

through age five/six have a significantly higher Total Difficulties Score: Experience of transition renders a mean of the SDQ score equal to 12.3 score points compared to 10.4 score points for those not experiencing a transition (see row 1 of Table 2.1). Other non-cognitive skill measures, i.e. prosocial behavior, normal behavior, and borderline behavior are not significantly different by family instability. But preschoolers exposed to maternal partnership changes are significantly more likely to display "abnormal" behavior, i.e are more likely to have conduct problems, emotional problems or peer problems[5].

Table 2.1: Distribution of maternal partnership transitions and children's non-cognitive skills

		Mean		
	All	No transitions	Transitions	*t-ratio*
Socio-emotional behavior	10.72	10.44	12.27	2.3005**
Prosocial behavior	7.36	7.37	7.29	-0.3916
Normal	0.70	0.71	0.63	-1.3612
Borderline	0.15	0.16	0.12	-0.6109
Abnormal	0.15	0.13	0.25	2.3610**
N	426	361	65	

Note: Data from the SOEP v26, (2008-2009), pooled data, authors' calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ denote significance level of differences between children experiencing a transitions and children experiencing no transitions.

Non-cognitive skill measures of adolescents

For adolescents we also use two well-established non-cognitive skill measures, namely locus of control (Rotter, 1966) and personality traits (McCrae and Costa, 1996, 1999), described by a Five Factor model. The SOEP measures ***locus of control***

[5]These differences in children's non-cognitive skills for those exposed to maternal partnership transitions and those living in stable families are also shown in Figure A.2.1 in Appendix.

on the youth questionnaire using a ten-item instrument. Adolescents rate each item on a scale from 1 (completely disagree) to 7 (completely agree). Using a factor analysis enables us to determine whether adolescents believe that their life depends on their own action (internal locus of control) or whether they believe that their life is determined by others or by fate (external locus of control).

We examine the correlation between adolescents' external locus of control and maternal partner changes, as we argue that children who experience instability in their family composition might more likely believe that life is determined by fate. Some studies show that believing in fate (having an external locus of control) is associated with negative outcomes during adulthood (Caliendo et al., 2010; Heineck and Anger, 2010). For example, Caliendo et al. (2010) find that individuals who have an external locus of control are less likely to leave unemployment.

The ***personality traits*** are surveyed with a sixteen-item instrument and are based on the Five Factor Model by McCrae and Costa (1996, 1999). In order to examine potential associations between changes in maternal partnerships and children's personality, we extract five factors using a factor analysis: Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism. Children experiencing multiple transitions in their environment might be more likely characterized as less conscientious or less agreeable than children from stable families. A study analyzing personality traits and female labor force participation finds that conscientious women are more likely to participate in the labor force in general (Wichert and Pohlmeier, 2010). In the SOEP, personality traits are only available starting with the 2006 wave, hence we observe personality traits for *338* adolescents in our sample.

In Table 2.1a the skill differences of adolescents experiencing maternal partnership transitions and of those not exposed to any partnership change are shown.

A first descriptive comparison by family instability indicates that the means of adolescents' external locus of control significantly differs (see top panel of Table 2.1a). Thus, adolescents whose mother changes her partner are significantly more likely to believe that life depends on fate or others than those who live in stable families during childhood. With regard to adolescents' personality traits we find significant differences by exposure to maternal partnership transitions for *conscientiousness* and for *agreeableness*. Adolescents who experience family instability during childhood are less likely to "do things efficiently (conscientiousness)", and they are less likely to "trust or be flexible (agreeableness)" (see bottom panel of Table 2.1a)[6].

Table 2.1a: Distribution of maternal partnership transitions and adolescents' non-cognitive skills

	Mean			
	All	No transitions	Transitions	*t-ratio*
External locus of control	-0.000	-0.062	0.194	2.9717***
Internal locus of control	-0.111	-0.055	-0.286	-2.6062***
N	682	516	166	
Openness	-0.029	-0.002	-0.114	-0.8915
Conscientiousness	0.021	0.114	-0.261	-3.0698***
Extraversion	-0.079	-0.066	-0.119	-0.4158
Agreeableness	-0.012	0.045	-0.186	-1.7865*
Neuroticism	0.105	0.109	0.096	-0.1010
N	324	244	80	

Note: Data from the SOEP v26, (2001-2009), pooled data, authors' calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ denote significance level of differences between children experiencing a transitions and children experiencing no transitions.

[6]These differences in adolescents' locus of control by family instability are depicted in Figure A.2.2 in Appendix.

2.4 Empirical strategy

For both preschoolers' *total difficulties score* and *total score of prosocial behavior* and adolescents' *locus of control* and *personality traits* ordinary least squares (OLS) models are estimated. In all models we control for child, mother, family, and household characteristics. When the outcome of interest is *abnormal behavior*, we analyze a logit model. In the preschool sample, 70 per cent are classified into the category normal, 15 per cent into the category borderline, and 15 per cent into the category abnormal.

We use the following general equation to describe the relationship between non-cognitive skills and family instability:

$$S_{ij} = \beta_{ij} INSTABILITY_{ij} + \gamma_{ij} X_{ij} + \delta_i + \upsilon_{ij} \tag{2.1}$$

where S_{ji} is our measured non-cognitive skill j of child i. The vector X_{ij} comprises our control variables and δ_i represents family characteristics that are fixed over time.

However, this linear model does not account for unobserved heterogeneity. In our context this implies that families with certain characteristics which might not be observable are more likely to experience family instability and these characteristics influence child outcomes as well. Such a factor could be mothers' personality. Thus, in a second model specification we control for maternal personality traits in both our preschool sample and our adolescent sample.

By including maternal personality characteristics as covariates, we control for a potential correlation between maternal partnership stability and personality on the one hand and child outcome measures and mothers' personality on the other

hand. Mothers' personality is measured using the same scale as in our analysis of adolescents' personality traits. Yet maternal personality traits are only measured for a subsample of our data.

Nevertheless, this approach might not entirely solve the problem of unobserved heterogeneity. Other relevant variables might still be unobserved. Thus we furthermore estimate a family fixed effects model to deal with other omitted variables. Given the limited sample sizes of our data, sibling differences are only possible for our adolescence sample. For this reason we create a sub sample by clustering on families defining siblings to be a family if they have the same mother and the same father identifier.

This family fixed effects model controls for the time invariant factor δ_i. In Equation 1 δ_i represents family characteristics that are fixed over time and that are unobserved. In our particular case δ_i is invariant across siblings. Hence as depicted in Equation 2.2, we take the difference of Equation 2.1 between siblings to control for heterogeneity in family backgrounds. This model investigates the relationship between non-cognitive skills and family instability within families across siblings.

$$S_{j1} - S_{j2} = (INSTABILITY_{j1} - INSTABILITY_{j2})'\beta + (X_{j1} - X_{j2})'\gamma + (v_{j1} - v_{j2}) \quad (2.2)$$

Equation 2.2 can also be written as a within-family estimator applicable to families with more than two children, where δ_i can be eliminated by subtraction of Equation 2.1 for individual means:

$$(S_{jn} - \overline{S_j}) = (INSTABILITY_{jn} - \overline{INSTABILITY_j})'\beta + (X_{jn} - \overline{X_j})'\gamma + (v_{jn} - \overline{v_j}) \quad (2.3)$$

The coefficient β remains if *INSTABILITY* is varying over siblings, whereas δ_i is eliminated (see Equation 2.4). However, particular child specific effects, such as the cognitive ability of the child, are not accounted for by sibling differences. This

would be problematic for our analyses if such child specific effects were important factors determining sibling differences in family instability.

$$\Delta S_j = \Delta INSTABILITY_j'\beta + \Delta X_j'\gamma + \Delta v_j \tag{2.4}$$

2.5 Results

First, we report the relationship between family instability and socio-behavioral outcomes of preschoolers. In a second step, we discuss how maternal partnership transitions are associated with adolescents' non-cognitive skills. In all our tables we only present the estimates for the variables of interest: family instability[7]. In all models we additionally incorporate time dummies, since our samples consist of pooled cross-sectional data.

2.5.1 Family instability and non-cognitive skills of preschoolers

For our analysis with regards to changes in maternal partnerships, we present two models, all of which contain age of mother, years of education (mother), household income near the time of birth, child's age in months, gender of the child, hours spent in formal care, younger sibling present and older sibling present, region (East Germany vs. West Germany), and migration background as control variables. For a detailed sample overview a descriptive summary of our control variables is given in Table A.2.3 in Appendix. The model includes number of family structure changes and types of changes experienced. In a second model specification we control for maternal personality traits.

[7]The models with all covariates are available from the authors upon request.

Preschool children, who experience multiple changes, hence two or three maternal partnership transitions, have a higher Total Difficulties Score than children who experience no change in their family structure. Table 2.2 shows that the number of family transitions is positively correlated with the socio-emotional behavior of preschoolers. Hence, the more transitions a child experiences, the higher their socio-emotional problems: One more partner change increases the SDQ score by 1.2 (see top panel of Table 2.2).[8] Moreover, looking at multiple transitions shows that children's SDQ score significantly increases by 2.6 score points, whereas the experience of one transition is not significantly correlated with preschoolers' socio-emotional behavior (see middle panel of Table 2.2). Differentiating between types of changes, i.e. new partner or no new partner (separation/divorce) does renders a significant association between children's socio-emotional behavior and multiple partnership changes, but not with type of one transition (see bottom panel of Table 2.2.). The probability of being abnormal is only positively correlated with experiencing one change, i.e. preschoolers whose mother separate or divorce once from birth through age five/six are more likely to have peer problems or conduct problems (see bottom panel of Table 2.2). The prosocial behavior of children is also negatively associated with one maternal partnership transition if we distinguish whether this one change is a transition from a single to a two-parent household or from a two-parent to a lone parent household. In particular the transition to a lone parent household increases the probability of abnormal behavior.

[8] Whereas an extra year in mother's education reduces a child's socio-emotional behavior score by 0.24.

Table 2.2: Estimation of socio-emotional behavior and maternal partner changes *(preschool sample)*

	Socio-emotional behavior	Prosocial behavior	Abnormal behavior: marg. eff.
Number of transitions	1.154**	-0.179	0.055**
	[0.4973]	[0.1435]	[0.0268]
N	421	426	410
R^2	0.085	0.057	
pseudo R^2			0.035
Baseline: No transitions			
One transition	1.175	-0.368	0.162**
	[1.0384]	[0.2510]	[0.0745]
Multiple transitions	2.648**	-0.126	0.082
	[1.3179]	[0.4235]	[0.1149]
N	421	426	410
R^2	0.084	0.058	
pseudo R^2			0.044
Baseline: No transitions			
One transition (New partner)	-0.420	-0.556*	-0.024
	[1.2851]	[0.3335]	[0.0806]
One transition (No new partner)	2.202	-0.248	0.308***
	[1.4078]	[0.3320]	[0.1073]
Multiple transitions	2.739**	-0.115	0.094
	[1.3254]	[0.4234]	[0.1190]
N	421	426	410
R^2	0.088	0.059	
pseudo R^2			0.059

Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: We control for age of mother, years of education (mother), log of household income near birth, age of child (months), gender, hrs spent in childcare, younger siblings present, and older siblings present, region (East Germany vs. West Germany, migration background, and time dummies. Authors' calculations: SOEP v26, (2008-2009).

To address the problem of self-selection of mothers into sequential partnerships, we perform further analyses. We might be capturing changes in children's behavior simply because mothers who are in sequential partnerships are more likely to have an outgoing personality, which in turn might be associated with their children's socio-emotional behavior. Mother's personality are based on the Five Factor Model by McCrae and Costa (1996, 1999) which renders five factors using factor analysis: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticisim. Small sample sizes restrict us to include one personality dimension instead of five dimensions in our analyses. Therefore we estimate separate models for each personality dimension and only present the ones with the personality dimension "*neuroticism*", which correlates most with our skill measures. Descriptive analyses show that the number of transitions of maternal partnerships is not correlated with maternal personality traits in our preschool sample. If we analyze our previous models by controlling for maternal personality traits our results remain nearly unchanged (see Table 2.2a). Multiple transitions are only marginally significantly correlated with children's SDQ score (see middle and bottom panel of Table 2.2a). And in addition one transition (no new partner) marginally increases preschoolers' socio-emotional behavior (see bottom panel of Table 2.2a). Nonetheless, we argue that the results in Table 2.2a depict a possible causal influence of sequential partnership transitions on children's socio-emotional behavior, as the inclusion of maternal personality traits renders similar results compared to our first model specification (see Table 2.2) suggesting that our estimates are not necessarily biased due to omitted variables, i.e. maternal characteristics inducing partnership changes.

Table 2.2a: Estimation of socio-emotional behavior and maternal partner changes including maternal personality traits *(preschool sample)*

	Socio-emotional behavior	Prosocial behavior	Abnormal behavior: marg. eff.
Number of transitions	1.194**	-0.224	0.050*
	[0.5026]	[0.1481]	[0.0282]
Maternal personality traits	✓	✓	✓
N	355	360	345
R^2	0.125	0.068	
pseudo R^2			0.037
Baseline: No transitions			
One transition	1.404	-0.431*	0.177**
	[1.0554]	[0.2532]	[0.0801]
Multiple transitions	2.350*	-0.229	0.027
	[1.2914]	[0.4496]	[0.1153]
Maternal personality traits	✓	✓	✓
N	355	360	345
R^2	0.123	0.069	
pseudo R^2			0.050
Baseline: No transitions			
One transition (New partner)	0.072	-0.564*	-0.003
	[1.4753]	[0.3333]	[0.0945]
One transition (No new partner)	2.340*	-0.338	0.326***
	[1.3850]	[0.3367]	[0.1160]
Multiple transitions	2.431*	-0.221	0.038
	[1.2946]	[0.4498]	[0.1182]
Maternal personality traits	✓	✓	✓
N	355	360	345
R^2	0.127	0.070	
pseudo R^2			0.065

Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: We control for age of mother, years of education (mother), log of household income near birth, age of child (months), gender, hrs spent in childcare, younger siblings present, and older siblings present, region (East), migration background, maternal personality traits, and time dummies. Authors' calculations: SOEP v26, (2008-2009).

Controlling for stable single parent households ("never partnered" from birth through age five/six of the child) in our models rather than including it in our baseline category allows us to test the social control theory in particular. If we include stable single parent households as dummy in our model, the potential associations of maternal partner changes with children's socio-emotional behavior remains. Redefining our baseline also indicates that living in a stable single parent household does not significantly change children's outcome compared to children who live in stable two-parent households. In addition, we find that the experience of multiple partnership transitions increases the socio-emotional behavior score by 2.74 (see Table A.2.4 in the Appendix).

2.5.2 Family instability and non-cognitive skills of adolescents

Maternal partnership transitions and adolescents' outcomes are assessed in different models accounting for transitions during different periods in life. All estimations contain additional control variables, such as age of mother, years of education, enrolled school track etc. (for an overview see Table A.2.3 in Appendix). First we present a model in which we examine how changes in maternal partnership from birth until the age of seventeen are associated with adolescents' non-cognitive skills, and we differentiate maternal partner changes experienced by adolescents during childhood stages - hence between birth and the age of six, between age six and age ten, and between age ten and age seventeen (see Table 2.3). These models allow us to assess whether long-term correlations between number of family structure transitions and child outcomes exist, as already examined in the short-term association for our preschool sample. In all of our tables we again present the estimates of the various variables on maternal partnership transitions alone.

Locus of control

Table 2.3 shows that adolescents who experience more transitions from birth until the age of seventeen are more likely to believe that their life is determined by fate or others. If a child experiences one more transition from birth until age seventeen, he or she has a higher external locus of control by 9.6 per cent of a standard deviation[9]. If we differentiate whether one or multiple changes are correlated with the external locus of control factor, we see that multiple partnership transitions increase the coefficient of adolescents' belief in an external determination of life. Being exposed to multiple transitions during complete childhood increases children's belief that life depends on fate by 29 per cent of a standard deviation (see column 1 of Table 2.3). Adolescents' belief in self-determination decreases with their experience of one change in maternal partnership - either a separation or a new partner - during their life (see column 2 of Table 2.3). In a final step we differentiate whether a one-time transition is a change from a single to a two-parent or from a two-parent to a single parent household in order to see what type of change is correlated with the internal locus of control factor. In the bottom panel of Table 2.3 this distinction is presented and we see that a partner change ("new partner") is negatively correlated with adolescents' belief in self-determination (see column 2 of Table 2.3)[10].

In Table 2.3 we also depict the association of maternal partnership transitions distinguished by childhood stages (see column 3 and column 4). This allows us to show if being exposed to maternal partnership transitions during early childhood

[9]In comparison, an extra year of mothers' education leads to a lower external locus of control by nearly 2.4 per cent of a standard deviation.

[10]If we examine all relations for girls and boys separately, we find no significant correlations for girls. For male adolescents, on the other hand, significant associations between multiple partnership transitions and their external locus of control factors exist. These analyses do not distinguish at what stage during childhood transitions occur. These gender specific results are not presented in this paper, but are available from the authors upon request.

might have long-term consequences, as non-cognitive skills are measured at age seventeen. The middle panel of Table 2.3 shows that transitions occurring between birth and the age of six are significantly correlated with adolescents' locus of control. One partnership transition experienced from birth until the age of six decreases adolescents' internal locus of control by 35 per cent of a standard deviation (see column 4 of Table 2.3). Further, the middle panel of Table 2.3 shows that multiple transitions during early childhood marginally increase adolescents' external locus of control by 39 per cent of a standard deviation (see column 3 of Table 2.3)[11].

[11]For boys, on the other hand, we see that the number of transitions from birth until the age of six is correlated with their external locus of control factor - they are more likely to believe that their life depends on fate or others. Thus locus of control is correlated with family instability at different childhood stages for boys and girls. These gender specific results are not presented in this paper, but are available from the authors upon request.

Table 2.3: Estimation of locus of control and maternal partner changes for complete childhood and by childhood stages *(adolescence sample)*

	External locus of control	Internal locus of control	External locus of control	Internal locus of control
Number of transitions (*complete childhood*)	0.096*	-0.071		
	[0.0493]	[0.0479]		
Number of transitions (*early childhood*)			0.095	-0.124
			[0.0861]	[0.0932]
Number of transitions (*middle childhood*)			0.024	-0.002
			[0.1207]	[0.0928]
Number of transitions (*late childhood*)			0.147	-0.067
			[0.0915]	[0.0916]
N	682	682	682	682
R^2	0.103	0.151	0.104	0.152
Baseline: No transitions				
One transition (*complete childhood*)	0.130	-0.344***		
	[0.1068]	[0.1194]		
Multiple transitions (*complete childhood*)	0.292**	-0.101		
	[0.1348]	[0.1200]		
One transition (*early childhood*)			-0.030	-0.354**
			[0.1431]	[0.1505]
Multiple transitions (*early childhood*)			0.387*	0.026
			[0.2239]	[0.2261]
One transition (*middle childhood*)			0.136	-0.108
			[0.1581]	[0.2008]
Multiple transitions (*middle childhood*)			-0.010	0.197
			[0.3603]	[0.1718]
One transition (*late childhood*)			0.128	-0.124
			[0.1364]	[0.1245]
Multiple transitions (*late childhood*)			0.374	0.034
			[0.2505]	[0.3202]
N	682	682	682	682
R^2	0.105	0.159	0.108	0.161
Baseline: No transitions				
(complete childhood only)				
One transition (New partner)	0.118	-0.626***		
	[0.1745]	[0.2218]		
One transition (No new partner)	0.104	-0.181		
	[0.1359]	[0.1435]		
Multiple transitions	0.285**	-0.095		
	[0.1346]	[0.1198]		
N	682	682		
R^2	0.104	0.162		

Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: We control for age of mother, years of education (mother), log of household income, gender, attended school track, region (East), birth order, migration background, and time dummies. Authors' calculations: SOEP v26, (2001-2009).

Similar to the analyses in our preschool sample, we address the potential problem of omitted variable bias by including maternal personality traits in our OLS estimations shown in Table 2.3. Descriptive analyses show that mothers who relate to *extraversion* and relate less to *agreeableness* are more likely to change their partner in our adolescence sample. Due to small sample sizes we only include one personality dimension instead of five dimensions in our analyses. The estimation of separate models for each personality dimension show that the personality dimension "*neuroticism*" correlates most with our skill measures. Thus we control for neuroticism in our analyses shown in Table 2.4. But, as can be seen in Table 2.4, the results obtained from OLS including maternal personality traits remain nearly unchanged compared to the estimates shown in Table 2.3.

Table 2.4 depicts the correlation of maternal partnership transitions including maternal personality traits differentiated by complete childhood (column 1 and 2) and different childhood stages (column 3 and 4). The associations found in Table 2.3 remain. Adolescents' belief that life depends on fate or others still increases by 29 per cent of a standard deviation if they experience multiple transitions during complete childhood (see column 1 of Table 2.3). The early years remain marginally significant as well (see column 3 and 4 of Table 2.4). Therefore we argue that already the OLS results without controlling for maternal personality traits estimate possible influences of family instability on children's non-cognitive skills and to a much smaller extent depict associations between maternal characteristics by which mothers' self-select into sequential partnerships. Yet, in Section 2.5.3 of this chapter we will further address the issue of unobserved heterogeneity by analyzing family fixed effects for a sibling subsample of our adolescence sample.

Table 2.4: Estimation of locus of control and maternal partner changes including maternal personality traits *(adolescence sample)*

	External locus of control	Internal locus of control	External locus of control	Internal locus of control
Number of transitions (*complete childhood*)	0.094*	-0.058		
	[0.0519]	[0.0499]		
Number of transitions (*early childhood*)			0.087	-0.117
			[0.0875]	[0.0946]
Number of transitions (*middle childhood*)			0.037	-0.000
			[0.1226]	[0.0937]
Number of transitions (*late childhood*)			0.145	-0.036
			[0.0989]	[0.0990]
Maternal personality traits	✓	✓	✓	✓
N	649	649	649	649
R^2	0.104	0.152	0.105	0.154
Baseline: No transitions				
One transition (*complete childhood*)	0.138	-0.350***		
	[0.1090]	[0.1212]		
Multiple transitions (*complete childhood*)	0.291**	-0.063		
	[0.1399]	[0.1226]		
One transition (*early childhood*)			-0.065	-0.332**
			[0.1481]	[0.1550]
Multiple transitions (*early childhood*)			0.390*	0.018
			[0.2247]	[0.2287]
One transition (*middle childhood*)			0.159	-0.116
			[0.1644]	[0.2082]
Multiple transitions (*middle childhood*)			0.010	0.207
			[0.3615]	[0.1752]
One transition (*late childhood*)			0.132	-0.097
			[0.1398]	[0.1254]
Multiple transitions (*late childhood*)			0.366	0.082
			[0.2760]	[0.3555]
Maternal personality traits	✓	✓	✓	✓
N	649	649	649	649
R^2	0.107	0.162	0.110	0.162
Baseline: No transitions				
One transition (New partner)	0.084	-0.647***		
	[0.1759]	[0.2286]		
One transition (No new partner)	0.124	-0.183		
	[0.1398]	[0.1454]		
Multiple transitions	0.283**	-0.057		
	[0.1397]	[0.1224]		
Maternal personality traits	✓	✓		
N	649	649		
R^2	0.106	0.165		

Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: We control for age of mother, years of education (mother), log of household income, gender, attended school track, region (East), birth order, migration background, maternal personality traits, and time dummies. Authors' calculations: SOEP v26, (2001-2009).

Personality traits

Table 2.5 shows how adolescent personality traits are associated with maternal partnership instability if this instability is experienced throughout their entire childhood, until they turn seventeen. The traits *conscientiousness* and *agreeableness* are significantly correlated with family instabilities, as has already been identified in a descriptive comparison shown in Table 2.1a. For the different types of transitions (see middle panel of Table 2.5) we see that one transition is negatively associated with the factor conscientiousness (e.g., to do things effectively and efficiently) and multiple transitions are negatively correlated with the factor agreeableness (e.g., be flexible or to trust), but only at the ten per cent significance level. This result indicates that children who experience multiple partnership transitions throughout childhood are less likely to trust or to be flexible by 36 per cent of a standard deviation (see column 4 of the middle panel of Table 2.5). If we further differentiate one transition (see bottom panel of Table 2.5), we find that the factor conscientiousness is negatively correlated with a change from a single parent to a two-parent household. The correlation of multiple transitions and adolescents' agreeableness remains significant at the 10 per cent level after further differentiating types of one transition (see column 4 of bottom panel).

For adolescents who experience family instability at various stages during childhood, we find similar correlations for the traits conscientiousness and agreeableness, but these results are only significant at the ten per cent level. Yet they show that instability occurring during early childhood is in relative terms the most significant association[12].

[12]The results are available by the authors upon request.

Table 2.5: Estimation of personality traits and maternal partner changes for complete childhood *(adolescence sample)*

	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
Number of transitions	-0.019	-0.093	-0.032	-0.127*	0.033
	[0.0569]	[0.0741]	[0.0683]	[0.0698]	[0.0599]
N	324	324	324	324	324
R^2	0.111	0.087	0.058	0.087	0.082
Baseline: No transitions					
One transition	-0.230	-0.414**	0.133	-0.097	-0.223
	[0.1765]	[0.1776]	[0.1751]	[0.1980]	[0.1665]
Multiple transitions	0.037	-0.249	-0.260	-0.362*	0.148
	[0.1551]	[0.2000]	[0.1813]	[0.1952]	[0.1763]
N	324	324	324	324	324
R^2	0.117	0.103	0.067	0.086	0.089
Baseline: No transitions					
One transition (New partner)	-0.395	-0.663***	-0.135	-0.055	-0.408
	[0.3338]	[0.2375]	[0.2849]	[0.3823]	[0.3481]
One transition (No new partner)	-0.131	-0.279	0.311	-0.019	-0.236
	[0.2096]	[0.2439]	[0.2107]	[0.2175]	[0.1862]
Multiple transitions	0.039	-0.246	-0.264	-0.351*	0.140
	[0.1552]	[0.2005]	[0.1819]	[0.1967]	[0.1766]
N	324	324	324	324	324
R^2	0.118	0.104	0.073	0.085	0.093

Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: We control for age of mother, years of education (mother), log of household income, gender, attended school track, region (East), birth order, migration background, and time dummies. Authors' calculations: SOEP v26, (2001-2009).

When we include maternal personality traits in the analyses shown in Table 2.5, the results remain stable (see Table 2.6). Due to small sample sizes we only control for one personality dimension, namely "*neuroticism*", as this trait correlates most with our skill measures. Thus accounting for potential omitted variable bias by including maternal personality traits in this smaller sub sample enables us to identify possible influences of family instability on children's non-cognitive skills and to a much smaller extent depict associations between maternal characteristics by which mothers' self-select into sequential partnerships.

Table 2.6: Estimation of personality traits and maternal partner changes including maternal personality traits *(adolescence sample)*

	Openness	Conscientiousness	Extraversion	Agreeableness	Neuroticism
Number of transitions	-0.021	-0.095	-0.041	-0.128*	0.035
	[0.0570]	[0.0741]	[0.0683]	[0.0706]	[0.0603]
Maternal personality traits	✓	✓	✓	✓	✓
N	318	318	318	318	318
R^2	0.118	0.094	0.065	0.080	0.084
Baseline: No transitions					
One transition one_ch	-0.226	-0.422**	0.130	-0.073	-0.230
	[0.1765]	[0.1762]	[0.1761]	[0.1989]	[0.1661]
Multiple transitions	0.038	-0.249	-0.295	-0.379*	0.171
	[0.1597]	[0.2047]	[0.1827]	[0.1997]	[0.1793]
Maternal personality traits	✓	✓	✓	✓	✓
N	318	318	318	318	318
R^2	0.124	0.110	0.075	0.079	0.092
Baseline: No transitions					
One transition (New partner)	-0.395	-0.663***	-0.135	-0.055	-0.408
	[0.3338]	[0.2375]	[0.2849]	[0.3823]	[0.3481]
One transition (No new partner)	-0.131	-0.279	0.311	-0.019	-0.236
	[0.2096]	[0.2439]	[0.2107]	[0.2175]	[0.1862]
Multiple transitions	0.039	-0.246	-0.264	-0.351*	0.140
	[0.1552]	[0.2005]	[0.1819]	[0.1967]	[0.1766]
Maternal personality traits	✓	✓	✓	✓	✓
N	324	324	324	324	324
R^2	0.118	0.104	0.073	0.085	0.093

Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: We control for age of mother, years of education (mother), log of household income, gender, attended school track, region (East), birth order, migration background, maternal personality traits, and time dummies. Authors' calculations: SOEP v26, (2001-2009).

2.5.3 Unobserved heterogeneity

Although the models including maternal personality traits render nearly unchanged estimates (see Tables 2.4 and 2.6) compared to our other linear models (see Tables 2.3 and 2.5), this approach might not eliminate all unobserved heterogeneity. Other relevant variables inducing maternal partnership transitions and non-cognitive skill levels of preschoolers and adolescents might still be

omitted. Thus, estimating a family fixed effects model in our adolescent sample aims at solving this additional bias. Family fixed effects are estimated in a sub sample of our adolescence sample comprising only siblings. By clustering adolescents in families, we generate a sample of 383 siblings across 178 families.

We compare the potential impact of maternal partnership instability within families, namely across siblings. We apply random and fixed effects while we cluster on the family-level and control for sibling-variant characteristics such as age of mother, school track attended, gender, birth order, and our main explanatory variable, partnership transitions experienced. The standard Hausman test suggests that the fixed effects model applies, i.e. that unobserved characteristics δ_i are correlated with our covariates. We find that multiple transitions experienced from birth until age seventeen remain positively correlated with adolescents' belief that life depends on fate. In our fixed effects model this suggests that the external locus of control increases for siblings who are exposed to more maternal partnership transitions within a family (see middle panel of Table 2.7). This effect remains if we differentiate types of one-time transitions shown in the bottom panel of Table 2.7. All coefficients depicted in Table 2.7 are significant at the 10 per cent level indicating that we find a marginal effect of family instability on adolescents' locus of control. Yet, this might to some extent be due to our small sample size which provides less statistical power for our estimation strategy.

Table 2.7: Estimation of locus of control and maternal partner changes using fixed effects for complete childhood *(adolescence-siblings sample)*

	External locus of control	Internal locus of control
Number of transitions	0.352	-0.074
	[0.3663]	[0.4558]
N	343	343
R^2	0.066	0.184
Baseline: No transitions		
One transition	-0.126	-0.418
	[0.4177]	[0.4362]
Multiple transitions	1.113*	0.144
	[0.6261]	[1.0345]
N	343	343
R^2	0.088	0.192
Baseline: No transitions		
One transition (New partner)	-0.509	-0.818*
	[0.4319]	[0.4391]
One transition (Separation)	0.349	0.078
	[0.4513]	[0.4282]
Multiple transitions	0.926*	-0.051
	[0.5054]	[0.9510]
N	343	343
R^2	0.099	0.201

Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: We control for age of mother, gender,attended school track, birth order. Authors' calculations: SOEP v26, (2001-2009).

2.6 Conclusion

This chapter contributes to the small empirical literature on children's non-cognitive skill formation, as parents and thus family environments are in the first instance those who help their children to adopt these so-called "soft skills". In addition, we target non-cognitive skills as outcome measures, as these skills determine outcomes later in life, such as labor market outcomes (see Caliendo et al., 2010; Carneiro et al., 2007; Heineck and Anger, 2010). Rather than assessing a potential impact of family structure itself, we infer the relationship between non-cognitive skills and family instability by looking at family structure changes and by taking the perspective of the mother when children are preschoolers and adolescents. Based on German data we distinguish between instabilities during different childhood stages and we identify different types of partnership changes related to children's non-cognitive skills at age five/six or at age seventeen.

The results show that family instability is associated with an increase in socio-behavioral problems for preschool children and with a decrease in self-determination for adolescents. The latter may impede the success later on the labor market, whereas the former may hamper achievements in school. Early childhood experiences of maternal partnership transitions determine not just short-term outcomes, but also non-cognitive skills at the age of seventeen. Thus, not only early child outcomes are influenced by family environments, as recent literature suggests, but also early childhood occurrences matter for children's skill formation throughout the course of life. They matter more than instabilities during later childhood stages. Thus, these results once more demonstrate the importance of the early years.

When examining early childhood outcomes and their potential association with

maternal partner changes, we find that multiple transitions are significantly stronger correlated with preschoolers' socio-emotional behavior than single transitions. According to the stress theory these children experience more stress. Stable environments, with respect to family structure, seem to be best for this child outcome. These results are consistent with studies for other countries (see for instance Andersen et al., 2007). There are some hints that the transition from two parents to single parent seems to affect the socio-emotional behavior in a more severe manner than the transition from a two-parent to a different two-parent household or from a lone parent to a two-parent household. If this is verified by other studies, it would not comply with social control theory.

Further, we find that non-cognitive skills of adolescents are negatively associated with the number of family structure transitions experienced. Adolescents' perceived belief of whether life depends on others or if one determines one's own life is correlated with maternal partner changes throughout childhood. Here we find that early childhood occurrences of family instability persist. Non-cognitive skills measured at the age of seventeen are affected by maternal partnership transitions during early childhood. Transitions that happen in later childhood periods are less strongly correlated with outcomes in adolescence. Thus, experiencing family instability early in life is likely to alter adolescents' belief that life depends on fate.

In reference to developmental psychology, our results indicate that disrupting family bonds is 'harmful' in early years. Losing an attachment figure once or twice early in life is likely to result in a setback for children's development. Studies in developmental psychology also show that a larger number of family transitions are associated with worse emotional adjustments for boys (e.g., Capaldi and Patterson, 1991; Martinez and Forgatch, 2002). In line with these findings we argue that it is necessary to examine family instability, namely multiple maternal

partnership transitions, rather than analyzing just the family structure. More than single transitions - whether divorce/separation or a new partner moving into the household - it seems that multiple events are more 'harmful' for child development early on in life. Hence, although social control theory is related to family transitions - especially for one-time changes - and explains its influence on child development, we find some evidence that the theory of stress is strongly linked to non-cognitive skill formation of preschoolers and adolescents. Nevertheless, the underlying mechanisms are not the focus of this chapter. Further research is needed to disentangle these mechanisms.

The relative small sample size limits the possibilities of further research and the interpretations drawn from our results. Another shortcoming of our analysis is that we cannot be entirely certain that we show a clear causal relationship between our child outcomes and maternal partnership transitions, as family fixed effects results confine interpretations to children with siblings only. Moreover the family fixed effect models cannot control for child specific factors, such as the cognitive ability of the child, which might affect family instability as well. Not eliminating such child specific factors might be problematic if these factors are determinants of family instability. Hence it might be likely that the family fixed effects models overestimate the cost of family instability. Nevertheless, our models also include maternal personality traits reducing potential omitted variable bias that is not limited to siblings. Here the results remain nearly unchanged compared to the OLS estimates not accounting for maternal personality traits, indicating that there exists a possible causal relationship between non-cognitive skills and sequential partnership transitions.

From a policy perspective, we argue that children who experience maternal partnership transitions should have their non-cognitive skills addressed in order to reduce the long-run negative effects. Institutions, other than the family, could

assist children who lack support at home. Here day care and schools could play an important role in helping children's non-cognitive skill formation. Teachers who know about children's family situation can interact with these children and could help them to cope with stress and instability due to changes in maternal partnerships (see Potter, 2010).

2.7 References

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Appendix

Table A.2.1: Descriptive statistics of maternal partner changes *(preschool sample)*

	Mean	Std. dev.	N
Number of changes *(min=0, max=3)*	0.20	0.55	431
One change	0.11	0.32	431
New partner (single parent to two parent)	0.04	0.20	431
No new partner (two parent to single parent)	0.07	0.26	431
Multiple changes	0.04	0.19	431
No changes	0.85	0.36	431

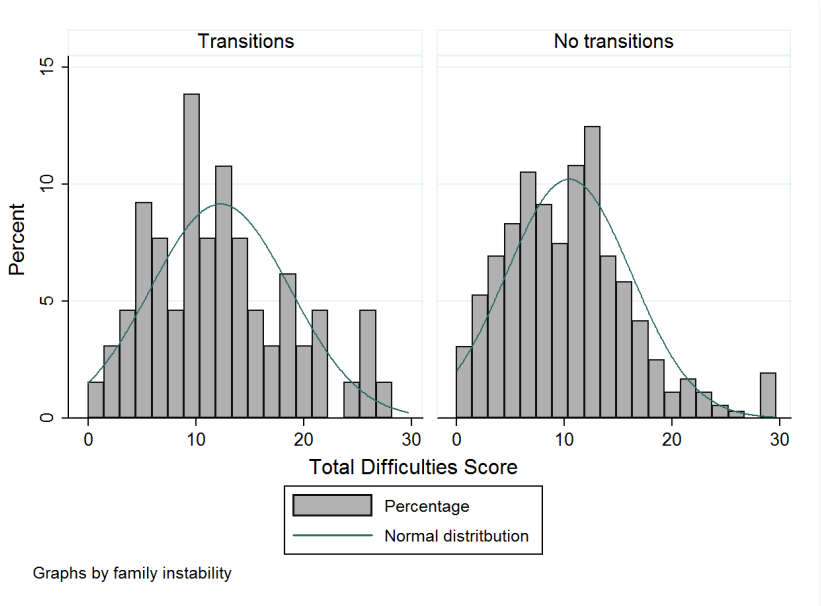
Note: Data from the SOEP v26, (2008-2009), pooled data, authors' calculations.

Table A.2.2: Descriptive statistics of maternal partner changes *(adolescence sample)*

	Mean	Std. dev.	N
Complete childhood			
Number of changes *(min=0, max=5)*	0.44	0.89	726
One change	0.13	0.34	726
New partner (single parent to two parent)	0.04	0.19	726
No new partner (two parent to single parent)	0.08	0.27	726
Multiple changes	0.12	0.33	726
No changes	0.75	0.43	726
Early childhood			
Number of changes *(min=0, max=3)*	0.17	0.48	726
One change	0.10	0.30	726
New partner (single parent to two parent)	0.05	0.22	726
No new partner (two parent to single parent)	0.05	0.21	726
Multiple changes	0.04	0.19	726
No changes	0.87	0.34	726
Middle childhood			
Number of changes *(min=0, max=3)*	0.09	0.37	726
One change	0.06	0.23	726
New partner (single parent to two parent)	0.02	0.12	726
No new partner (two parent to single parent)	0.04	0.19	726
Multiple changes	0.02	0.14	726
No changes	0.92	0.27	726
Late childhood			
Number of changes *(min=0, max=3)*	0.16	0.46	726
One change	0.11	0.31	726
New partner (single parent to two parent)	0.03	0.18	726
No new partner (two parent to single parent)	0.07	0.25	726
Multiple changes	0.03	0.16	726
No changes	0.87	0.34	726

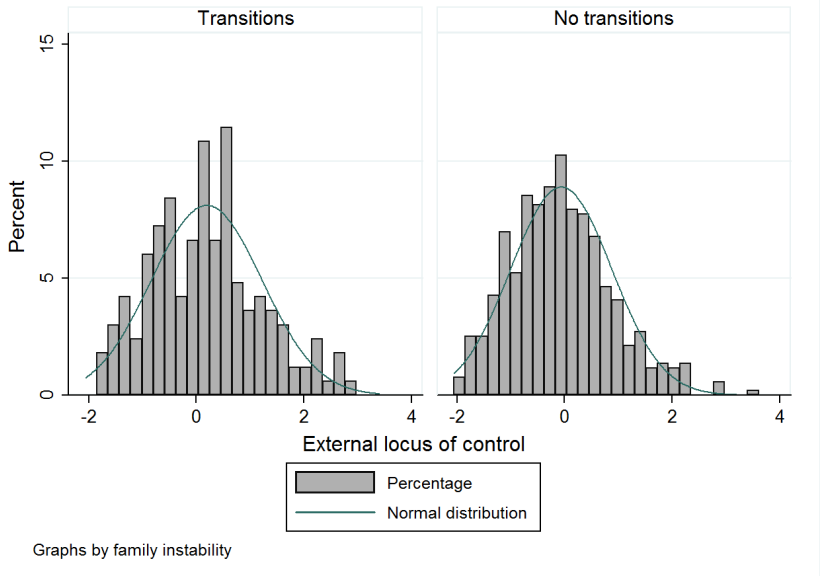
Note: Data from the SOEP v26, (2001-2009), pooled data, authors' calculations.

Figure A.2.1: Distribution of total difficulties score by family instability



Data Source: SOEP v26 (2008-2009), authors' calculations.

Figure A.2.2: Distribution of external locus of control by family instability



Data Source: SOEP v26 (2001-2009), authors' calculations.

Table A.2.3: Descriptive statistics of covariates by family stability

	No transition		Transitions	
Variables	Mean	Std. dev.	Mean	Std.dev.
Preschool sample				
Socio-emotional behavior	10.44	5.79	12.27	6.47
Prosocial behavior	7.37	1.52	7.29	1.63
Normal	0.72	0.45	0.63	0.49
Borderline	0.15	0.36	0.12	0.33
Abnormal	0.13	0.34	0.25	0.43
Age of child in months	69.62	4.12	69.64	3.92
Female	0.48	0.50	0.46	0.50
Hrs spent in child care	20.58	13.99	24.40	14.80
Younger siblings	0.34	0.47	0.20	0.50
Older siblings	0.49	0.50	0.45	0.41
Age of mother	36.98	5.21	34.43	5.61
Log(household income)	7.40	0.44	6.94	0.47
Years education	13.11	2.81	11.93	2.84
N	*366*		*65*	
Adolescence sample				
External locus of control	-0.05	0.95	0.24	1.05
Internal locus of control	-0.04	0.97	-0.25	1.09
Female	0.50	0.50	0.52	0.50
Birth order	1.35	0.58	1.23	0.48
East	0.10	0.30	0.10	0.30
Lower school track	0.09	0.29	0.17	0.38
Middle school track	0.28	0.45	0.25	0.44
Upper school track	0.33	0.47	0.28	0.45
Age of mother	44.92	4.85	43.37	5.13
Log(household income)	10.55	0.38	10.30	0.50
Years education	11.51	2.46	11.38	2.48
N	*516*		*166*	

Note: Data from the SOEP v26, (2001-2009), pooled data, authors' calculations.

Table A.2.4: Estimation of socio-emotional behavior and maternal partner changes *(preschool sample)*

	Socio-emotional behavior	Prosocial behavior	Abnormal behavior: marg. eff.
Baseline: No transitions and partnered			
One transition	1.301	-0.398	0.172**
	[1.0463]	[0.2527]	[0.0763]
Multiple transitions	2.741**	-0.148	0.087
	[1.3269]	[0.4261]	[0.1172]
Never partnered	1.378	-0.340	0.080
	[1.3300]	[0.3370]	[0.1269]
N	421	426	410
R^2	0.085	0.060	
pseudo R^2			0.045
Baseline: No transitions and partnered			
One transition (New partner)	-0.330	-0.575*	-0.019
	[1.2855]	[0.3336]	[0.0826]
One transition (No new partner)	2.36*	-0.283	0.324***
	[1.4157]	[0.3340]	[0.1086]
Multiple transitions	2.842**	-0.138	0.101
	[1.3344]	[0.4260]	[0.1218]
Never partnered	1.482	-0.330	0.094
	[1.3416]	[0.3363]	[0.1322]
N	421	426	410
R^2	0.090	0.060	
pseudo R^2			0.061

Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Note: We control for age of mother, years of education (mother), log of household income near birth, age of child (months), gender, hrs spent in childcare, younger siblings present, and older siblings present, region (East Germany vs. West Germany, migration background, and time dummies. Authors' calculations: SOEP v26, (2008-2009).

3 Trick or treat? Maternal involuntary job loss and children's non-cognitive skills *

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3.1 Introduction

Negative effects of job loss on adults such as a considerable fall in income, persistence of unemployment, bad health or even divorce have been discussed widely in the literature (see for example the studies by Charles and Stephens, 2004; Eliason and Storrie, 2009; Rege et al., 2009). Negative consequences of job loss for adults may spread to their children. These potential effects on children have been mainly studied for academic performance, for the likelihood of grade repetition, for health, or for earnings (Huff-Stevens and Schaller, 2011; Kalil and Ziol-Guest, 2008; Lindo, 2011; Oreopoulos et al., 2008; Rege et al., 2011). But the influence of job loss on children's non-cognitive skills and the related mechanisms have been less examined.

This chapter investigates effects of maternal involuntary job loss on children's non-cognitive skills, as effects of mothers' end of employment have so far been examined only in addition to effects of fathers' job loss (for example Kalil and Ziol-Guest, 2008; Rege et al., 2011). Although mothers are in most cases second earners in households, they are still the main caregivers of children and therefore a shock experienced by mothers may be more closely related to children's non-cognitive skills than fathers' job loss.

Research on human capital formation shows that aside from cognitive outcomes non-cognitive skills are important. Yet, non-cognitive skills have received less attention in the literature (see Chapter 1). Non-cognitive skills are traits enabling a person to communicate and interact with other people. They depict people's social ability. Motivation, socio-emotional regulation, or personality traits are examples of non-cognitive skills (see Heckman, 2008) which are also more malleable at later

stages in a child's life[1]. Moreover, they affect children's success later in life, as studies show that these skills are good predictors for success on the labor market (see for instance the study by Carneiro et al., 2007).

This chapter focuses on two non-cognitive outcome measures one assessed at age five/six and the other at age seventeen. For preschool children, I analyze maternal job loss on socio-emotional behavior using the SDQ measure developed by Goodman (1997), and for adolescents on locus of control based on the concept by Rotter (1966). Job loss is identified as end of employment due to plant closures or dismissals/layoffs by employer. Doing so, effects of maternal job loss on children's non-cognitive outcomes are estimated using the propensity score method as identification strategy, since this allows to account for potential selection bias of maternal job loss.

Identifying effects of maternal job loss on children's non-cognitive skills depends indirectly on maternal employment decisions. In order to estimate an influence of maternal job loss on child outcomes the selection in treatment has to be considered. So far the effect of maternal job ends on child outcomes has been less examined, whereas maternal employment and its influence on child well-being has been widely discussed. Yet the direction of potential effects of maternal employment on child outcomes remains unclear. Some studies find a negative influence of mothers' employment on children's outcomes focusing mainly on cognitive outcomes (see for example Hill et al., 2005; James-Burdumy, 2005; Ruhm, 2004), whereas other analyses find both negative and positive results (Waldfogel et al., 2002). These results indicate that the mere association of maternal employment and child well-being might be spurious, since childcare settings, maternal preferences, and maternal background determine a mother's decision

[1]Cunha et al. (2010) show that a successful way to remediate disadvantages in adolescence is to foster non-cognitive skills.

to work. Consequently any study interested in identifying an effect of maternal employment, or of *end of employment* for that matter, on child outcomes has to correct selection bias.

Different methods can be used to correct for selection bias: either using "selection on unobservables" applying a Heckman correction model or an instrumental variable approach, or using "selection on observables" by the propensity score method. In addition, difference-in-differences estimation or family fixed effects models are possible identification strategies. But substantial evidence on mothers' decision to work exists, from which preferences, background characteristics and child-relevant factors leading to mothers (re)entering the labor market after childbirth can be determined (see for example among others Baum II, 2003; Lucas-Thomson et al., 2010; Ruhm, 2004, 2008, 2009). Hence relevant maternal characteristics driving mothers' selection in job loss are most likely observable in survey data.

Given these studies and the differences in econometric strategies, I utilize propensity score methods in this chapter, since the heterogeneity of mothers who experience a job loss compared to those who keep their job can most likely be *observed*. In addition, a mother's selection in end of employment is not independent of her child's development. Thus, although job loss is identified to be involuntary by using plant closure or dismissal by employer, the effect of job loss on non-cognitive skills of children can only be estimated if mothers do not differ in preferences and background characteristics.

Using the German Socio-Economic Panel Study (SOEP), which comprises information on characteristics of mothers and children, enables me to obtain bias-corrected estimates of involuntary job loss on children's non-cognitive skills. Other methods to solve selectivity such as the Heckman correction model or

an instrumental variable approach are not applied in this chapter, since a valid instrument correlated with mothers' job loss but not with children's non-cognitive skills is hard to obtain. Heckman's correction model is a sample selection model, i.e., the model analyzes outcome data observed only for the "treated".

This chapter focuses on children's outcomes which are observed for all children. A difference-in-differences estimator or family fixed effect model require changes over time or across families. The former is not possible with the data used in this chapter, as children's outcomes are measured only once. With regard to family fixed effects, on the one hand this method does not control for child specific factors which may influence the estimation of maternal job loss on children's non-cognitive skills, e.g. children's health (see Chapter 2 for a detailed discussion of this method), and on the other hand the comparison of children's non-cognitive skills within a family requires differences in children's experience of maternal job loss, i.e., enough within-family-variation in the data used. Thus, family fixed effects is not a feasible identification strategy in this chapter.

But in what way are maternal involuntary job loss and children's non-cognitive skills related? By asking trick or treat in the title, the chapter implicitly suggests that mechanisms that mediate an effect may be twofold. Meaning maternal job loss could influence child outcomes negatively (as in trick) or positively (as in treat). One mechanism by which maternal job loss negatively affects outcomes of preschool children and adolescents is through a drop in income. An income loss may lead to a deterioration of a child's environment. As a result of a decrease in the household income parents might invest less in their children which may impede a child's progress (for example see Eliason, 2011; Kalil and Ziol-Guest, 2008). However Kalil and Ziol-Guest (2008) argue that negative impacts of father's involuntary employment ends depend less on income loss and more on "family dynamics" (Kalil and Ziol-Guest, 2008, p. 500).

Following results of Kalil and Ziol-Guest (2008) and looking at the vast literature on life satisfaction and unemployment, a potential drop in parents' mood could be an important mediator by which maternal job loss negatively influences children's non-cognitive skills. The SOEP data used in this chapter provides information on maternal life satisfaction and household income *before* and *after* maternal job loss. This allows me to roughly assess whether maternal job loss affects children's socio-emotional behavior or adolescents' locus of control via an income loss, via a change in maternal life satisfaction (used as a crude measure of frustration/stress), or via both.

A third possibility through which children's outcomes could be affected is a substitution effect, as mothers who lose their job might substitute their working hours by occupying their time with more time on caring. This effect might be positively associated with children's outcomes, as a mother spends more time with her child than before the job loss supporting her child's development. The quality of mother-child activities cannot be measured directly in the SOEP data. But the data comprise information that allow to assess whether mother-child activities, e.g. reading stories or going to the playground, increase or decrease. Thus, an indirect analysis of this substitution mechanism is possible.

My work complements the existing literature by analyzing how maternal involuntary job loss affects children's non-cognitive skills. The literature has so far provided scarce evidence on how job loss of parents is linked to children's non-cognitive outcomes. As mothers' job loss is identified based on survey data, the use of propensity score methods enables me to work in a quasi-experimental setting to provide robust estimates. Using maternal job loss due to plant closure or layoffs, this chapter provides evidence on how *end of employment*, rather than maternal employment per se, is related to children's well-being and through which potential mediators. Furthermore, this chapter adds to the scarce

literature on children's non-cognitive skills and potential distortions influencing this outcome.

The remainder of the chapter is structured as follows: Section 3.2 summarizes the related literature. In Section 3.3 the data set is described and Section 3.4 outlines the empirical strategy. In Section 3.5 the estimation results are discussed. Section 3.6 comprises several sensitivity analyses before Section 3.7 concludes.

3.2 Related literature

Besides parental employment affecting child outcomes, studies examine how the *ends* of employment, defined as exogenous income shocks, influence child development (see Oreopoulos et al., 2008; Rege et al., 2011). Yet so far these have analyzed either paternal job loss or child outcomes that are regarded to be cognitive outcomes, e.g. academic achievement. The study by Rege et al. (2011) analyses the effect of parental job loss on teenager's academic performance using Norwegian register data. As natural experiment setup they assume that plant closures in Norway between 1999 and 2005 are determined by exogenous shocks and are independent of unobservable determinants of children's school performance. For maternal job loss the authors find that the grade point average of children aged 16 is marginally increased[2]. A study based on Canadian data finds that fathers' job loss from plant downsizing lowers annual earnings of their children compared to those children whose fathers were not laid off (Oreopoulos et al., 2008)[3].

[2]Rege et al. (2011) find that fathers' exposure to plant closure imposes stress on a father. If future employment is discouraging this stress causes children to perform worse in school.
[3]Based on Norwegian employer-employee data, Bratberg et al. (2008) find no effect of fathers' displacement on earnings of children more than ten years after the employment shock.

Yet not all studies identify exogenous job loss based on a natural experiment approach, researchers also examine involuntary job loss using survey data. Still those few studies based on survey data do not explicitly analyze maternal job loss or non-cognitive skills as child outcome for that matter. Kalil and Ziol-Guest (2008) estimate children's academic performance as a function of parental employment patterns using US data from the Survey of Income and Program Participation. They determine involuntary job loss due to quitting, dismissal, or illness amongst others (Kalil and Ziol-Guest, 2008, p. 506). They find no significant correlation between mothers' employment experiences and children's grade repetition or exclusion/suspension. Huff-Stevens and Schaller (2011) analyze job loss and children's likelihood of grade repetition based on the same data as Kalil and Ziol-Guest (2008), yet they define involuntary job ends more narrow focusing only on dismissals or plant closure. Applying child fixed effects they show that exogenous displacements of parents are detrimental for children's academic performance in the short-run[4].

Analyzing exogenous job loss of fathers circumvents the potential selection bias due to different decision processes of mothers. Since this chapter is interested in maternal involuntary job ends, which are defined to be exogenous, an involuntary job loss does not account for variations between mothers who work compared to those who do not work. A prolific body of literature documents potential effects of maternal employment on child well-being showing at the same time that mothers have different preferences and face different obstacles for re-entry in employment after childbirth[5]. Papers analyzing maternal employment and its association with early child outcomes often assess the timing of mother's return to work (see for example Berger et al., 2005). Yet, this type of research is confronted with selection,

[4]Parental job loss significantly increases children's likelihood of grade repetition.
[5] For example see the works by Baum II (2003, 2004); James-Burdumy (2005); Ruhm (2008); Waldfogel et al. (2002).

since mothers of young children who work differ in terms of their preferences and backgrounds from mothers who do not work.

The studies by Berger et al. (2005) and Hill et al. (2005) have discussed matching methods as estimation technique to identify the causal impact of maternal employment on early child outcomes. Both papers apply the propensity score method beside ordinary least squares including a so-called "complete" set of covariates in their analyses. Hill et al. (2005) use US data from the National Longitudinal Study of Youth (NLSY) analyzing the effect of maternal employment during the first year after birth on children's cognitive and behavioral outcomes between ages three and eight. Based on propensity score matching they find that children's cognitive outcomes are less developed if mother return to work full-time within a year after childbirth. Berger et al. (2005) also examine data from the NLSY focusing on health and developmental outcomes of children. The authors investigate mothers return to work using variations in women's maternity leave taking and its effect on child outcomes, e.g. externalizing behavior problems or the Peabody Picture Vocabulary Test. Contrary to Hill et al. (2005) the paper finds that the obtained propensity score estimates are consistent with OLS results and are "generally stronger for mothers returning full-time within 12 weeks" (Berger et al., 2005, p. F45).

Beside these two studies, research on maternal employment and its effect on child outcomes is also conducted by Baum II (2003, 2004); Ruhm (2004, 2008, 2009); Waldfogel et al. (2002), and James-Burdumy (2005) amongst others. Compared to the analyses by Berger et al. (2005) and Hill et al. (2005), these studies estimate maternal employment by applying different methods, such as fixed effect models (see for example James-Burdumy, 2005; Ruhm, 2008). Nonetheless the estimation presented in this chapter is based on these works as well, as their research is particular important for choosing the appropriate set of conditioning

variables, i.e., maternal background characteristics that influence employment and child outcomes (for further discussion see Section 3.3.3 in this chapter), to account for selection bias. Baum II (2003) investigates how maternal employment during early months in an infant's life affect a child's cognitive outcome at age three using US data from the National Longitudinal Survey of Youth (NLSY)[6]. Baum II (2003) finds a negative effect of maternal employment, if mothers worked during the first four months of a child's life[7]. Ruhm (2009) and Han and Waldfogel (2009) provide a general overview of the literature on maternal employment research discussing different estimation techniques and relevant factors concerning maternal employment and children's outcomes.

3.2.1 Mechanisms: how maternal job loss could be linked with children's non-cognitive skills

Before describing the data more thoroughly, the related literature with respect to potential mediators through which maternal job loss is associated with children's non-cognitive skills is discussed. This chapter assumes that job loss affects children's socio-emotional behavior negatively. Meaning that experiencing maternal involuntary job ends during early childhood increases children's socio-emotional problems. Hence children are more likely to have peer problems or emotional problems. Adolescence who experience instability in their family environment due to an exogenous shock might no longer believe that their own action determines success. On the contrary it is likely that maternal job loss, due

[6]Based on the analysis by Baum II (2003) as well as other studies, descriptive differences between working mothers and non-working mothers can be identified, e.g. working mothers have a higher AFQT score or are more likely to live with a partner or are less likely to be foreign born. These characteristics are useful for applying the propensity score methods in this chapter.
[7]James-Burdumy (2005), who also uses the NLSY concludes that only the PIAT math test is negatively affected by maternal working hours in the first year of a child's life using a fixed effects approach.

to plant closure for example, is regarded as something that has *happened* to the family due to others. Adolescents could thus believe that fate or actions of others determines success in life. Hence these adolescents may become externalizers. Some studies show that having an external locus of control is associated with negative labor market outcomes (Caliendo et al., 2010; Heineck and Anger, 2010)[8]. But apart from negative labor market outcomes, this context can also be extended to childhood. Adolescents who are likely to have an external locus of control could be less successful in educational attainment, because they might be less proactive or less determined to continue their education after secondary schooling. This in turn affects their labor market outcomes eventually. Preschoolers with a higher Total Difficulties Score could face problems in school, as they could be less likely to interact with peers or teachers.

An income loss after job loss might be one potential cause of instability at home. Tension due to decreased financial resources between parents could spread to their children, leading to an unstable temper of children affecting their relationship with their peers. This chapter hypothesizes that a job loss of mothers may affect child outcomes most likely via a change in maternal emotional balance and not via an income loss. First, because in Germany mothers are often second earners and their job loss might be more closely related to their preferences than to the financial situation of the household. Although mothers face an income loss due to an involuntary job loss, a lot of mothers contribute in addition to their husband/partner to the household income. So an income loss could affect children's outcomes more strongly in a single parent household[9]. In general

[8]Caliendo et al. (2010) show that individuals who have an external locus of control are less likely to leave unemployment.

[9]In Germany 19 percent of families with children under 18 are single parent households (Statistisches Bundesamt, 2010). Although the share of single parent families increased since 1996 (14 percent compared to 19 in 2010), this chapter argues that other mechanisms than income loss might mediate maternal involuntary job loss.

this could be tested by estimating maternal involuntary job loss and children's non-cognitive skills separately for mothers living with a partner and single mothers. However due to small sample sizes and a small share of single mothers in the data used, this hypothesis cannot be inferred empirically. Second, an income loss as potential mediator of maternal job loss might be less likely, as mothers of preschoolers work less hours, which leads to a minor income loss. Thus, mothers who lose their job may rather be stressed due to a job loss itself, which indirectly affects their bond with their children.

Maternal job loss might decrease a mother's life satisfaction which in turn could deteriorate the emotional stability of her relationship with her child, since a mother might have re-entered the labor market after being dissatisfied with "solely" being a mother (see for example the study on maternal life satisfaction and child outcomes by Berger and Spiess, 2011). A change in parents' emotional balance is closely related to the literature on unemployment and life satisfaction (see for example the work by Clark et al. (2010) or Knabe et al. (2010)). Parents may experience their life less positive due to job loss. In the economic literature a negative effect of unemployment on life satisfaction is identified. Clark et al. (2010) show that regional unemployment for a given level of perceived job security has a negative effect on life satisfaction. Given that, the incidence of job loss which leads to unemployment could affect mothers overall life satisfaction.

Working mothers compared to non-working mothers might have selected themselves in employment, because they were dissatisfied with "solely being a mother", which increases their probability of job loss for that matter. The overall life satisfaction may therefore decrease after experiencing a job loss due to unemployment *itself* or frustration of being "at home". The effect of maternal life satisfaction on child outcomes has also been studied. Berger and Spiess (2011) show that higher maternal life satisfaction decreases children's socio-emotional

problems. They argue that the positive effect of maternal life satisfaction stems from more responsiveness to the children, which affects the quality of mother-child interactions.

Apart from maternal life satisfaction being directly related to children's outcomes, it might also be closely related to maternal preferences. Meaning that mothers who are forced to stay at home after an involuntary job loss may be less willing to engage in mother-child interaction. If mothers regard their job as fulfilling and not as sole means to earn money, mothers could be disappointed to be "only" a mother after experiencing a dismissal or plant closure. A job loss thus may also affect the *quality* of time spent together.

Yet the substitution effect of mothers' time after job loss could also mediate a positive effect of mothers' displacement. If mothers spent more time with their children it could increase children's development. A Norwegian study by Rege et al. (2011) for example finds that mothers' displacement due to plant closure marginally increases children's grade point average at age sixteen. Thus, mothers' supervision, while spending time with their children, who are for example doing homework, seems to have a small but positive effect. However stress or frustration are also associated with job loss and might indirectly aggravate the quality of time spent with children.

Having to substitute working hours in time spent with children might be more difficult for mothers who decided to work instead of being a "housewife". The quality of activities done with children might be mediocre, since mothers might show their discouragement after job loss while supervising their children. The SOEP data used comprise a crude measure of the quality of time spent with children. In the data activities done by mother and child, such as reading a book together or going to the playground, are observed. A change in "reading together"

after job loss roughly summarizes either a drop, no change, or even an increase in the "quality" of time. Thus, at least in part I am able to assess whether a job loss and mothers' potential substitution of time has a positive or a negative effect.

3.3 Data

Using data from the German Socio-Economic Panel Study (SOEP), my analysis is based on a representative and rich data set. The SOEP started in 1984 and is an annual household panel[10] that comprises a series of mother-child questionnaires as well as a youth specific questionnaire. The child-specific modules of the SOEP contain detailed information on children, i.e., non-cognitive skills, birth weight, child care usage, school attendance, and grade repetition amongst others. In addition the SOEP has rich information on individual characteristics of children's mothers as well as on family characteristics. The SOEP accumulates information on current household compositions as well as on past formations. Based on this vast data set mothers' probability of involuntary job loss is estimated.

In this chapter I restrict the sample of children aged five/six in the SOEP to children whose mothers answered the mother-child questionnaire, whose mothers were 20 years and older at childbirth, who have non-missing information on the measured non-cognitive skills, and whose mothers participated in the survey prior 2003, and therefore have non-missing information prior childbirth. For the implementation of propensity score matching, I determine a point in time at which mother's are observed to lose their jobs. Since mothers are entitled to three years of parental leave in Germany, I assess mothers' working status after a child's

[10] A general overview of the SOEP is given by Wagner et al. (2007), whereas Schupp et al. (2008) and Siedler et al. (2009) describe the mother-child questionnaires used in this chapter. Frick and Lohmann (2010) document the youth questionnaire.

third birthday. In period $t > 3$ when children are three years and older, I observe whether mothers are working and thus may lose their job. A detailed discussion of variables used for modeling the selection decision is given in the Section 3.3.3. Thus, the sample used to examine effects of maternal job loss for children aged five/six includes *315 observations* of children whose mothers are observed to be working after age three of the child.

In the youth sample of the SOEP, children aged 17 and older are pooled. The sample is restricted to children who are living with their parents, who are born between 1984 and 1993 and thus are 17 years old at the time of the survey, who have non-missing non-cognitive skill information, whose mothers were 20 years and older at childbirth, and whose mothers have reported their employment status during early childhood. Unlike in the preschool sample maternal employment patterns prior childbirth cannot be observed for all birth cohorts, as the household panel started in 1984 and because a lot of households in the SOEP since 2000. Meaning that for those children nearly no information prior to 2000 is included in the SOEP (N=1397 of 3679 adolescents (*37.97 percent*)). Thus, I have to use another cut-off date to predict mothers' propensity scores. In addition, for some mothers earlier working information coincides with unification and its transition year 1990/1991. A second reason for diverting from the cut-off date used for preschool children is related to children's school careers in Germany. From age ten onwards children transit from primary to secondary school. Thus if I were to use an earlier cut-off date observing an even longer period of time where mothers of adolescents might experience an involuntary job loss, the results could be spurious due to other events. Besides mothers of these birth cohorts were more likely to return to work full-time while children were in secondary school[11]. Hence the period during which maternal job loss is observed ranges from age ten until age

[11]In 2008, for example, 59 percent of mothers with children below the age of six were employed compared to 70 percent of mothers with children age ten or older (Rübennach, 2010).

seventeen of the child. The final sample of adolescents comprises *742 observations* of adolescents whose mothers are observed to be working after age ten of their child. Similar to the preschool sample I predict mothers' likelihood of job loss using a vast set of covariates (see Section 3.3.3 for a detailed discussion).

3.3.1 Involuntary job loss

Involuntary job loss is first and foremost identified as job ending due to *plant closure*. In the SOEP a job loss is experienced by mothers within a survey year and is reported by stating that they "left a job after December 31^{st} and how this job was terminated" since the last interview. Mothers can choose among eight categories for job ends, including resignation, retirement, suspension, end of temporary contract, or *dismissal by employer*. Since plant closure occurs less frequent in the data used, I include both, plant closure and layoff experiences, in my analyses as involuntary job loss measure. By adding dismissals to mothers' involuntary job loss, I follow (Huff-Stevens and Schaller, 2011, p. 291) who define job ends based on the following answer categories: "the person was fired or discharged, if the employer was sold or went bankrupt, or if the job loss was due to slack work or business conditions".

Thus, analogue to previous works[12], this chapter considers plant closure as a "truly" exogenous shock whereas layoffs might be partly endogenous. Compared to dismissal by employer a firm closure cannot be caused by maternal behavior. However, I argue that maternal behavior, such as lack of concentration or absence due to sickness of children, which may lead to a dismissal can be partly accounted for in the analyses. First by including child-related characteristics in the estimation

[12]See among others the studies by Coelli (2011); Huff-Stevens and Schaller (2011); Kalil and Ziol-Guest (2008).

of maternal propensity scores and second by including maternal personality traits in the analyses.

In both samples job loss is analyzed by using a comprehensive measure which includes involuntary incidences of job loss, i.e plant closure and dismissal by employer. In the pooled sample of children aged five/six, 6 percent of working mothers lose their job in the observation period, whereas in the pooled sample of children aged seventeen 12 percent of mothers experience an involuntary job loss (see Table 3.1). Plant closures as job loss are experienced by 2 percent of mothers of children aged five/six and by 5 percent of mothers of adolescents. The different percentages can also be attributed to a variation in length of the observed time periods, since young children's mothers can loose a job within three years, whereas adolescents' mothers face a seven year time frame and thus have a higher chance of job loss.

Table 3.1: Distribution of maternal involuntary job loss

	Mean	
	Preschool sample	Adolescence sample
Involuntary job loss	0.064	0.124
	[0.2459]	[0.3297]
Plant closure	0.020	0.051
	[0.1414]	[0.2206]
Dismissal by employer	0.044	0.073
	[0.2056]	[0.2599]
N	295	742

Note: Standard deviation in parentheses. SOEP v27 (2001-2010). Own calculations. Samples only include working mothers.

3.3.2 Non-cognitive skills

In the SOEP non-cognitive skills are measured at different childhood stages using divergent scales. Non-cognitive outcomes often include behavioral, social and emotional skills. This is true for the outcomes used in this chapter as well. The *socio-emotional behavior* measures non-cognitive skills of preschool children, whereas *locus of control* is used for adolescents' non-cognitive outcome.

Socio-emotional behavior describes a child's behavior in terms of feelings or relationships with family and peers. Goodman (1997) developed the Strength and Difficulties Questionnaire (SDQ), which assesses children's socio-emotional regulation. The SOEP uses a modified version of the SDQ to collect information on preschool children aged five/six. The construction of children's overall socio-emotional behavior accounts for the fact that mothers answer the questionnaire related to children's emotional symptoms, peer problems or conduct problems and others[13]. The reliability of this total difficulties score has also been shown by other studies (see for example Ermisch, 2008). In the preschool sample children's SDQ ranges from 0 to 30 with a higher score representing a negative outcome of the child, e.g. having peer problems. In addition children can be grouped in different behavioral categories: normal, borderline, and abnormal. A child's behavior falls into the category "normal" if the Total Difficulties Score is ≤ 13, whereas a child's behavior is classified "abnormal" if the Total Difficulties Score is ≥ 17. If a child's Total Difficulties Score is ≥ 14 and ≤ 16 her behavior belongs to the category "borderline"[14].

Locus of control is the non-cognitive outcome in the adolescence sample based on

[13]Information on the reliability and construction of the SDQ, as well as the categorization into different behavioral groups can be found at *http://www.sdqinfo.org*

[14]Within the preschool sample 73 percent are in the group "normal", 12 percent in "abnormal" and the remaining 15 percent in "borderline". The sample mean of the total difficulties score is 10.26.

the concept developed by Rotter (1966). The locus of control is part of the youth questionnaire since 2001 and adolescents report on a scale from 1 (completely disagree) to 7 (completely agree) regarding "what happens in life depends on me" or "what you achieve is a matter of luck". Factor analysis is used to extract two factors determining whether adolescents believe that their life depends on their own action (internal locus of control) or whether they believe that life is determined by others (external locus of control). In this chapter the analyses focus on *internal locus of control*, since children's belief may be altered by experiencing maternal involuntary job loss. Adolescents may perceive an involuntary job end of their mother as unfair and imposed, which may change their idea of "everything is possible as long as you work hard".[15]

A first descriptive comparison between mothers who lose their job and mothers who keep their job shows that the mean of preschoolers' total difficulties score differs by 3 score points between job loss and no job loss (see Table 3.2). This difference is statistically significant and hinges towards a potential negative relationship between maternal involuntary job loss and children's socio-emotional behavior: the higher the total difficulties score the higher a child's socio-emotional problems. For adolescents' internal locus of control the difference between children who experience maternal job loss and those whose mothers keep their job is less statistically significant. Yet, the mean of internal locus of control of adolescents exposed to maternal job loss is below zero indicating a likelihood to belief less in self-determination. Thus, a first glance at the descriptives suggests that there might be negative effects on children's non-cognitive skills when a job loss occurs, although the difference between adolescents' internal locus of control is marginally statistically different from zero.

[15]Thus, maternal job ends could decrease children's factor score, falling below the mean of zero indicating an external locus of control "loading".

Table 3.2: Distribution of maternal involuntary job loss and children's non-cognitive skills

	Mean			
	All	Job loss	No job loss	*t-ratio*
Preschool sample				
Total difficulties score	9.85	12.60	9.66	-2.03**
Normal	0.78	0.60	0.79	-1.72*
Borderline	0.12	0.20	0.12	-0.96
Abnormal	0.10	0.20	0.09	-1.33
N	230	15	215	
Adolescence sample				
Internal locus of control	-0.004	-0.185	0.019	1.54*
External locus of control	-0.064	0.055	-0.079	1.09
N	560	64	496	

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. SOEP v27 (2001-2010). Own calculations. Samples only include working mothers applying common support restriction.

3.3.3 Description of observables

The choice of *observables*, i.e., relevant characteristics used to match treated and untreated individuals, is based on other empirical studies which investigate maternal employment and child well-being. These variables are likely correlated with maternal involuntary job loss and children's non-cognitive skills[16]. Using rich and representative survey data (SOEP) allows me to include all observables found to be good predictors of maternal job loss.

[16]Conditioning variables are based on the following studies: Berger et al. (2005); Hill et al. (2005); Huff-Stevens and Schaller (2011); James-Burdumy (2005); Ruhm (2008, 2009) and Baum II (2003).

In this chapter I utilize a regression-adjusted matching approach as preferred model specification which requires to control for all conditioning variables in the post-matching estimations (see Stuart, 2010). However some child or family background characteristics measured after treatment are relevant variables related to children's non-cognitive skills. Hence apart from including the conditioning variables in the estimations, regional unemployment rates, child's gender and migration background, and maternal personality traits are used as additional explanatory variables in the preschool sample (see Table A.3.1 in Appendix). These variables are known to be predictive of children's socio-emotional behavior. Small sample sizes restrict not only the set of conditioning variables but also the used covariates included in the post-matching analyses (see Stuart, 2010). In the adolescence sample I use as additional control variables regional unemployment rates, living in East Germany, maternal education, partner present, maternal working hours, number of children <16 living in the household, logarithmic household income, and maternal personality traits (see Table A.3.2 in Appendix).

As crude approximation of maternal unemployment duration, I control in all regression analyses for regional unemployment rates which capture the rigidity of the local labor market of mothers. Analyzing maternal job loss and its potential influence on child outcomes requires to asses how long mothers stay unemployed in the subsequent periods. The duration of unemployment is strongly linked to life satisfaction and overall well-being of mothers through which job loss might affect child outcomes (Clark et al., 2010; Knabe et al., 2010).

3.4 Empirical strategy

The goal of this chapter is to identify an impact of a given treatment on children's non-cognitive skills. The association of maternal involuntary job loss and children's non-cognitive skills can be summarized by the following reduced form equation,where S_{ij} comprises non-cognitive outcome of child i at age j, $JOBL_{ij}$ is a variable capturing involuntary job loss, X_{ij} represents our measured covariates and v_{ij} is an error term.

$$S_{ij} = \beta_{ij} JOBL_{ij} + \gamma_{ij} X_{ij} + v_{ij} \tag{3.1}$$

The coefficient of interest is β_{ij} and it will render causal estimates if the following assumptions are satisfied. The estimates of β_{ij} are "true" if maternal job loss is uncorrelated with children's non-cognitive outcomes, i.e., $E(v|JOBL_{ij}) = 0$. Estimating Equation 3.1 yields unbiased estimates in case there is no correlation of involuntary job loss with the error term v_{ij} and thus job loss is exogenous with respect to non-cognitive skills. But since maternal involuntary job loss is related to maternal preferences, selectivity may bias the OLS estimates of β_{ij}.

An estimation of maternal job loss has to consider endogeneity due to omitted variables which may bias the results. Mothers' decision to work is correlated with $JOBL_{ij}$. But mother's participation on the labor market is not independent of her child's development, of her educational background, of her preferences, or of her own skills. If the selection bias due to differences in mothers' characteristics is ignored in the analyses the error term v_{ij} will be correlated with β_{ij}.

Propensity score matching has only recently been applied to estimate effects of maternal employment on child development (Ruhm, 2008, 2009). Ruhm

(2009) for instance discusses several methods to measure causal effects of parental employment amongst others family fixed effects, instrumental variables, and propensity score matching. Propensity score matching has an advantage compared to family fixed effects in this context, since it is not limited to children with siblings and allows to infer potential influences of maternal job loss for *all* children. A similar advantage of the propensity score method applies when comparing it to an instrumental variable approach. Propensity score matching identifies an average treatment effect rather than a local average treatment effect. Meaning that a potential effect of involuntary job loss can be revealed for the population of all children comprised in the sample and not only for those where changes in the instrument are observed.

In a seminal paper Rosenbaum and Rubin (1983) define that the probability of receiving treatment (here involuntary job loss) can be summarized as a vector of observed characteristics, called propensity score. And matching based on this propensity score can remove selection bias. Predicting mothers' propensity score implements a "random sample", where mothers who work and lose a job do not differ from mothers who work and keep their job in terms of observables, e.g. education, income, or marital status amongst others. So far propensity score matching has been mainly applied for evaluating participation in job training programs (see the work by Ashenfelter, 1978; Dehejia and Wahba, 2002; Heckman et al., 1997; LaLonde, 1986). Yet the empirical literature increasingly uses propensity score matching to account for various selection biases. For example Jiang et al. (2010) estimate the effect of breast feeding on child cognitive outcomes using propensity score matching, or Eliason (2011) analyzing job loss effects on income, and Gebel (2009) uses propensity score matching to estimate the probability of fixed-term contracts at labor market entry using data from the German Socio-Economic Panel Study.

3.4.1 Propensity score methods

In order to predict maternal propensity scores, *observables* that predict mothers' job loss have to be identified in the data. In the preschool sample maternal probability of job loss is observed after a child's third birthday. The data used in this chapter consists only of those children whose mothers have the "most complete" information on preferences, background characteristics and employment behavior. Thus, only those mothers who can be observed before childbirth are utilized in the early childhood analyses. For the adolescence sample also only children with mothers providing longitudinal information on observables are included in the analyses. Thus, mothers' probability of job loss is predicted after age ten of the child, as it is discussed in the previous section (see Section 3.3.).

Propensity score matching

Propensity score matching (Rosenbaum and Rubin, 1983, 1984) is a well-established method to correct selection bias. It is a quasi-experimental approach, comparing outcomes of those who are "treated" to those who are "untreated", simulating a random sample design. Similar to ordinary least squares, propensity score matching relies on the assumption that selection is based on observable characteristics. By using a rich set of variables predicting mothers' likelihood of job loss after age three or age ten respectively, this chapter assumes that all relevant information related to maternal job loss can be observed (for an overview of application of matching see Caliendo and Kopeinig, 2008). The assumption that selection only exists on observables is known as *conditional independence assumption (CIA)*. Under the conditional independence assumption, the outcome variable - children's non-cognitive skills - and maternal job loss, i. e. exposure to treatment, are independent given characteristics X. Given the data

quality at hand, I argue that the analyses in this chapter are able to meet this requirement and that relevant observable characteristics that affect mothers' job loss are accounted for.

$$Y_1, Y_0 \perp D|X \tag{3.2}$$

Following Rosenbaum and Rubin (1983) mothers' probability of job loss is predicted based on the relevant X_s obtaining a comprehensive measure of all covariates for each person, i.e., the propensity score: $P(D = 1|X) = P(X)$, where X represents the set of observed maternal characteristics as well as relevant child and household characteristics, D summarizes the "treatment condition", here whether maternal involuntary job loss after age three or age ten of the child respectively is experienced (D=1) or not (D=0), and *P(X)* is the estimated propensity score.

A second requirement is the common support condition, which implements that a match between mothers of the treatment group and those of the control group is obtained. By applying this restriction those children whose mothers do not overlap with regards to the relevant observables are discarded from the analysis.

$$0 < P(X) < 1, \forall X \tag{3.3}$$

Expression 3.3 simply states that the sample does not consist of only working mothers who keep their job *(P(X) = 0)* or of only working mothers who experience an involuntary job loss *(P(X) = 1)* for all given X_s.

After predicting mothers' propensity score, the observations are matched based on the obtained *P(X)*. All observations who do not comply with the overlap condition are discarded from the sample. Hence the sample used for examining maternal involuntary job loss consists only of those working mothers who have a balanced match based on the same characteristics set X. Kernel matching is used to obtain a

balanced sample.[17]

Different matching techniques can be applied such as "nearest neighbor (NN) matching", "caliper matching", or "kernel matching". NN matching simply chooses the mother of the comparison group who is identical to the mother of the "treatment" group based on the closeness of their propensity scores. The nearest neighbor technique renders bad matches if the "best" fit in the control group is far away. In order to prevent bad matches a tolerance level can be imposed. This tolerance level defines a maximum propensity score distance referred to as caliper. Applying caliper matching may improve the "quality" of the match, but only if the correct tolerance level is chosen beforehand – a choice which is very difficult to make (Smith and Todd, 2005).

In contrast to nearest neighbor and caliper matching, the kernel matching method uses weighted averages of those mothers in the control group depending on the differences in the propensity score (see for an in depth discussion: Imbens, 2000; Stuart, 2010). Whilst the usage of nearly "all" untreated mothers is an advantage, it may also cause bad matches[18]. In this chapter mothers who lose their job are matched with "similar" mothers who keep their job based on kernel matching using the Epanechnikov distribution and a bandwidth of 0.06 to obtain a *balanced* sample[19]. In the Appendix summary tables depict the balance of the used X_s between treatment and control group before and after matching (see Table A.3.3 and A.3.4).

After matching mothers on their propensity score the average treatment effect of

[17] Matching is implemented in Stata11 using the program *psmatch2* provided by Leuven and Sianesi (2003).
[18] Kernel matching requires a decision on the kernel function and on a bandwidth parameter. The former requirement is less important compared to the latter (Caliendo and Kopeinig, 2008).
[19] Figures A.3.1 and A.3.2 in the Appendix summarize the overlap of estimated propensity scores for the treatment and control groups in the preschool and adolescence sample respectively.

the treated (ATT) can be estimated. The ATT renders estimates of the difference in child outcomes between treatment and control group due to involuntary job loss. Equation 3.4 shows the estimation of the ATT using a regression-adjusted matching approach, where a matching-specific weight $W_{i,j}$, in this chapter obtained from kernel matching, is used in the analysis. The regression-adjustment method avoids further potential bias if matching is not exact.

$$ATT = \sum_{i \in T} W_i[(Y_{1i} - x_i\hat{\beta}) - \sum_{j \in C} W_{i,j}(Y_{0j} - x_j\hat{\beta})] \tag{3.4}$$

In Equation 3.4, the symbols T and C stand for T = *treatment group* and C = *control group* respectively. $W_{i,j}$ represents a matching-specific weight which is the weight placed on *individual j* to be comparable to *individual i*[20]. The weight $W_{i,j}$ includes values obtained from kernel matching for the control group of each treated i:

$$W_{i,j} = \frac{G(\frac{P_i - P_j}{b_n})}{\sum_{j \in (d=0)} G(\frac{P_i - P_j}{b_n})} \tag{3.5}$$

where $G(.)$ is a kernel function, e.g. Gaussian or Epanechnikov, and b_n is a bandwidth parameter.

Propensity score weighting

Beside matching on the propensity score, the average treatment effect of the treated can also be identified by propensity score weighted regressions (see Hirano and Imbens, 2001). Propensity score weighting weights the outcomes of untreated mothers with the inverse of the estimated propensity score *(P(X))*. A critical aspect of using the estimated propensity score as weight is its sensitivity to large estimated propensity scores, since these large values receive a larger weight. This problem decreases with sample size as each observation is less relevant for

[20] W_i reweights the treated to obtain their outcome.

estimating the coefficient of interest. However, the overall sample size of the samples used in this chapter are relatively small. Nonetheless I argue that I have a large enough number of untreated mothers compared to the treatment group. And by restricting the post estimations to the common support area, the problem of "large propensity score values" should have only a minor impact. To estimate the ATT the regression of non-cognitive skills on involuntary job loss is weighted by assigning $w = 1$ to mothers who lose their job $(D = 1)$, and $w = \frac{1}{(1-P(X))}$ to mothers of the control group $(D = 0)$. By weighting the estimated regression, omitted variable bias can be corrected[21]. I apply propensity score weighting as an alternative to matching.

3.5 Results

The results are presented in three steps: **(1)** the OLS estimates, i.e., regressing maternal job loss on children's non-cognitive skills, then the results obtained from **(2)** propensity score weighting are shown, and thirdly results from **(3)** regression-adjusted propensity score matching[22] are displayed. For example in Table 3.3 in column 2 the estimates of the average treatment effect on the treated (ATT) using propensity score weighted regression are reported and in column 3 of Table 3.3 those of the ATT using regression-adjusted propensity score matching. The model depicting OLS simply shows whether the propensity score method compared to an ordinary least squares analysis which includes *prior job loss* information ("OLS complete") of mothers is more efficient. In a small sample OLS "complete" may be less efficient, e.g. including prior treatment covariates could

[21] Berger et al. (2005) argue that using the propensity score as weight depends, similar to the conditional independence assumption (CIA), on the specification of observables used to correct selection bias.

[22] The estimates in the matched sample are obtained after applying *kernel matching*.

lead to larger standard errors than for estimates based on the propensity score methods. In all tables only the coefficient of the explanatory variable of interest is depicted: involuntary job loss.

3.5.1 Involuntary job loss and non-cognitive skills of preschoolers

In Table 3.3 the results of involuntary job loss affecting children's socio-emotional behavior are presented. Maternal involuntary job loss is significantly correlated with children's socio-emotional behavior. Using regression-adjusted propensity score matching renders the estimates displayed in column 3. Including the same controls as in the OLS estimation the negative effect on children's total difficulties score remains statistically significant accounting for selection bias. This effect is negative since an increase in the score implies an increase in a child's likelihood of having "behavioral problems". Accounting for selection bias yields a significant positive effect of maternal involuntary job loss: A child's total difficulties score increases by 3 score points, which "lifts" the mean child closer to "abnormal" behavior. The findings in column 2 compared to column 3 suggest that estimating the average treatment effect of the treated using propensity score weighted regression is slightly less efficient as the standard errors are smaller in column 3. The overall negative effect of involuntary job loss on non-cognitive skills remains.

Table 3.3: Estimation of socio-emotional behavior and maternal involuntary job loss *(preschool sample)*

	Socio-emotional behavior		
	"OLS complete"	PS weighting	Regression-adjusted PS matching
	(1)	(2)	(3)
Involuntary job loss	2.916*	2.918*	3.090**
	[1.6113]	[1.6184]	[1.2714]
N	230	230	230
R^2	0.147	0.145	0.374

Robust standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note: All models control for regional unemployment rate, child's gender (female=1), and child's migration background beside the variables used to predict maternal propensity scores. Own calculations, SOEP v27 (2008-2010).

However, propensity score matching assumes that selection is only based on observables and does not account for unobserved heterogeneity. Children's non-cognitive skills may be correlated with maternal non-cognitive skills which in turn may be affected by an involuntary job loss. Thus, in another specification I control for potential unobserved heterogeneity between the matched mothers by including maternal personality traits in my analysis. Controlling for mothers' personality renders the same estimates of maternal involuntary job loss on children's socio-emotional behavior using "OLS complete", propensity score weighting, or regression-adjusted matching (see Table 3.4). The effect size drops from 3 score points to 2.3 score points in the preferred specification (see column 3 of Table 3.4).

Table 3.4: Estimations of socio-emotional behavior under inclusion of maternal personality traits *(preschool sample)*

	Socio-emotional behavior		
	"OLS complete"	PS weighting	Regression-adjusted PS matching
	(1)	(2)	(3)
Involuntary job loss	2.640*	2.627*	2.284**
	[1.5432]	[1.5439]	[1.1253]
Maternal personality traits	✓	✓	✓
N	229	229	229
R^2	0.174	0.175	0.435

Robust standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note: All models control for regional unemployment rate, child's gender (female=1), and child's migration background beside the variables used to predict maternal propensity scores. Maternal personality traits comprise five dimensions: **O**penness, **C**onscientiousness, **E**xtraversion, **A**greeableness, **N**euroticism. Due to sample size restrictions only the factor *Neuroticism* is included as maternal personality traits, which correlates the most with children's non-cognitive outcomes. Own calculations, SOEP v27 (2008-2010).

3.5.2 Involuntary job loss and non-cognitive skills of adolescents

Table 3.5 summarizes the relationship of adolescents' internal locus of control and maternal job loss. Using OLS with prior information ("OLS complete") as it is depicted in column 1 indicates that maternal job loss decreases the likelihood of believing in self-determination by 23.1 percent of a standard deviation. The results based on propensity score weighting show also a marginal significant average treatment effect of the treated (see column 2 of Table 3.5). Meaning that adolescents whose mothers experience plant closure or dismissal by employer are less likely to believe that working hard or striving for ones own success helps to achieve ones

goals. An involuntary job loss decreases adolescents belief in self-determination by $1/5^{th}$ of a standard deviation. This effect remains stable and only decreases slightly in size when using regression-adjusted propensity score matching (by 22.4 percent of a standard deviation, see column 3).

Table 3.5: Estimation of internal locus of control and maternal involuntary job loss *(adolescence sample)*

	Internal locus of control		
	"OLS complete"	PS weighting	Regression-adjusted PS matching
	(1)	(2)	(3)
Involuntary job loss	-0.231*	-0.225*	-0.224*
	[0.1356]	[0.1362]	[0.1158]
N	542	542	542
R^2	0.153	0.150	0.288

Robust standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note: All models include as additional covariate regional unemployment rate, region (East=1), maternal education (Ref. category: vocational degree | university degree, no degree), logarithmic household income, maternal working hours, partner present, and number of children <16 in the household plus all variables used to predict maternal propensity scores. Own calculations, SOEP v27 (2001-2010).

Similar to the preschool sample, maternal personality traits are included to control for unobserved heterogeneity. The significance of the effect of an experienced job loss on internal locus of control and the size of the effect increase from 22 per cent of standard deviation in Table 3.5 to 26 per cent of a standard deviation (see Table 3.6, column 3). Both, including maternal personality traits and applying a regression-adjusted matching approach, indicate that the findings are robust and suggest that the results could hint towards a causal relationship between maternal involuntary job loss and children's non-cognitive skills.

Table 3.6: Estimations of internal locus of control under inclusion of maternal personality traits *(adolescence sample)*

	Internal locus of control		
	"OLS complete"	PS weighting	Regression-adjusted PS matching
	(1)	(2)	(3)
Involuntary job loss	-0.277**	-0.270*	-0.260**
	[0.1395]	[0.1402]	[0.1199]
Maternal personality traits	✓	✓	✓
N	522	522	522
R^2	0.156	0.151	0.292

Robust standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note: All models include as additional covariate regional unemployment rate, region (East=1), maternal education (Ref. category: vocational degree | university degree, no degree), logarithmic household income, maternal working hours, partner present, and number of children <16 in the household plus all variables used to predict maternal propensity scores. Maternal personality traits comprise five dimensions: **O**penness, **C**onscientiousness, **E**xtraversion, **A**greeableness, **N**euroticism. Again only the factor *Neuroticism* is included as maternal personality trait, which correlates the most with adolescents' non-cognitive outcome. Own calculations, SOEP v27 (2001-2010).

3.6 Sensitivity analysis

In order to relate my obtained results to the literature, this section presents additional estimations. First, I divide involuntary job loss into its two components: *plant closure* and *dismissal by employer*. This approach aims at comparing my findings to studies solely focusing on firm closure as a natural experiment. In a second step I provide estimates of non-cognitive skills and job loss including potential mediators, i.e., differences in income or in life satisfaction, in my analyses.

3.6.1 Plant closure

Compared to studies using a natural experiment approach the incidence of observing job loss due to plant closure in the SOEP is relatively small, which makes it impossible to match on plant closure incidences only. Although dismissal by employer is perceived to be exogenous in this chapter, the strict definition of exogeneity applies to the incidence ***plant closure***, meaning that maternal behavior cannot lead to firm downsizing.

In Table 3.7 the results of post matching estimations of the relationship between internal locus of control and involuntary job loss distinguishing between plant closure and dismissal by employer are shown. In order to disentangle the overall job loss effect the relationship of children's non-cognitive skills and job loss is inferred by using job loss due to plant closure and due to dismissals as separate dummy variables instead of including the overall measure *involuntary job loss* in the analyses. The direction of the effect remains negative for both types of job loss, but the coefficient of plant closure is not statistically significant. The results indicate that job ends due to layoffs by employer have a significant effect on adolescents' internal locus of control. This could suggest that dismissals might be more closely related to mothers' emotional balance, which is assumed to be a potential mediator affecting children's outcomes. However by splitting the incidence of involuntary job loss, the coefficient of plant closure is bound to be insignificant as fewer mothers are exposed to firm closure compared to dismissals.

Table 3.7: Estimation of internal locus of control distinguishing on plant closure and dismissal by employer

	Adolescence sample	
	PS weighting	Regression-adjusted PS matching
Job loss due to plant closure	-0.016	-0.025
	[0.1828]	[0.1511]
Job loss due to dismissals	-0.373**	-0.364***
	[0.1747]	[0.1381]
N	542	542
R^2	0.153	0.299

Robust standard errors in second row, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note: All models include as additional covariate regional unemployment rate, region (East=1), maternal education (Ref. category: vocational degree | university degree, no degree), logarithmic household income, maternal working hours, partner present, and number of children <16 in the household plus all variables used to predict maternal propensity scores. Own calculations, SOEP v27 (2001-2010).

3.6.2 Estimations of non-cognitive skills considering possible mechanisms mediating involuntary job loss

At the beginning of this chapter potential mediators through which an involuntary job loss could affect children's non-cognitive skills are discussed. In order to test these complied hypotheses I compare changes in life satisfaction, changes in income, and changes in mother-child activities. By contrasting the observed means before and after the incidence of maternal involuntary job loss I assess potential directions through which mothers' experiences are linked with child outcomes.

In Table 3.8 a first descriptive examination shows the t-ratios of the mean comparison before and after treatment. In column 1 the differences in life

satisfaction, household income, or in mother-child activities of *treated* mothers in the matched preschool sample are shown. Maternal life satisfaction significantly decreased for mothers who experience a job loss. Whereas the difference in household income is not significant for mothers who are exposed to a job end. Indicating that household income is not significantly different after job loss. This could stem from husbands/partners that are still working and contributing to the overall household earnings. In addition, mothers of preschool children work less hours compared to mothers of older children, which leads to a "minor drop" in income. In column 2 the changes in life satisfaction and in household income for displaced mothers in the *matched* adolescence sample are shown. Only the mean difference of household income is found to be significantly different before and after treatment[23].

Table 3.8: Underlying mechanisms: Comparing potential drivers *before* and *after* treatment *(mean(x_{before})=mean(x_{after}))*

	Preschool sample *t-ratio*	Adolescence sample *t-ratio*
Life satisfaction	2.41**	0.21
Household income	-1.16	-3.89***
Mother-child activities		
Going to the playground	-0.59	–
Reading stories	-0.43	–
N	14	64

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Own calculations, SOEP v27 (2001-2010). Samples only include working mothers applying common support restriction. The t-ratios displayed are for treated mothers only.

[23]The t-ratio is negative suggesting that mothers' job loss might not affect children's non-cognitive skills via an income loss.

This first descriptive glance at mothers' outcomes shows that mothers who are displaced report a significantly lower overall life satisfaction. They also read less often stories with their young children, yet this difference is not statistically significant (see Table 3.8). Interestingly for mothers of children aged seventeen the overall life satisfaction is not significantly different before and after displacement. This could suggest that mothers of young children are more stressed or frustrated about their job loss than mothers of older children. Yet mothers' own perception of life could be affected by involuntary job loss which might influence their children's beliefs. However in the SOEP the question on adults' locus of control is only surveyed in 2005 and 2010, so that a mean comparison before and after job loss cannot be applied. Instead I include mothers' internal locus of control in the regression analysis beside maternal personality traits in order to account for this potential channel of discouragement.

In Table 3.9 the differences of potential mediators are included in the propensity score weighted regressions. Using the differences as covariates shows that a change in household income (see model (1)) or a change in life satisfaction (see model (2)) are not statistically significant. However, both mediators increase the overall sample fit indicating that they are explaining part of the variance of socio-emotional behavior. In addition by including differences in maternal life satisfaction the coefficient of involuntary job loss becomes statistically insignificant. The inclusion of mother-child activities decreases the sample size significantly (see column 4 of Table 3.9), as not all children are observed at age three and at age six. The relationship found in the descriptives suggests that mothers' emotional balance might be affected, as maternal life satisfaction is significantly lower after involuntary job loss in the preschool sample (see Table 3.8). However, the evidence is not sufficient to completely support the emotional balance hypothesis, but it suggests that mothers are less satisfied after having lost

their job. This could be a possible mediator of job loss.

Table 3.9: Estimation of socio-emotional behavior including differences in life satisfaction, household income and mother-child activities (using PS weighting) *(preschool sample)*

	Socio-emotional behavior			
	(1)	(2)	(3)	(4)
Involuntary job loss	2.599*	2.445	2.440	1.564
	[1.4904]	[1.5092]	[1.5405]	[1.7991]
Potential mechanisms:				
Δ *Household income*	-1.016		-0.913	-2.263
	[1.1516]		[1.0395]	[1.4006]
Δ *Life satisfaction*		-0.199	-0.177	
		[0.2345]	[0.2703]	
Δ *Reading stories*				-0.338
				[0.6860]
Δ *Going to the playground*				0.196
				[0.4230]
Maternal personality traits	✓	✓	✓	✓
N	229	228	228	151
R^2	0.178	0.177	0.179	0.275

Note: Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note: All models control for regional unemployment rate, child's gender (female=1), and child's migration background besides the variables used to predict maternal propensity scores. Please note that in column 4 the sample size is smaller than in column 1-3, as not all children have valid information on mother-child activities at age three. Maternal personality traits comprise five dimensions: **O**penness, **C**onscientiousness, **E**xtraversion, **A**greeableness, **N**euroticism. Again only the factor *Neuroticism* is included as maternal personality trait, which correlates the most with children's non-cognitive outcome. Own calculations, SOEP v27 (2008-2010).

In the adolescence sample the crude measures used to address underlying mechanisms do not sufficiently disentangle potential mediator effects. In Table 3.10 it is shown that none of the differences included in the regression analyses are significantly explaining parts of the variance of adolescents' internal locus of

control. In contrast to the preschool sample changes in household incomer or in maternal life satisfaction do not influence the correlation of involuntary job loss and non-cognitive skills of adolescents, as the estimates remain statistically significant. The hypothesis of emotionally imbalanced mothers may already be captured by maternal non-cognitive skills which are controlled for as well. Mothers' internal locus of control is significantly correlated with adolescents' beliefs in self-determination. In addition the effect of involuntary job loss on adolescents' outcome increases when maternal internal locus of control is included in the regression (see model (4)), suggesting that the measure of maternal locus of control might be spurious, as it is surveyed after job loss but not before.

Table 3.10: Estimation of internal locus of control including differences in life satisfaction, household income and maternal locus of control (using PS weighting) *(adolescence sample)*

	Internal locus of control			
	(1)	(2)	(3)	(4)
Involuntary job loss	-0.266*	-0.267*	-0.261*	-0.296**
	[0.1450]	[0.1400]	[0.1449]	[0.1373]
Potential mechanisms:				
Δ *Household income*	-0.054		-0.043	
	[0.1652]		[0.1651]	
Δ *Life satisfaction*		-0.026	-0.026	
		[0.0320]	[0.0321]	
Maternal internal locus of control				0.160***
				[0.0459]
Maternal personality traits	✓	✓	✓	✓
N	521	522	521	516
R^2	0.150	0.152	0.151	0.172

Note: Robust standard errors in second row. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. PS=propensity score. Note that all models include as additional covariate regional unemployment rate, region (East=1), maternal education (Ref. category: vocational degree | university degree, no degree), logarithmic household income, maternal working hours, partner present, and number of children <16 in the household plus all variables used to predict maternal propensity scores. Maternal personality traits comprise five dimensions: **O**penness, **C**onscientiousness, **E**xtraversion, **A**greeableness, **N**euroticism. Again only the factor *Neuroticism* is included as maternal personality trait, which correlates the most with adolescents' non-cognitive outcome. Own calculations. SOEP v27 (2001-2010).

3.7 Conclusion

This chapter is interested in the potential effect of maternal involuntary job loss on children's non-cognitive skills. Although mothers are often second earners in German households, they are on the other hand the main caregivers of children. Thus, an exogenous shock does not affect the household's financial situation in a

substantial way, at least in most cases, yet it may affect the emotional stability of mothers causing stress and discouragement at home. Maternal satisfaction might decrease after job loss and thus might be closely related to children's development and in particular to the development of non-cognitive skills, such as motivation or socio-emotional regulation.

A potential problem for the analysis of maternal involuntary job loss on child outcomes is selection. Maternal job loss depends on maternal preferences, maternal background, available child care or on children's development which biases any results obtained from OLS. Meaning that mothers whose children are more independent and socio-emotional "stable" are more likely to lose a job. Thus, mothers' displacement is not independent of children's skills. In this chapter I therefore estimate the relationship between job loss and child outcomes whilst accounting for selection bias by using propensity score methods. The propensity score method assumes that selection is based on observables which are used to match "similar mothers", i.e., in terms of observed characteristics, who do not experience a job loss with those who are exposed to plant closure or dismissal by employers.

When comparing OLS estimates with those obtained using propensity score weighting or a regression-adjusted matching approach, the effects of maternal job loss on non-cognitive outcomes are similar, but they vary in size of their standard errors and thus differ in their efficiency, i.e., regression-adjusted propensity score matching is preferred because of smaller standard errors. Experiencing maternal involuntary job ends during early childhood increases children's socio-emotional problems. Children are more likely to have peer problems or emotional problems. The hypothesis that mothers substitute lost working time with more time for caring does not result in "better" quality of time due to stress or discouragement. I find descriptive evidence that mothers are less satisfied after experiencing a job

loss and that they spend less time reading stories or going to the playground – suggesting a decrease in their emotional balance. Children's total difficulties score increases by 3 score points, which lifts the mean child closer to "abnormal" behavior.

For adolescents' outcome an adverse effect of maternal job loss can be found. Children are less likely to believe in self-determination if their mother experienced an involuntary job loss due to plant closure or dismissal. The effect of maternal job loss is substantial, since adolescents internal locus of control decreases by $1/5^{th}$ of a standard deviation using the propensity score method and correcting selection bias. Including maternal personality traits in the analysis to account for unobserved heterogeneity confirms this negative result. The results become even more statistically significant indicating that an involuntary job loss "causes" adolescents to believe less in self-determination, in other words to be less motivated or striving for success. The results of distinguishing the reasons for job loss indicate that mothers' job loss due to dismissal by employer is strongly correlated with children's non-cognitive outcomes. The findings from distinguishing between plant closure and layoffs should nonetheless be interpreted carefully, as plant closures are less frequently observed in the data.

The difference in maternal life satisfaction suggests that maternal frustration could be affecting the mother-child relationship. In addition the negative association of maternal job loss and children's outcomes could be due to "mediocre" quality of time spent with children. The descriptive support for these potential mediators sheds some light on underlying mechanisms, but changes in income and in life satisfaction cannot completely explain the relationship between maternal job loss and children's non-cognitive skills, as the coefficient remains significant at least in the adolescence sample. In contrast to the preschool sample mothers life satisfaction remains unchanged due to job loss. Mothers' belief in

self-determination is closely related to their children's outcome, yet this chapter cannot test whether maternal locus of control changed due to experiencing a displacement. This chapter therefore infers potential mediators only in a limited way suggesting that future research should address mechanisms linking parental job loss with children's outcomes (for a first study see: Wightman, 2011).

The propensity score method suggests a potential causal relationship between children's non-cognitive skills and maternal involuntary job loss, since the estimates are consistent with the OLS results, yet provide smaller standard errors. Although the propensity score method reduces potential biases resulting from differences in mothers' characteristics, it does not account for entire "cause" of unobserved heterogeneity. But the findings remain robust even after including maternal personality traits in the estimations. Given the literature on negative effects of maternal employment on child well-being, this chapter argues that while maternal job loss might be beneficial for cognitive outcomes, i.e., test scores (Rege et al., 2011), this might not be true for non-cognitive skills. These negative effects of maternal involuntary job loss on non-cognitive skills might impede children's progress in school or on the labor market. Thus, further analyses regarding non-cognitive development and potential influences should be carried out.

With regards to policy implications, this chapter shows that further research is necessary in order to disentangle potential influences of maternal job loss on children's non-cognitive skills. The evidence found in this chapter indicates that financial support should not be the only means to help mothers who experience a displacement. For example job centers could provide additional help during job search for mothers, as mothers' overall life satisfaction decreases affecting the mother-child relationship. Supporting mothers to be less stressed or discouraged with job loss could be beneficial for their children.

3.8 References

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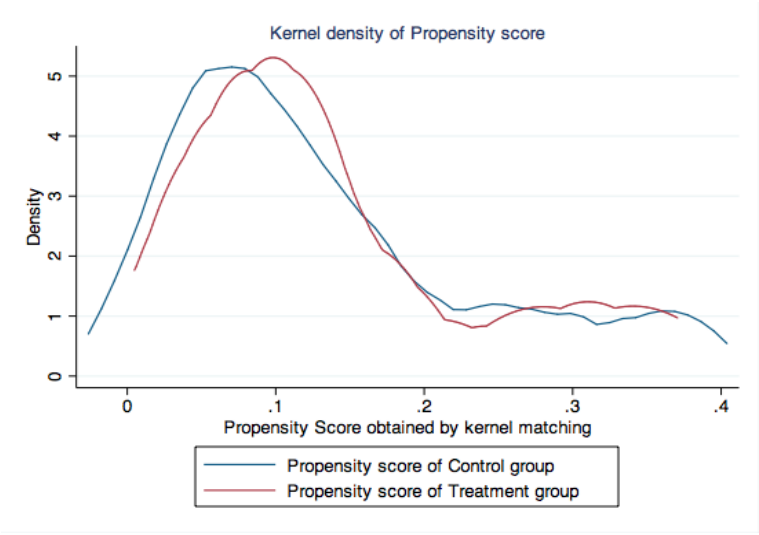
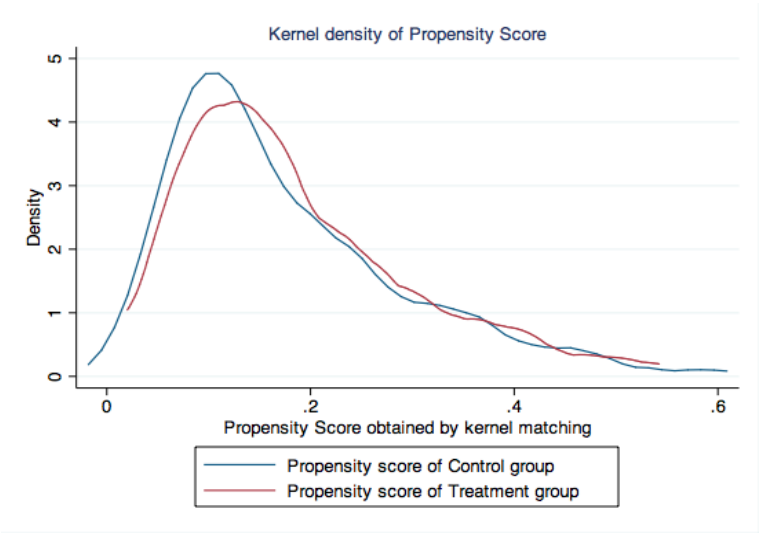
Appendix

Figure A.3.1: Propensity score of treated and untreated *(preschool sample)*



Data Source: SOEP v27 (2008-2010), own calculations.

Figure A.3.2: Propensity score of treated and untreated *(adolescence sample)*



Data Source: SOEP v27 (2001-2010), own calculations.

Table A.3.1: Summary statistics of observables used for propensity score estimation and of additional explanatory variables used in the estimations *(preschool sample)*

	All		Job loss		No job loss	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Pre-treatment explanatory variables:						
Full time employed prior childbirth	0.46	0.49	0.47	0.52	0.46	0.50
Part time employed prior childbirth	0.23	0.42	0.33	0.49	0.22	0.41
Full time employed in the birth-year of child	0.35	0.48	0.40	0.51	0.35	0.48
Part time employed in the birth-year of child	0.23	0.42	0.27	0.46	0.22	0.42
Years of education around childbirth	13.11	2.63	12.13	2.05	13.18	2.66
Partner present in birth-year of child	0.92	0.27	0.80	0.41	0.93	0.26
Number of children < 16 in HH in birth-year of child	1.77	0.84	1.53	0.74	1.79	0.85
Logarithmic household income around childbirth	7.98	0.45	7.81	0.51	7.99	0.45
Satisfaction with "only being mother" (1=not satisfied)	0.16	0.37	0.27	0.46	0.15	0.36
Living in East Germany in 1989	0.35	0.48	0.47	0.52	0.35	0.48
Living in East Germany	0.32	0.47	0.40	0.51	0.31	0.46
Living in an urban area around childbirth	0.30	0.46	0.33	0.49	0.30	0.46
Grandparent care around childbirth	0.59	0.49	0.53	0.52	0.59	0.49
Age of mother at childbirth:						
Age group 20-25	0.07	0.25	0.13	0.35	0.06	0.25
Age group 25-30	0.32	0.47	0.33	0.49	0.32	0.47
Age group 35+	0.27	0.44	0.13	0.35	0.26	0.47
Age of child (in months)	69.16	4.09	69.40	3.52	69.15	4.14
Additional explanatory variables:						
Gender of child (female=1)	0.49	0.50	0.47	0.52	0.49	0.50
Migration background of child	0.14	0.34	0.26	0.46	0.13	0.33
Regional unemployment rate	9.33	4.07	9.49	4.55	9.32	4.04
N	234		15		219	

Own calculations. SOEP 27v (2001-2010).

Table A.3.2: Summary statistics of observables used for propensity score estimation and of additional explanatory variables used in the estimations *(adolescence sample)*

	All		Job loss		No job loss	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Pre-treatment explanatory variables:						
Full time employed at age six of child	0.30	0.46	0.38	0.49	0.29	0.46
Part time employed at age six of child	0.34	0.47	0.31	0.47	0.34	0.47
Working hours at age six of child	20.66	17.27	22.59	18.21	20.41	17.15
Years of education at age six of child	12.09	2.49	12.47	2.88	12.04	2.44
Partner present at age six of child	0.93	0.25	0.92	0.27	0.94	0.25
Number of children < 16 in HH at age six of child	2.09	0.80	2.08	0.84	2.09	0.79
Logarithmic household income at age six of child	7.29	1.83	6.76	2.27	7.36	1.75
Living in East Germany in 1989	0.37	0.48	0.48	0.50	0.35	0.48
Living in an urban area at age six of child	0.30	0.46	0.22	0.42	0.31	0.46
Overall life satisfaction at age six of child	6.99	1.61	6.53	1.55	7.05	1.61
Tenure at age six of child	4.05	5.37	3.51	4.62	4.12	5.46
Size of firm at age six of child	5.27	4.03	4.92	3.90	5.32	4.04
Age of mother at childbirth	27.58	4.62	27.95	4.82	27.54	4.59
Age group 20-25	0.28	0.45	0.28	0.45	0.27	0.45
Age group 30-35	0.21	0.41	0.25	0.44	0.21	0.41
Age group 35+	0.08	0.27	0.06	0.24	0.08	0.27
Gender of child (female=1)	0.47	0.49	0.55	0.50	0.46	0.49
Migration background of child	0.16	0.37	0.16	0.37	0.16	0.37
Additional explanatory variables:						
Regional unemployment rate	12.71	5.70	13.91	5.69	12.55	5.69
Logarithmic household income	7.88	0.46	7.74	0.39	7.89	0.47
Partner present	0.88	0.32	0.84	0.37	0.89	0.31
Number of children <16 in HH	1.47	0.64	1.36	0.52	1.48	0.65
Living in East Germany	0.37	0.48	0.45	0.50	0.35	0.48
University degree (mother)	0.24	0.42	0.28	0.45	0.23	0.42
No degree (mother)	0.15	0.36	0.14	0.35	0.15	0.36
Maternal working hours	28.37	15.09	27.06	17.89	28.54	14.71
N	560		64		496	

Own calculations. SOEP 27v (1990-2010).

Table A.3.3: Balance of covariates between treatment and control group *(preschool sample)*

	Mean		Bias	
	Treated	Untreated	|Bias|	p>|t|
Full time employed - prior childbirth				
Unmatched	0.50	0.45	9.0	0.725
Matched	0.47	0.51	8.2	0.827
Part time employed - prior childbirth				
Unmatched	0.31	0.23	18.0	0.462
Matched	0.33	0.29	8.7	0.825
Full time employed				
Unmatched	0.47	0.36	22.7	0.350
Matched	0.40	0.39	0.1	0.999
Part time employed				
Unmatched	0.24	0.22	2.4	0.921
Matched	0.27	0.25	3.7	0.924
Years of education				
Unmatched	11.91	13.27	56.4	0.044
Matched	12.13	12.16	1.3	0.969
Partnered				
Unmatched	0.76	0.94	48.2	0.010
Matched	0.80	0.78	4.8	0.912
Logarithmic household income				
Unmatched	7.79	8.02	50.4	0.038
Matched	7.81	7.81	1.1	0.978
Number of children < 16				
Unmatched	1.53	1.75	27.8	0.298
Matched	1.53	1.55	2.4	0.944
Living in East Germany 1989				
Unmatched	0.42	0.33	18.9	0.410
Matched	0.47	0.45	3.1	0.936
Living in East Germany				
Unmatched	0.32	0.29	5.6	0.811
Matched	0.40	0.38	3.7	0.926
Living in an urban community				
Unmatched	0.26	0.27	2.1	0.928
Matched	0.33	0.33	1.0	0.981
Grandparent care				
Unmatched	0.53	0.58	10.6	0.668
Matched	0.53	0.51	5.1	0.892
Satisfaction with being a mother				
Unmatched	0.24	0.17	15.8	0.499
Matched	0.27	0.24	7.1	0.861
Aged 20 - 25 at childbirth				
Unmatched	0.11	0.06	15.6	0.455
Matched	0.13	0.11	6.7	0.881
Aged 30 - 35 at childbirth				
Unmatched	0.42	0.29	25.7	0.258
Matched	0.33	0.32	2.6	0.945
Aged 35+ at childbirth				
Unmatched	0.16	0.29	31.7	0.217
Matched	0.13	0.17	9.2	0.779
Age of child (in months)				
Unmatched	69.53	69.19	8.8	0.726
Matched	69.40	69.47	1.9	0.958

Note: All variables are measured around child birth unless indicated otherwise. Own calculations. SOEP 27v (2001-2010).

Table A.3.4: Balance of covariates between treatment and control group *(adolescence sample)*

	Mean		Bias	
	Treated	Untreated	|Bias|	p>|t|
Full time employed				
Unmatched	0.39	0.29	20.9	0.081
Matched	0.38	0.37	0.2	0.993
Part time employed				
Unmatched	0.29	0.33	7.1	0.570
Matched	0.31	0.29	4.4	0.803
Working hours				
Unmatched	22.61	19.95	14.6	0.218
Matched	22.59	22.42	0.9	0.958
Years of education				
Unmatched	12.34	12.13	7.9	0.509
Matched	12.47	12.38	3.4	0.854
Partnered				
Unmatched	0.92	0.93	3.5	0.774
Matched	0.92	0.93	3.6	0.836
Logarithmic household income				
Unmatched	6.76	7.37	30.3	0.006
Matched	6.76	6.92	7.9	0.688
Number of children < 16				
Unmatched	2.09	2.08	2.2	0.857
Matched	2.08	2.10	2.0	0.912
Living in East Germany 1989				
Unmatched	0.48	0.34	29.3	0.007
Matched	0.48	0.47	2.3	0.898
Living in an urban community				
Unmatched	0.19	0.26	17.8	0.127
Matched	0.22	0.22	1.0	0.956
Overall life satisfaction				
Unmatched	6.53	7.06	32.1	0.007
Matched	6.53	6.57	2.3	0.896
Age at childbirth				
Unmatched	27.74	27.47	6.0	0.594
Matched	27.95	27.94	0.3	0.989
Aged 20 - 25 at childbirth				
Unmatched	0.28	0.28	0.9	0.937
Matched	0.28	0.28	0.5	0.977
Aged 30 - 35 at childbirth				
Unmatched	0.27	0.21	13.9	0.196
Matched	0.25	0.26	3.2	0.861
Aged 35+ at childbirth				
Unmatched	0.05	0.07	6.9	0.551
Matched	0.06	0.06	0.0	0.999
Tenure at firm				
Unmatched	3.29	4.06	15.2	0.246
Matched	3.51	3.46	1.0	0.950
Size of firm				
Unmatched	4.68	5.39	18.3	0.157
Matched	4.92	4.79	3.2	0.857
Gender of child (female=1)				
Unmatched	0.55	0.48	15.5	0.164
Matched	0.55	0.53	2.8	0.875
Migration background of child				
Unmatched	0.18	0.18	1.3	0.903
Matched	0.16	0.16	0.5	0.976

Note: All variables are measured at age six of child. Own calculations. SOEP 27v (1990-2010).

4 Day care (quality) and differences in children's health and personality characteristics*

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4.1 Introduction

In the economic literature studies so far examine potential effects of day care attendance on child outcomes. Yet, these works mostly infer the broad measure "day care attendance" by itself, and scarcely differentiate by amount of time spent in day care or day care quality. Studies in recent years mainly show that universal day care has a beneficial impact on children's outcomes (e.g., Datta Gupta and Simonsen, 2010; Havnes and Mogstad, 2010, 2011). However, evidence remains mixed on whether all types of day care attendance have a positive effect on children's development. Studies investigate attendance versus non-attendance, but day care quality is rarely addressed.

The pedagogical/psychological literature refers to three types of day care quality: structural quality, process quality, and "guidance quality"[1]. Structural quality comprises standards that address issues such as child-staff-ratio, group size, qualification of caregivers, or health and safety practice. Whereas process quality assesses how caregivers stimulate and support child development or how caregivers interact with children. The pedagogical concept of a day care institution is part of the so-called "guidance quality" (see Smidt, 2012, for a detailed discussion). With regard to these types of quality, this chapter assumes that it does not suffice to relate day care attendance to children's outcomes, as day care attendance indirectly includes a variety of quality standards children can be exposed to. For example, day care facilities vary in terms of structural quality, e.g. child-staff-ratio, group size, or educational level of staff. Hence, while it might be beneficial to attend a day care center, a longer stay or a stay at an institution with mediocre quality might have negative consequences. The economic literature is rather silent about the relationship between (1) day care attendance and *changes* in

[1] In German it is called "Orientierungsqualität".

child outcomes as well as between (2) *day care quality* and child outcomes.

Studies outside the field of Economics show that not day care attendance itself "causes" differences in children' outcomes, but age at entry, average amount of time spent at an institutions, and quality of day care centers matter (for an overview of the literature see Bradley and Vandell, 2007). Bradley and Vandell (2007) report that research shows that "high caregiver-child-ratios, small group size, and well-trained caregivers result in higher quality care" (Bradley and Vandell, 2007, p. 671), and that children who attend day care institutions with higher structural quality standards, i.e., small group size, had fewer behavioral problems and more positive social behavior (Bradley and Vandell, 2007, p. 672). Thus, this chapter follows the idea to assess not only day care attendance, but also amount of time spent in day care and structural day care quality. Given this, I aim at showing that from an economic perspective day care (quality) is important for children's development, i.e., changes in children's outcomes.

By examining how variations in day care quality can explain variations in children's outcomes, this chapter contributes to the current literature. There exists scarce evidence on the linkage between structural quality indicators and changes in children's outcomes. So far the literature answers the questions regarding day care quality and children's outcomes only insufficiently. For instance, which quality indicator is more related to children's development? And what could be a potential mechanism linking day care quality and changes in children's outcomes? Does a smaller group improve children's ability to concentrate? Or does a higher share of children per staff decrease children's ability to comprehend? The small economic literature on day care quality related to cognitive development suggests that a small group size and higher share of non-Danish staff are positively correlated with children's language score at the end of ninth grade (Bauchmüller

et al., 2011). Could such an indicator be related to other child outcomes[2]?

In general, economic studies analyzing the potential effect of formal care mainly focus on cognitive outcomes without considering that children already possess different endowment of these skills before entering day care institutions. Apart from cognitive skills measured *post* day care attendance, some studies investigate its relation with non-cognitive development (see Datta Gupta and Simonsen (2010, 2011)). Datta Gupta and Simonsen (2010) for example are interested in day care attendance influencing children's socio-emotional behavior, which they only examine at age seven. In contrast personality traits of young children have scarcely been examined. Personality traits are a part of the broader concept "non-cognitive skills". In addition, few studies in Economics infer day care attendance and child health (see for example Berger et al., 2005; Currie and Hotz, 2004; Gordon et al., 2007) – an outcome, which is frequently assessed in the pedagogical/psychological literature (see Bradley and Vandell, 2007, for a summary of studies). In this chapter I examine changes in children's health, because child health during early childhood is an important factor for later outcomes in life. Currie (2009) and Conti et al. (2010) state that child health affects the production of skills or educational attainment[3]. On the one hand negative health outcomes early in life are likely to affect future health and on the other hand children with poor health, e.g. children born with low birth weight, might have difficulties in acquiring skills later on (Currie, 2009).

This chapter aims at identifying a potential causal effect of day care (quality) on changes in children's health and in their personality characteristics[4].

[2]In the pedagogical/psychological literature studies find that these structural quality indicators are correlated with children's cognitive ability, behavioral problems, social behavior, and communicable illnesses.
[3]Conti et al. (2010) find that for individuals good health early in life is associated with higher educational attainment.
[4]In this chapter the term "personality characteristics" is used for simplification, since personality

Personality traits and especially a person's "Openness to experience (Intellect)" and "Conscientiousness" are positively correlated with educational attainment (Almlund et al., 2011; Cobb-Clark and Schurer, 2012). In this chapter I am interested in identifying potential factors that might affect the development of behavior between age three and age six, as children's behavior at age three predicts adult personality traits at age 26 (Caspi et al., 2003). Relating day care (quality) to differences in children's personality characteristics accounts for different "starting levels" of non-cognitive skills among children *prior* treatment.

Apart from changes in non-cognitive skills, I investigate changes in children's health. Various studies in the psychological/pedagogical literature, in particular for the US, show that day care exposure leads to an increase in chances of illnesses, such as colds, ear infections and the like (Chen, 2012). A study using data from the National Institute of Child Health and Human Development (NICHD) demonstrates that children's likelihood of illness is affected by group size, i.e., number of children, rather than length of stay (Bradley and NICHD Early Child Care Research Network, 2003). This chapter investigates changes in children's ear infections and in atopic eczema, as both illnesses are susceptible to environmental factors. Ear infections are caused by viral or bacterial infections, which are correlated with day care attendance among others (Rovers, 2008). In contrast atopic eczema might be dormant within children before entering day care and different quality factors might awake or prolong this illness.

The aim of this chapter is to identify a potential causal effect of day care (quality), which requires to account for children's selection into day care. Thus, the analysis is confronted with a counterfactual problem, namely estimating changes in health and personality characteristics if a child had not experienced day care.

traits of children are only measurable from the age four onwards. Before, i.e., for young children at age three, these characteristics rather depict a child's temperament.

Propensity score matching is a well-known method to correct omitted variable bias[5]. But propensity score matching relies on *selection on observables*, and if children who are treated differ systematically from children who are not treated in terms of unobservable characteristics, in other words innate cognitive ability, propensity score matching suffers from endogeneity. A possible alternative estimation strategy suggests to combine a difference-in-differences estimator with propensity score matching, the so-called conditional difference-in-differences matching (cDiD), (see for an introduction Heckman et al., 1997)). In contrast to existing studies, I therefore combine a difference-in-differences strategy with propensity score matching. Conditional difference-in-differences matching allows me to compare the differences in children's health and personality characteristics of those who attend day care at age four with the outcome changes of "nearly" identical children not participating in formal care at age four. In order to estimate a potential causal effect of day care quality, this chapter combines data from the German Socio-Economic Panel Study (SOEP) with regional data from the "Kinder- und Jugendhilfestatistik" (statistics on child and youth welfare) on day care quality at the youth welfare office level[6].

My analyses complement the existing literature by shedding light on potential causal effects of day care (quality) on changes in children's outcomes over time. In addition to studies examining day care attendance and its effect on child development, the present study investigates dynamics in child outcomes, i.e., changes in health and personality characteristics. Furthermore the chapter contributes by examining how structural quality of day care centers affect children's health or personality traits, apart from the influence of day care

[5]In the seminal paper Rosenbaum and Rubin (1983) propose to estimate a one-dimensional propensity score to match treated and untreated individuals with nearly identical observable characteristics to circumvent the counterfactual problem.
[6]For simplification I refer from here on to the "youth welfare office level" using the term *"county level"*.

attendance itself.

The remaining chapter is structured as follows. In Section 4.2 the related literature is discussed and Section 4.3 presents the data used. Section 4.4 depicts the empirical strategy before the results are presented in Section 4.5. In Section 4.6 feasible sensitivity checks are discussed and Section 4.7 concludes.

4.2 Related literature

In the pedagogical/psychological literature studies have considered quality, duration and attendance of day care when analyzing child development and day care (Beijers et al., 2011; Belsky et al., 2007; Burchinal et al., 2010; Preisner-Feinberg et al., 2001; Undheim and Drugli, 2012). NICHD research network and Duncan (2003), for example, aim at identifying a causal effect of day care quality on child outcomes for the US. Including an extensive set of variables measured prior day care attendance enables NICHD research network and Duncan (2003) to address selection bias. Their study finds a positive effect of day care quality on children's cognitive ability, emphasizing the need to account for day care selection factors.

Studies usually examine day care effects related to children's educational achievement or cognitive ability (for an overview see the meta-analyses of Burger (2010); Gorey (2001), and Nelson et al. (2003)). Burger (2010) systematically reviews empirical studies that examine early childhood programs between age three and age six and children's cognitive and socio-emotional behavior, as well as, grade repetition and educational attainment. All studies summarized in Burger (2010) estimate age at entry or how many years a child attends formal care. In 22 out of 32 papers there exists a positive association between a child's cognitive skills and day care attendance.

A vast literature outside the field of economics exists with regard to child health and day care attendance. Studies often investigate potential effects of day care on ear infection or on eczema (see for example Danhauer et al. (2011); Winskel (2006) or Chen (2012)). Chen (2012) is interested in whether multiple care arrangements apart from day care attendance are correlated with children's health problems. The author uses US data from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) and relates the total number of arrangements to ear infections and unintended injuries of the child. Applying random and fixed effects methods to reduce omitted variable bias, Chen (2012) finds that an increase in the total number of care arrangements is correlated with greater chances of ear infections.

Cramer et al. (2011) on the other hand are interested in explaining why day care attendance might support prevalence of atopic eczema in Germany. They differentiate between East and West Germany, as in the Eastern states childhood eczema is more widespread. Cramer et al. (2011) analyze data from an ongoing population-based birth cohort study "Influence of Life-style factors on the development of Immune system and Allergies (LISAplus)". They identify different potential driving factors of the prevalence of eczema among which day care attendance during the first two years of life significantly correlates with neurodermatitis.

Bradley and Vandell (2007) give an overview of research on day care and well-being of children. Their study aims at evaluating studies of day care, which explicitly focus on amount, quality, and type of day care. Among cognitive outcomes and behavioral problems Bradley and Vandell (2007) also discuss works interested in relating day care and communicable illnesses, such as diarrheal illness, otitis media, and respiratory infections. They show that researchers often identify correlations between large number of children in day care centers and

children's likelihood of suffering from infectious illnesses[7]. However, Bradley and Vandell (2007) point out that so far few studies have inferred the relationship of day care quality and children's health[8].

The literature in economics on day care and its influence on child development chiefly focuses on potential effects of attendance, i.e., comparing children in formal care to children not in formal care. In recent years studies examining non-cognitive skills and day care attendance have become apparent (see for example Datta Gupta and Simonsen, 2010, 2011; Felfe and Lalive, 2010; Schlotter, 2009). Personality traits of young children have been less examined in the literature, studies mostly analyze children's behavioral problems. Datta Gupta and Simonsen (2010) investigate whether attending preschool or family day care in Denmark affects children's socio-emotional behavior differently compared to children in home-based care. Exploiting regional variation in day care provision on the municipality-level, the authors find that non-cognitive skills of boys are negatively affected if they attend family day care and not home-based care. But boys benefit from attending preschool compared to family day care.

Children's health and day care attendance has been less examined by economists, as research studies often infer maternal employment and child health accounting indirectly for day care attendance (see for example Berger et al., 2005; Gordon et al., 2007)[9]. Gordon et al. (2007) infer how maternal employment and hours in day care are associated with a child's experience of injuries and infectious disease by using data from the National Institute of Child Health and Human Development Study

[7] Among the studies Bradley and Vandell (2007) examine are among others studies by the NICHD Early Child Care Research Network (e.g. Bradley and NICHD Early Child Care Research Network, 2003; NICHD Early Child Care Research Network, 2001).

[8] Among those few studies Bradley and NICHD Early Child Care Research Network (2003) show that children in day care centers with larger group size have a higher chance of communicable illnesses.

[9] Among the studies, which examine these potential effects, listed in Gordon et al. (2007) are: Currie and Hotz (2004); Ruhm (2000).

of Early Child Care (NICHD-SECC). Interestingly, Gordon et al. (2007) do not find any significant correlations between maternal employment and child health, but they identify that time spent in center-based care increases children's chances of respiratory problems and ear infections (Gordon et al., 2007, p. 328).

Overall there is limited evidence in the economics literature on day care quality or quantity for that matter and its relationship with children's outcomes. Landvoigt et al. (2007) examine day care quantity and its effect on children's educational attainment in Germany. They refer to day care dosage as day care intensity which apart from the overall influence of day care attendance and day care duration is related to children's likelihood to attend upper secondary schooling (Gymnasium). Landvoigt et al. (2007) use data from the German Socio-Economic Panel Study estimating probit models without correcting a potential selection bias. They find a positive association between day care attendance and children's probability of uppers secondary schooling, yet attending an institution full-time on the other hand reduces children's likelihood.

The study by Loeb et al. (2007) also investigates different day care effects: attendance, age at entry, duration and intensity. These differences are related to children's cognitive skills and their social behavior. Analyzing ECLS-K data from the US, Loeb et al. (2007) distinguish between "moderate intensity" (15-30 h per week) and "high intensity" (30 h or more per week). Their OLS results suggest that high intensity of day care has a positive correlation with cognitive skills, yet a negative association with social behavior. Considering heterogeneity Loeb et al. (2007) find a positive effect of high intensity for children from low-income families, whereas children from high income families show negative behavior if they attend a center program longer hours.

One of the few studies focusing on day care quality rather than day care attendance

is the recent study by Bauchmüller et al. (2011). The authors assess how day care quality influences children's language test scores at the end of ninth grade[10]. An instrumental variable approach on the municipality-level renders positive significant effects of *"share of male staff"* and of *"share of non-danish staff"* on language test scores at age sixteen.

4.3 Data

In order to relate day care quality and individual child outcomes, I combine data from the German Socio-Economic Panel Study (SOEP)[11] and regional data on structural quality from the statistics on child and youth welfare ("Kinder- und Jugendhilfestatistik")[12]. The German Socio-Economic Panel Study is a representative household survey of Germany providing vast information on child development, family background, household composition, and place of residence among others. The richness of the SOEP provides an ideal data set to apply conditional difference-in-differences matching to estimate the potential causal effect of day care (quality) on differences in child outcomes.

The German Socio-Economic Panel Study comprises mother-child-specific questionnaires, which address child-specific and mother-specific issues at different childhood stages. The first questionnaire in this series targets mothers with

[10]The authors use Danish register data on day care institutions with (1) child-staff-ratio, (2) share of male staff, (3) share of pedagogically qualified personnel, (4) share of non-danish staff, and (5) stability of staff per center per year as quality indicators.

[11]General information on SOEP data is given by Wagner et al. (2007), whereas Schupp et al. (2008) and Siedler et al. (2009) provide an overview on the mother-child questionnaires that are used in this chapter.

[12]The regional data on structural quality of day care is provided by the statistical office (Statistisches Bundesamt). The quality indicators are from the statistics on children and employees in day care institutions calculated and edited at the "Dortmunder Arbeitsstelle Kinder- und Jugendhilfestatistik" (Statistisches Bundesamt, 2011).

newborn children, i.e., children between birth and age one. The next issue of the mother-child questionnaires measures child development at age two/three, followed by measures of child characteristics at age five/six. In 2003 the "mother-child-series" started with the birth cohort of children born in 2002, and as these children grow older the series is extended, e.g. in 2012 these children are aged nine/ten and thus a new mother-child questionnaire will be included in the SOEP. Apart from this specific birth cohort, information on all children born into SOEP households since 2003 is collected.

For my empirical analysis I will focus on child-specifics surveyed at ages 0/1, 2/3, and 5/6. This allows me to use information on health, personality traits, and child development describing changes in those characteristics and using observable measures to predict day care attendance. In addition, the SOEP accumulates data on current household compositions as well as past formations, parental background characteristics, individual characteristics of children's mothers, as well as general household information, e.g. apartment size or place of residence. Based on this vast data set children's probability of day care attendance is estimated.

Beside the individual child data from the German Socio-Economic Panel Study, I match regional data on structural day care quality to my "child sample". In order to avoid mixing county and municipality level, I solely match data from the SOEP with data from the statistics on child and youth welfare using county identifiers[13] included in both data sets. Thus, I discard children living in youth welfare office districts identical to municipalities from my estimations. This ensures that I can include other county characteristics relevant for my analyses later on. Furthermore, matching both data sets, enables me to benefit from

[13]Although some youth welfare office districts overlap with German municipality levels, I only include those districts identical with German county levels.

information on structural quality and from information on changes in children's health and personality characteristics. This chapter assumes that structural quality on the county level is exogenous with respect to children's outcomes. The "*Kinder- und Jugendhilfestatistik*" (statistics on child and youth welfare) comprises data that is collected yearly since 2006, and consists of different information, e.g. statistics on children and employees in day care institutions. This statistic gives information on structural quality of day care institutions in each youth welfare service district. Each center reports on: How many employees work there, in which position ..., how many hours ... **plus on** how many children attend, for how long and at what age. Based on this data different structural quality indicators are generated by the center of the statistics on child and youth welfare. The collected data is edited by the DJI (Deutsches Jugendinstitut) at the Technical University of Dortmund. At the "Dortmunder Arbeitsstelle Kinder- und Jugendhilfestatistik" quality indicators such as child-staff-ratio and group size among others are calculated and distributed to the public via the statistical offices. Yet, not every indicator surveyed in the statistics on children and employees in day care institutions is made available every year. Thus, although the statistics for 2007, 2008, 2009 and 2010 can be used, 2010 comprises the most indicators with the least missing information.

Before I describe my dependent and main explanatory variables in more detail, I give a short summary of the construction of my analytical sample. The data on children from birth through age five/six from the SOEP are restricted to children whose mothers answered the mother-child questionnaires at ages 2/3 and 5/6, as this chapter is interested in differences of children's health and personality characteristics **between age three and age six**, i.e., the analytical period of interest is between $t \geq 3$ and $t \leq 6$. Apart from this major restriction my sample needs to

fulfill the following criteria: a valid county identifier[14] *(Kreiskennziffer)* on which I match the regional data on structural quality with the SOEP data, information of child's health at birth, and valid data on day care attendance. The sample consists of $N = 695$ children.

4.3.1 Treatment and control group

Children's attendance of formal care is not random, as day care attendance depends on a child's characteristics and parental preferences. The potential selection bias due to differences between children attending day care and those not in formal care is corrected by combining propensity score matching and a difference-in-differences estimator. For the implementation of conditional difference-in-differences matching, I predict children's likelihood of attending formal care in $t = 4$ to be able to compare children's outcomes before (t=3) and after (t=6) treatment. Given this, the treatment and control group are composed as follows. First, the sample used in the analyses consists of 695 children whom I observe at age two/three and at age five/six. Children are part of the treatment group, if they are observed to attend a day care institution at age four in the SOEP, because the first level of children's health and personality characteristics are measured at age three. In order to estimate a potential causal effect of day care attendance the entry into formal care has to be measured after age two/three. This treatment cut-off allows me to relate changes in children's outcomes before and after receiving treatment. Moreover in Germany the majority of children still start participating in formal care after their third birthday. The control group consists of children who either do not attend a day care center at age four or who are observed to have participated in formal care at age three or earlier and who attend day care

[14] As mentioned before, I discard children living in youth welfare office districts identical to municipalities, in order to perform analyses solely on the county level.

centers in period t=3.

4.3.2 Child outcomes

In this chapter I examine two different categories of child outcomes: **health** and **personality characteristics**. Children's health is measured as children's chance of having an illness at age three or at age six respectively. Different illnesses are surveyed in the SOEP and are described in more detail below. With regards to personality characteristics I have already stated at the beginning of this chapter that children's personality traits are measurable around the age of five. But certain "personality-like" behavior can be observed at an earlier age and is usually referred to as temperament. Since I am interested in investigating ***changes*** in children's health and personality characteristics between age three and age six, I compare the particular items measuring behavior at age three (child's temperament) to the observed items of behavior, i.e., personality traits, at age six. Both measures, assessed at age three and at age six, are labeled "personality characteristics" for simplification. In the following paragraphs both outcome measures and their construction are discussed.

Health measures

Different health indicators are measured within the SOEP, e.g. asthma, acute spasmodic laryngitis, allergic coryza, otitis media and eczema. This chapter focuses on two health measures which are known to be susceptible to a child's environment: *otitis media* and *eczema*. Both ear infection and neurodermatitis are illnesses that occur frequently to young children (below the age of 7). Ear infection is commonly caused by viral, bacterial or fungal pathogens, whereas eczema is related to genetic factors, changes of an individual's immune system,

and environmental influences.

Before discussing ear infection and eczema and the potential association with day care quality, Table 4.1 shows how the health measures, which are reported by mothers, from the SOEP compare to "objectively" reported information on these illnesses from the *Kinder- und Jugendgesundheitssurvey* (KiGGS). KiGGS is a national study surveying the health of children and adolescence (population of children aged 0-17) in Germany and is conducted by the Robert-Koch-Institut. KiGGS collected information on children's health between 2003 and 2006, surveying on the one hand parents and on the other hand questioning doctors to assess prevalence of illnesses (see for example Kamtsiuris et al., 2007; Schlaud et al., 2007). Although the survey periods between SOEP and KiGGS do not completely overlap, Table 4.1 shows that maternal reports on whether a particular illness has been diagnosed once by a doctor do not differ from doctoral reports on prevalences by and large.

Table 4.1: Comparison of health measures used in this chapter (SOEP) with incidences of these illnesses obtained from KiGGS (percentages)

	Illnesses (SOEP) "Illness diagnosed by doctor once"	Illnesses (KiGGS) "Prevalence last 12 months"
Otitis media		
at age three	23.9	
at age six	31.7	
age three – age six		22.9
birth – age seventeen		11.0
Eczema		
at age three	8.5	
at age six	8.9	
age three – age six		8.5
birth – age seventeen		7.2
N	695	17.641

Note: SOEP v28 (2005-2011) and results from *Kinder- und Jugendgesundheitssurvey* (KiGGS) by Kamtsiuris et al. (2007) and Schlaud et al. (2007).

Ear infection *(otitis media)* often occurs to young children, as they have shorter Eustachian tubes. Eustachian tubes equalize the pressure between the middle ear and the atmosphere. This chapter is interested in identifying a possible causal effect of day care attendance and quality on chances of ear infections, as this illness is often caused by bacteria. Risk of infection is related to environmental factors such as having a sibling or attending day care (Rovers, 2008, p. G2). Structural quality proxies a child's environment at a day care institution. For example larger groups (group size) consist of more potential "infectious agents". A less educated staff might pay less attention to children changing beds or putting toys in their mouth, as teachers might be less aware of potential transmission paths. Thus, a combination of different structural quality indicators describes children's risk

of illness explaining more in depth potential effects of day care attendance on children's health.

With regards to atopic eczema this chapter hypothesizes that neurodermatitis has been dormant before attending day care and day care attendance and quality could either awake or prolong atopic eczema. Children who suffer from atopic eczema might require more attention, which might be difficult to provide in large groups. In addition, less educated teacher might be less aware of special requirements, e.g. different nutrition, and they might also be less responsive to extra care. Both measures of illness between age two/three and age five/six are susceptible to quality of day care institutions, e.g. "lack of hygiene", and structural quality indicators are possible substitutes for a child's environment. Since eczema is less often observed than ear infections, this chapter utilizes a comprehensive measure of children's changes in illnesses.

The overall "health measure" consists of changes in otitis media and changes in eczema. I analyze changes in "overall health" as well as differences in ear infection. The dependent variable ΔY ranges from *-1 to 1* if children's illness is examined. A value of **-1** indicates an improvement, i.e., *decrease in illnesses*, as differences in overall child health (ΔY) is constructed by subtracting children's outcome at age three from the information given at age six: $\Delta Y = Y_6 - Y_3$. A value equal to **0** depicts *no change* meaning a mother did either not report otitis media or eczema at age three and at age six, or a child suffered at age three **and** at age six from ear infection or neurodermatitis. Thus, a value of **1** represents a worsening of children's health, i.e., an *increase in illnesses* between t_3 and t_6.

Children attending day care at age four differ significantly from children not attending day care at age four in terms of illness. Children in day care at age four are more likely to have an increase in their "overall health" from three through six,

i.e., they are infected with the measured illness at age six. Children in the treatment group also suffer more often from ear infections (see Table 4.1a)[15].

Table 4.1a: Changes in children's illness

	All		Children in day care at age four		Children not in day care at age four	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
ΔY in health	0.072	0.5506	0.118	0.5779	0.038	0.5274*
Otitis media						
at age three	0.239	0.4267	0.222	0.4164	0.251	0.4343
at age six	0.317	0.4654	0.340	0.4745	0.299	0.4584
ΔY	0.078	0.5033	0.118	0.5749	0.048	0.4657*
Eczema						
at age three	0.085	0.2789	0.054	0.2261	0.108	0.3108**
at age six	0.089	0.2852	0.067	0.2510	0.106	0.3076*
ΔY	0.004	0.2602	0.013	0.2321	-0.003	0.2794
N	695		297		398	

Note: SOEP v28 (2005-2011). Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ denote significance level of differences between children in the treatment group and those in the control group.

Measures of personality characteristics

For young children a modified measure of the "Fünf-Faktoren-Fragebogen für Kinder (FFFK)" (five factor questionnaire for children) based on Asendorpf and van Aken (2003) is included in the mother-child questionnaire 5/6. Studies in Personality Psychology show that parental rating of three-to-five-year-old children's personality varies in five dimensions: Extraversion, Neuroticism, Conscientiousness, Agreeableness, and Intellect (e.g., Kohnstamm et al., 1998).

The mother-child questionnaire 2/3 of the SOEP surveys four personality

[15]For atopic eczema, children not attending day care at age four are more likely infected. This descriptive evidence is in line with the controversy of influences/causes of neurodermatitis, i.e., genetics, environment or something else.

characteristics and according to Asendorpf et al. (2007) these four items are related to three dimensions of the Big Five plus to a combination of "Extraversion" and "Neuroticism". Thus, the four personality characteristics measured at age two/three are included in the ten-item instrument measured at age five/six based on FFFK by Asendorpf and van Aken (2003). Following Asendorpf et al. (2007) two indicators of the five personality traits of young children are analyzed in this chapter. Mothers report on a 11-likert scale whether their children are: **(1) concentrated - easily distracted** and **(2) be quick on the uptake - take time**. Both items are available at both time periods of interest to the analyses. Item (1) is part of the dimension "**Conscientiousness**" and ranges from *[1] concentrated ... to ... [11] easily distracted*, and item (2) is part of "**Openness to experience (Intellect)"** ranging from *[1] be quick on the uptake ... to ... [11] take time*. The analyses focus on characteristics related to "Conscientiousness" and "Openness to experience (Intellect)", as both dimensions of personality traits are correlated the most with educational outcomes later in life[16].

In order to interpret the estimated coefficients of changes in children's ability to concentrate/comprehend in a more straightforward way, I recode both personality characteristics to range from *[1] easily distracted ... to ... [11] concentrated* and *[1] take time ... to ... [11] be quick on the uptake*. Similar to the procedure of assessing changes in children's health, changes in personality characteristics are measured constructing the difference of children's ability to concentrate/ability to comprehend between age five/six and age two/three: $\Delta Y = Y_6 - Y_3$. Measuring the difference between age six and age three summarizes a change in personality characteristics ranging from *-10 to 10*, as mothers rate the their children's behavior on a scale from 1 to 11. A value **<0** indicates a *decrease* in children's ability to concentrate or comprehend, i.e., a child has a smaller value at age six than at age

[16]See Almlund et al. (2011); Cobb-Clark and Schurer (2012).

three. She moved from [11 = concentrated] to [1 = easily distracted]. A value **equal to 0** implies *no change* between t_3 and t_6, whereas values **>0** depict an *improvement*, meaning a child moved from [1 = take time] to [11 = be quick on the uptake].

In contrast to children's overall health, children's personality characteristics do not differ significantly for children attending day care at age four and those not in day care at age four (see Table 4.2.). This first descriptive glance might either be distorted by children's selection in day care attendance at age four, i.e., child characteristics that predict children's day care participation are correlated with children's personality characteristics, or for this particular child outcome other aspects of day care, such as amount of time spent in day care or structural quality of day care might be more important than differentiating day care attendance at age four itself.

Table 4.2: Changes in children's personality characteristics

	All		Children in day care at age four		Children not in day care at age four	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Conscientiousness						
concentrated - easily distracted						
at age three	6.80	2.66	6.85	2.69	6.77	2.63
at age six	7.23	2.68	7.36	2.63	7.13	2.71
ΔY	0.473	2.98	0.578	3.18	0.394	2.81
Intellect						
be quick on the uptake - take time						
at age three	9.08	1.93	9.09	1.97	9.09	1.89
at age six	8.81	2.17	8.73	2.25	8.86	2.10
ΔY	-0.206	2.42	-0.268	2.49	-0.160	2.36
N	647		272		375	

Note: SOEP v28 (2005-2011). Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ denote significance level of differences between children in the treatment group and those in the control group.

Table 4.2a therefore compares changes in children's personality characteristics with regard to full-time attendance. In Table 4.2a the means of children's ability to concentrate and to comprehend are reported for children attending day care at age four. This group of children is further differentiated according to 'full-time attendance – yes' (column 2 of Table 4.2a) and 'full-time attendance – no' (column 3 of Table 4.2a). Children who spend a full day in day care are on average less able to concentrate at age six compared to their level at age three (see ΔY of "conscientiousness" in Table 4.2a). In addition, children in full-time day care are on average less able to concentrate compared to children not in full-time attendance at age six.

Table 4.2a: Changes in children's personality characteristics and full-time attendance

	Children in day care at age four		Full-time attendance		No full-time attendance	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Conscientiousness						
concentrated - easily distracted						
at age three	6.85	2.69	7.30	2.25	6.87	2.68
at age six	7.37	2.63	6.10	3.14	7.47	2.52***
ΔY	0.578	3.18	-1.17	3.33	0.662	2.99***
Intellect						
be quick on the uptake - take time						
at age three	9.09	1.97	8.37	2.51	9.17	1.91**
at age six	8.73	2.25	8.07	3.02	8.79	2.15
ΔY	-0.268	2.50	-0.074	1.71	-0.288	2.57
N	272		30		242	

Note: SOEP v28 (2005-2011). Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$ denote significance level of differences between children in full-time attendance and not in full-time attendance.

4.3.3 Day care

The general information on day care attendance is obtained from the German Socio-Economic Panel Study (SOEP). In this chapter I infer if day care attendance by itself affects changes in children's outcomes as well as amount of time spent in day care if a child participates in formal care. In the SOEP parents report different day care arrangements starting with the birth of their child. The sample of children used in this chapter comprises 695 valid observations of which 42 percent are attending formal care[17] at age two/three and 76 per cent attend formal care at age five/six reported in the mother-child questionnaires (see Table A.4.1 in Appendix).

Apart from formal care, children also participate in informal care, meaning that grandparents, older siblings, or other relatives take care of the children, throughout the week. In this chapter only formal care measured as institutional care[18] is assessed, as structural quality is available for day care institutions. However, this chapter is also interested in identifying supplementary effects of day care, i.e., quality of care and duration of stay. With regard to these additional influences of care, time spent at a day care institution is assessed.

The quantity of day care is defined by the number of hours a child spends at a day care institution. Differentiating day care attendance by number of hours enables to analyze in depths how formal care affects child development. In recent years research on quantity of day care attendance has increased (see for example the studies by Landvoigt et al., 2007; Loeb et al., 2007). Since the SOEP does not

[17] In this chapter formal care describes day care institutions (*Kindergarten* in Germany). By using this definition I exclude family day care from the category "formal care", which in the literature is sometimes included.

[18] Again in this setting family day care attendance is not included in the analysis, since in this chapter I refer to day care centers, i.e., *Kindergarten* in Germany, as institutional care.

provide number of hours spent in day care centers for each age of a child, I use as a crude measure of "day care quantity" whether a household member reported that the child attends an institution full-time. Full-time attendance captures that a child spends the *whole day* in day care, i.e., more than 5 hours per day. Thus, this chapter investigates how *full-time attendance(yes or no)* between age three and age six is associated with changes in children's health and personality characteristics. A potential dosage effect is assessed solely for children in day care. Day care quantity is examined in the post-matching environment in order to identify a potential causal effect.

Table 4.3 summarizes the percentage of children participating in day care and the quantity of day care, i.e., full-time attendance of the overall sample. 43 per cent of children in day care have not participated at age three and are observed to attend a day care institution at age four for the first time. 21 per cent of children attend day care full-time in the overall sample. Of those children attending day care at age four (i.e., being part of the treatment group) 10 per cent attend full-time, and 28 per cent of the control group participate in day care full-time. In my sample on average children started to participate in day care around the age of three (2.56 years). Age of entry also depicts that the control group comprises children attending day care, yet they entered before age four. Thus, they are included in the control group rather than in the treatment group as otherwise I could not relate changes in children's outcome to day care attendance or structural quality in a causal way (see Section 4.3.1 for the definition of treatment).

Table 4.3: Distribution of children's day care attendance

Variables	Mean	Std. dev.	Min	Max	N
Age at entry[1]	2.56	0.97	0	4	653
Day care attendance at age four	0.43	0.49	0	1	695
Full-time attendance[2]	0.21	0.40	0	1	668
Full-time attendance and in day care at age four	0.10	0.31	0	1	288
Full-time attendance and not in day care at age four	0.28	0.45	0	1	380

Note: SOEP v28 (2002-2011). Own calculations. [1] The number of observations for *age at entry* differs from day care attendance at age four and full-time attendance, because for some children there is no valid birth month information or no valid starting date for day care participation could be determined. [2] The number of observations between day care attendance at age four and *full-time attendance* varies, as for some children there does not exist a valid information on amount of time spent in day care.

4.3.4 Structural day care quality

In this chapter I assess quality of care in terms of structural quality using the following indicators: (1) child-staff-ratio, (2) group size, (3) share of children not speaking German at home, and (4) share of teachers with a degree (educational level of caregivers). The indicators are available for 412 counties in Germany as of 2011 (see for an overview Statistisches Bundesamt, 2011) and are matched to the sample of children aged five/six of the SOEP data. Table 4.4 depicts the means of the structural indicators within the merged sample[19] (Table A.4.2 in the Appendix shows the "raw" means of structural quality variables of the statistics of children and employees in day care institutions in 2010, i.e., the distribution in the original data). Table 4.4 shows all structural quality indicators for the child population

[19] In Table 4.4 the overall share of children attending a day care institution between age three and age six per youth welfare office district is depicted. This usage rate is also included in the analyses on structural quality in Section 4.5.

aged three to six (age group 3-6) in each county[20].

The statistics on child and youth welfare is a yearly collection and the indicators for the years 2007, 2008, 2009 and 2010 are available for researchers upon request. Yet not all quality indicators of interest are edited/prepared in each year or the calculation of some indicators differs between the years[21]. In the matched sample child outcomes are surveyed for 2008 until 2011, i.e., for each child only once at age five/six. The information on structural quality collected in 2010 is matched to my analytical sample of children, because all in all the statistics on children and employees in day care institutions from 2010 provides the most information on structural quality with the least number of missings. The county identifiers comprised in the SOEP are used to match the regional statistics on quality of care. The county identifier for children represents the county at the time of the survey, i.e., information given in 2008 if the child is aged five/six in 2008. Hence the county information in the statistics on child and youth welfare measured in 2010 is matched on the SOEP county identifier of 2008 in this particular example. This avoids mismatches due to movers.

In this chapter amount of time spent in day care and structural quality of day care are assumed to be important aspects of how day care affects children's outcomes, as day care attendance itself is a rather broad measure to assess its influence on child outcomes. With regard to the influence of the structural quality indicators used in this chapter, different hypotheses are possible. One hypothesis of this chapter is that smaller groups are beneficial for children's development, meaning that children who attend day care at age four improve their ability to concentrate

[20] In general the statistics of children and employees in day care institutions in 2010 provides all indicators for the child population below the age of 3 (age group 0-3) and for the child population above the age of 3 (age group 3-6).

[21] In 2007 and 2009 indicators regarding group size or child-staff ratio are not included. And in 2008 group size and child-staff-ratio were calculated based on the mean, whereas in 2010 both indicators are based on the median.

between age three and age six, because the teacher can interact more often with children in smaller groups. Yet the opposite association could also be possible: A larger group could "teach" children to focus and concentrate more on their play task which might improve their overall patience. Similarly these indicators of day care quality, e.g. child-staff-ratio or group size, may influence changes in children's health. Day care attendance might increase children's chance of ear infection due to exposure to "potential infectious agents", which might be identifiable by analyzing structural day care quality rather than day care attendance. An environment with more children, e.g. a larger group size increases children's risk of ear infection by bacteria. Children who suffer from atopic eczema are in need of extra care, since for instance teachers eventually have to put cream on their itching skin in regular intervals. Thus, children's health could worsen if the child-staff-ratio prohibits such additional care.

Table 4.4: Summary of structural quality indicators in matched sample

Structural indicator	Mean	Std. dev.	Min	Max	N
Share of children attending day care institution	92.18	4.29	77.1	127.7	661
Share of children not speaking German at home	14.06	10.72	0.5	46.3	656
Child-staff-ratio	9.13	1.53	6.2	13.7	657
Group size	21.63	3.19	14	26	661
Educational level of teachers					
Share of teachers with degree	77.25	12.28	49.74	97.54	661
Share of teachers with no degree	22.75	12.28	2.46	50.26	661

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. All indicators displayed in this table refer to the child population aged three to six (age group 3-6) in each county.

4.3.5 Covariates

The empirical strategy relies on the assumption that the variables to predict day care attendance at age four and changes in children's outcomes are observed. Therefore the set of variables used to condition on children's propensity to attend day care is crucial for the identification strategy: conditional difference-in-differences matching. I base my choice of observables on other empirical studies which estimate why children attend day care centers early in life and why not (for a comprehensive overview see Burger (2010))[22]. Combining rich survey data with regional data on structural quality allows me to include all observables which other studies found to be good predictors of day care participation.

Table 4.5 depicts the set of covariates used to predict children's propensity to attend day care at age four. In the following section I explain the estimation strategy: Conditional difference-in-differences matching (cDid). Since I combine cDiD with regression-adjusted estimations in the post-matching sample, the conditioning variables summarized in Table 4.5. are also used as covariates in the post-matching analyses.

[22]In addition conditioning variables are based on the following studies: Büchner and Spiess (2007); Datta Gupta and Simonsen (2010, 2011); Felfe and Lalive (2010); Havnes and Mogstad (2010); Ruhm (2011); Schlotter (2011); Spiess et al. (2003); Waldfogel et al. (2002).

Table 4.5: Conditioning variables used to predict children's propensity of day care attendance at age 4

Observables	Mean	Std. dev.	Min	Max	N
Maternal Employment status *prior age three*					
Full time	0.08	0.274	0	1	701
Part time	0.19	0.398	0	1	701
Maternal Years of education *prior age three*	12.94	2.79	7	18	682
Satisfaction with being a mother **(0/1)** *around birth*	0.16	0.365	0	1	651
Partner present *at age three*	0.90	0.294	0	1	711
Maternal age *at birth*	30.71	5.52	16	46	714
Maternal personality traits *at age three*					
Extraversion	0.01	0.996	-3.16	2.65	653
Openness	0.01	1.003	-2.87	3.32	653
Conscientiousness	0.02	0.992	-5.64	1.77	653
Neuroticism	-0.02	0.993	-2.45	2.61	653
Agreeableness	-0.00	0.995	-3.12	2.04	653
Logarithmic household income *prior age three*	7.76	0.474	6.11	9.16	610
Number of children <16 in household	1.93	0.962	1	8	716
Urban area prior birth	0.28	0.452	0	1	716
Child gender **(1=female)**	0.52	0.499	0	1	716
Child's migration background	0.21	0.406	0	1	715
Child health **(1=illness)** *at birth*	0.07	0.241	0	1	650
Child "skills" *at birth*					
birth weight	0.06	0.246	0	1	652
Child skills *at age 3*					
Motor skills	8.07	1.76	0	10	712
Verbal skills	9.04	1.49	0	10	709
Social skills	8.81	1.49	1	10	713
Daily activities	6.33	2.38	0	10	713

Note: SOEP v28 (2002-2011). Own calculations.

4.4 Empirical strategy

This chapter aims at identifying a causal effect of day care (quality) on changes in children's health and personality characteristics between age three and age six by applying conditional difference-in-differences matching. This method enables

me to compare children who attend day care at age four with "nearly" identical children who do not attend day care at age four and to see how outcomes change for both groups of children. The following reduced form equation summarizes the relationship between day care quality and changes in children's outcomes. In Equation 4.1 $\Delta\ Y_{ij}$ represents the measured differences in outcome j for child i between period t_3 and t_6, $QUALITY_{ij}$ is a variable depicting structural quality of day care centers, X_{ij} is a vector summarizing the used covariates and ϵ_{ij} is an error term.

$$\Delta Y_{ij} = \beta_{ij} QUALITY_{ij} + \gamma_{ij} X_{ij} + \epsilon_{ij} \tag{4.1}$$

The coefficient of interest is β_{ij} and the results render causal estimates using ordinary least squares if the following assumption is valid: $E(\epsilon_{ij}|QUALITY_{ij}) = 0$. Meaning that the estimates of β_{ij} are "true" if day care quality is uncorrelated with the differences in children's outcomes: ΔY_{ij}.

The regional data provides structural quality only on the county level, i. e., not for each day care institution attended by each child in the sample[23]. As parents select care for their children, parents' decision on day care usage is correlated with $QUALITY_{ij}$. This decision is not independent of children's development, i.e., of initial child health, or of parental preferences[24]. Selectivity might therefore be captured in the error term ϵ_{ij} and might bias any OLS estimates of β_{ij}. Hence, an estimation of day care (quality) has to consider endogeneity due to omitted variable bias.

A prevalent method to correct omitted variable bias is propensity score matching (Blundell and Costa Dias (2000); Rosenbaum and Rubin (1983)). Propensity

[23]This would be the case with register data, e.g. data used by Bauchmüller et al. (2011).
[24]Demand for child care and choice characteristics of day care usage have been widely examined (see for example the studies by Blau, 1991, 1997; Hagy, 1998; Johansen et al., 1996; Spiess and Tietze, 2002).

score matching assumes that *conditional* on observable characteristics assignment to treatment is random. Compared to other established methods such as family fixed effects or instrumental variable approach, propensity score matching does not limit analyses to siblings or compliers and allows to infer potential influences of day care (quality) for *all* children. Yet, fixed effects methods, difference-in-differences techniques and an instrumental variable approach capture unobserved variances. Thus, combining a difference-in-differences estimation and propensity score matching allows to examine day care quality for all children whilst time-invariant effects are eliminated.

4.4.1 Conditional difference-in-differences matching

Conditional difference-in-differences matching is a non-parametric estimator that extends matching to the panel context. Conditional difference-in-differences matching accounts for selection on observables and on unobservables with time-invariant effects[25]. If differences in unobservables cannot be excluded from the analysis, reverse causality cannot be eliminated, i.e., changes in child outcomes induce day care attendance.

First consider the standard difference-in-differences (DiD) estimator, which compares a child's health at age six with her health at age three for the treated and the untreated:

$$DiD = E(Y_{1i}^{t_6} - Y_{1i}^{t_3}) - E(Y_{0i}^{t_6} - Y_{0i}^{t_3}) \tag{4.2}$$

The conditional difference-in-differences matching (cDiD) also estimates the effect of day care (quality) on changes in children's health and personality characteristics

[25]Heckman et al. (1997) combine the difference-in-differences approach with propensity score matching.

between age three and age six as shown in Equation 4.3, but the differences are examined ***conditional*** on the obtained probability of attending formal care, i.e., on the propensity score *(P(X))*.

$$cDiD = E(Y_{1i}^{t_6} - Y_{1i}^{t_3}|P(X), D = 1) - E(Y_{0i}^{t_6} - Y_{0i}^{t_3}|P(X), D = 0) \tag{4.3}$$

In the conditional difference-in-differences approach, propensity score matching is used to estimate the probability of receiving treatment. Propensity score matching relies on the assumption that selection is based on *observable* characteristics. In order to find a comparable control group for the treated children, I assume that all relevant information of parental preferences regarding day care are included in the estimation of P(X)[26]. The assumption, that selection on observables is valid, is known as *conditional independence assumption (CIA)*.

$$Y_0 \perp D|X \tag{4.4}$$

For the conditional difference-in-differences matching estimator the CIA assumption (Equation 4.4) translates into the following expression (as described in Blundell and Costa Dias (2000)):

$$Y_0^{t6} - Y_0^{t3} \perp D|X \tag{4.5}$$

Both Equation 4.4 and 4.5 state that the outcome of the control group is independent of the treatment given the observed set of characteristics X. Children's probability of day care attendance is predicted based on relevant characteristics X to obtain a comprehensive measure of all covariates for each child, i.e., the

[26]For an overview on propensity score matching see (Caliendo and Kopeinig, 2008).

propensity score[27]:

$$P(D = 1|X) = P(X) \tag{4.6}$$

In Equation 4.6, X represents the set of observed parental characteristics and child-specific characteristics related to day care participation at age four (see Table 4.5 for an overview), *D=1* defines the "treatment condition" and *P(X)* is the estimated propensity score.

Conditional on the estimated propensity score the average treatment effect of the treated (ATT) can be identified. The estimation of the ATT of day care attendance on differences in children's outcomes requires to restrict the analyses to the *common support* of propensity score matching. This *common support condition* restricts the post-matching sample to children of the treatment group and those of the control group that are similar in terms of the characteristics X. By applying this restriction those children who do not overlap conditional on observables are discarded from the estimation.

$$P(X) < 1, \forall X \tag{4.7}$$

The common support condition expressed in Equation 4.7 ensures that the analytical sample does not comprise *just* children attending day care at age four $(P(X) = 1)$ for given X. If then all relevant characteristics are balanced between treatment and control group and the common support restriction is satisfied, the change in outcome given treatment (D=1) conditional on the propensity score (P(X)) equals the change in outcome in absence of treatment (D=0) conditional on the propensity score (P(X)). Meaning that in the absence of treatment (day care attendance at age four) health and personality characteristics of children in day care at age four (treated) and the outcomes of the matched controls follows the

[27] See Rosenbaum and Rubin (1983, 1984).

same trend.

$$E(Y_{0i}^{t_6} - Y_{0i}^{t_3} | P(X), D = 1) = E(Y_{0i}^{t_6} - Y_{0i}^{t_3} | P(X), D = 0) \tag{4.8}$$

By applying both common support and CIA, a post matching estimation of day care attendance on changes in children's health and personality characteristics can be performed. Heckman et al. (1997) show that the cDiD can identify the ATT (Equation 4.9 as described in (Smith and Todd, 2005)).

$$ATT = \frac{1}{n_T} \sum_{i \in T} [(Y_{1t_6 i} - Y_{1t_3 i}) - \sum_{j \in C} W_{i,j} (Y_{0t_6 j} - Y_{0t_3 j})] \tag{4.9}$$

In Equation 4.9, T and C represent treatment and control group and $W_{i,j}$ is a matching-specific weight. For example if the treatment and control group are matched based on *kernel matching*, the weights $W_{i,j}$ are given by:

$$W_{i,j} = \frac{G(\frac{P_i - P_j}{b_n})}{\sum_{j \in (d=0)} G(\frac{P_i - P_j}{b_n})} \tag{4.10}$$

where $G(.)$ is a kernel function, e.g., Gaussian or Epanechnikov, and b_n is a bandwidth parameter.

In order to obtain the "best" match between treatment and control group there is not only one procedure (Caliendo and Kopeinig, 2008), but according to Heckman et al. (1997) and Smith and Todd (2005) kernel matching should be preferred. Thus, this chapter uses kernel matching as preferred procedure, since it also keeps as many observations as possible[28]. The kernel matching method uses weighted averages of those children in the control group depending on the proximity in terms of the propensity score (see for an in depth discussion: Imbens, 2000; Stuart,

[28]Matching is implemented in Stata11 using *psmatch2* provided by Leuven and Sianesi (2003).

2010). Whilst the usage of nearly "all" untreated children is an advantage, it may cause bad matches. Thus, applying the common support restriction is important when utilizing kernel matching[29].

4.5 Results

The Results Section consists of two parts, first assessing the overall effect of day care attendance on changes in child outcomes between age three and age six. In the second part differences in children's health and personality characteristics are related to quantity of day care and structural quality of day care. Since ΔY ranges from *-1 to 1* or *-10 to 10* respectively, either representing *changes in children's overall health*, *changes in children's ability to concentrate*, or *changes in children's ability to comprehend*, the analyses are based on ordinary least squares (OLS). In order to examine potential causal effects of day care attendance, quantity of day care, and structural quality, I utilize a regression-adjusted approach after conditional difference-in-differences matching (cDiD). Meaning that I control for all conditioning variables shown in Table 4.5 in all estimations. The tables only display the main coefficients: day care attendance, quantity of day care, and structural day care quality.

4.5.1 Day care attendance

Compared to existing studies[30] of day care attendance and its potential effect on children's outcome around the age of six or on long term outcomes, this

[29]Kernel matching requires a decision on the kernel function and on a bandwidth parameter. The former requirement is less important compared to the latter (Caliendo and Kopeinig, 2008).
[30]See for example the works by Datta Gupta and Simonsen (2010, 2011).

chapter investigates changes in outcomes between age three and age six. The estimates presented in Table 4.6 show that attending day care at age four increases children's chances of illnesses. The correlation (column 1 of Table 4.6) is marginally significant at the 10 per cent level and indicates that attending day care has a negative impact on children's health. For changes in children's personality characteristics I find no significant correlation (see column 2 and column 3 of Table 4.6) with day care attendance at age four. These marginal or insignificant effects are already visible in the descriptive comparisons shown in Table 4.1a and Table 4.2. Thus, either selection could bias the relationship of day care attendance and changes in children's outcomes or as suggested in the pedagogical/psychological literature distinguishing between quantity and structural quality is important.

Table 4.6: Estimation of day care attendance at age 4 (OLS)

	Change in overall health	Change in ability to concentrate	Change in ability to comprehend
Day care attendance	0.078*	0.170	0.013
	[0.0464]	[0.2643]	[0.2085]
N	639	620	594
R^2	0.040	0.024	0.041

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row. Note that all models include as covariates age of child, gender(female=1), migration background, age of mother, maternal years of education, maternal employment status (full time, part time, Ref. not employed), region(East Germany=1), logarithmic household income around age 3, partner present(yes=1), number of children <16 in HH, and time dummies.

Although the dependent variables consist of changes rather than levels implying that unobserved heterogeneity does not distort the obtained results, the estimates might still be biased due to children's selection in day care attendance at age four. Therefore, I estimate the likelihood of children's attendance and match children

from the control group to the treatment group based on their proximity in terms of their propensity scores (see Section 4.3.1 for the definition of treatment). By applying kernel matching, I obtain a sample of children in day care at age four and "nearly" identical children in terms of conditioning variables. The propensity to participate is predicted for *N=577* children and of those *N=551* fulfill the common support condition[31]. Based on this "random sample" the chapter aims at identifying a causal relationship between day care quality and changes in child outcomes.

In Table 4.7 the results from conditional difference-in-differences matching are presented. In addition, I include the set of conditioning variables depicted in Table 4.5 in all analyses and weight the individuals with W_{ij} (see Equation 4.10 in Section 4.4). This regression-adjustment method avoids further potential bias if matching is not exact. In contrast to the OLS estimates in Table 4.6, accounting for *selection on observables* and for *selection on unobservables* renders insignificant effects of day care attendance on changes in children's overall health and children's personality characteristics. These results suggest that children who experience the same changes, i.e., switching their score on *being concentrated vs. being easily distracted* from 4 to 8 or from 7 to 3, are not affected differently by day care attendance at age four[32].

[31] See Figure A.4.1 for the "goodness of fit" of the matched sample.

[32] Table A.4.4 in the Appendix replicates the OLS results of Table 4.6 in the post-matching environment controlling for the covariates used in Table 4.6, since in the OLS framework I cannot control for all conditioning variables to avoid over-specification. The insignificance of day care attendance at age four with respect to children's overall health remains.

Table 4.7: Estimation of changes in children's outcomes and day care attendance at age 4 (cDiD)

	Change in overall health	Change in ability to concentrate	Change in ability to comprehend
Day care attendance	0.027	0.105	-0.025
	[0.0559]	[0.2965]	[0.2488]
N	551	535	510
R^2	0.051	0.067	0.086

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row. Note that all models of include as covariates the set of conditioning variables summarized in Table 4.5

Before I discuss the estimates of structural quality of day care, I also examine potential effects of day care quantity for children in the treatment group. Children's full-time attendance can be regarded as a first broad measure of day care quality, as studies have shown that a positive effect of day care attendance on child outcomes varies in terms of the duration of their stay (Datta Gupta and Simonsen, 2010; Landvoigt et al., 2007; Loeb et al., 2007). The OLS estimates of quantity of day care are included in the Appendix (see Table A.4.5), since I present the results obtained from conditional difference-in-differences matching in Table 4.7a to assess potential "causal" effects on changes in outcomes for children in full-time attendance at age four.

Table 4.7a shows that for children, who attend day care centers full-time, their ability to concentrate significantly decreases (see column 2). The size of the coefficient is rather large, as children's ability to concentrate decreases by 2 points on the scale from 1 to 11. The sample average is 7 at age six. For children

in full-time care the chance of illnesses marginally increases (see column 1). The results suggest that full-time attendance has negative impacts for children's outcomes between three and six of the treatment group, i.e., of children attending day care at age four.

Table 4.7a: Estimation of changes in children's outcomes and quantity of day care (cDiD)

	Change in overall health	Change in ability to concentrate	Change in ability to comprehend
Full-time attendance	0.231*	-1.777***	0.252
	[0.1278]	[0.6853]	[0.4136]
N	228	220	205
R^2	0.119	0.131	0.137

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row. Note that all models of include as covariates the set of conditioning variables summarized in Table 4.5

4.5.2 Structural day care quality

So far the results suggest that changes in children's outcomes are not related to day care attendance at age four. In this chapter I assume that differences in children's health and personality characteristics between the ages three and six are driven by differences in day care quality[33]. Since this chapter combines data from the German Socio-Economic Panel Study (SOEP) with regional data from the "Kinder- und Jugendhilfestatistik" (statistics on child and youth welfare) on day care quality at the youth welfare office level, structural quality indicators on the county level are assumed to be exogenous to children's outcome changes, since the data on quality is not obtained from parents who provide information on their

[33]The results in Table 4.7a already suggest that differentiating "type of attendance" renders different results.

children's ability. Thus, structural quality of day care on the county level might explain part of the variation in children's outcomes. The estimates of Table 4.7 suggest that OLS estimations are biased and thus I assess potential effects of day care quality directly in the post-matching sample[34].

The regression of changes in health on day care quality in the matched sample suggests that a larger *child-staff-ratio* in the respective county (see column 1 of Table 4.8) increases children's chance of illnesses. Children in a larger group are exposed to more potential "infectious agents". In addition teachers are restricted in their time devoted to each child. Thus, children are more likely to be exposed to bacteria causing ear infections. Or children with dormant atopic eczema face a larger risk of infection, stress, or less care, which might awake or prolong their illness. With respect to changes in children's ability to concentrate I find negative correlations of *share of children not speaking German at home* and *share of staff holding advanced degree* (see column 2 of Table 4.8). These results show that children's ability to concentrate decrease in centers with a larger share of children not speaking German at home and in institutions where more teachers hold a degree. The latter correlation is counterintuitive, as teachers holding a degree are better trained to promote children's development. One possible explanation could be multicollinearity, i.e., the indicator *share of staff holding advanced degree* is correlated with other structural quality indicators. Before I turn to the potential problem of multicollinearity the remaining estimates of Table 4.8 are discussed. For changes in children's ability to comprehend a negative association with *share of children not speaking German at home* is depicted in column 3 of Table 4.8. This suggests that at an institution with a larger share of children not speaking German at home, children's ability to comprehend quickly decreases between age three and age six.

[34]For completeness Table A.4.6 in the Appendix shows the results of structural quality on changes in children's outcomes using OLS.

However, the results presented in models (1), (3), and (5) might still be biased due to omitted variables on the county level. For example, the effect of the indicator *share of children not speaking German at home* might be overestimated in Table 4.8, as children might live in counties whose characteristics, e.g. share of population with migration background or deprivation of neighborhoods, are related to changes in children's outcomes (overall health or ability to concentrate) and to the *share of children not speaking German at home*. Thus, before turning to possible average treatment effects on the treated, Table 4.8 also shows how the relationship between structural quality indicators and changes in child outcomes differ, if I include ***share of children aged 3-6 with foreign nationality on the county level***[35] in the analyses (see models (2), (4), and (6)).

Both correlations for structural quality indicator *share of children not speaking German at home* and (1) changes in children's ability to concentrate and (2) changes in children's ability to comprehend become insignificant, when I include the share of children aged 3-6 with foreign nationality on the county level in the analysis. This suggests that indeed without controlling for county characteristics, the indicator *share of children not speaking German at home* might be overestimated (see models (3) and (5)), as it captures other county characteristics related to changes in children's outcomes.

[35]The "share of children aged 3-6 with foreign nationality on the county level" can be downloaded from *Statistisches Bundesamt: GENESIS-Tabelle: Bevölkerungsstand: Bevölkerung nach Alter, Geschlecht und Nationalität – Stichtag 31.12.2009 – regionale Ebenen. online download 29.08.2012. and provides information of share of child population (age group 3-6) with migration background on the county level* (Statistisches Bundesamt, 2012).

Table 4.8: Estimation of changes in children's outcomes and structural day care quality (cDiD)

	Change in overall health		Change in ability to concentrate		Change in ability to comprehend	
	(1)	(2)	(3)	(4)	(5)	(6)
Day care attendance	0.028	0.025	0.176	0.173	-0.002	0.021
	[0.0570]	[0.0572]	[0.3089]	[0.3106]	[0.2403]	[0.2383]
Structural quality:						
Share of children not speaking German at home	0.004	0.002	-0.041*	-0.044	-0.031*	-0.010
	[0.0037]	[0.0047]	[0.0221]	[0.0286]	[0.0189]	[0.0225]
Child-staff-ratio	0.086**	0.089***	0.155	0.159	0.070	0.041
	[0.0333]	[0.0339]	[0.1395]	[0.1389]	[0.1237]	[0.1249]
Share of staff holding advanced degree	0.001	0.001	-0.026*	-0.027*	-0.007	-0.002
	[0.0024]	[0.0025]	[0.0145]	[0.0147]	[0.0105]	[0.0112]
N	517	517	502	502	484	484
R^2	0.075	0.077	0.093	0.093	0.104	0.110

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). The results presented in this table are obtained from a regression-adjusted diff-in-diff matching including pretreatment covariates as well as exogenous indicators of structural quality. Models (2), (4), and (6) also include *share of children aged 3-6 with foreign nationality* as covariate. The *share of children aged 3-6 with foreign nationality* is obtained from Statistisches Bundesamt: "GENESIS-Tabelle: Bevölkerungsstand: Bevölkerung nach Alter, Geschlecht und Nationalität – Stichtag 31.12.2009 – regionale Ebenen. online download 29.08.2012" and provides information of share of child population (age group 3-6) with migration background on the county level.

Yet, so far the estimates only depict associations of structural quality with changes in children's outcomes for all children (those of the treatment group and those of the control group.) – an intention-to-treat effect (ITT)[36]. In order to identify an effect of structural quality for those children attending day care institutions (an average treatment effect on the treated (ATT)), the analyses reported in Table 4.8 are run separately for children of the treatment group and for those of the control group. Ideally the analyses of structural quality in the control group should render insignificant correlations, as these children are not exposed to structural quality of day care centers at age four. Table 4.8a reports the same estimations as depicted in Table 4.8 but here the sample is restricted to children of the treatment group.

The results in Table 4.8a show that structural quality explains part of the variation in children's change in overall health and in their ability to concentrate. In the specification the *share of children not speaking German at home* seems to be a particular relevant indicator (see model (1) and (3)). Children's ability to concentrate decreases if they attend a day care center with a larger share of children not speaking German at home (see model (3) of Table 4.8a). With regard to illnesses, the estimates presented in Table 4.8a suggest that children's likelihood to suffer from ear infections or atopic eczema increases with a larger *child-staff-ratio* and with a larger *share of children not speaking German at home* (see model (1) and (2)). Again if I control for "share of children aged 3-6 with foreign nationality on the county level", *share of children not speaking German at home* is no longer significantly correlated with changes in overall health or changes in ability to concentrate for that matter.

[36]Regional data on structural day care quality allows for an intention-to-treat (ITT) analysis, because all children in the sample are prone to the same indicators if they live in the county regardless of their treatment status.

Table 4.8a: Estimation of changes in children's outcomes and structural day care quality (treatment group)

	Change in overall health		Change in ability to concentrate		Change in ability to comprehend	
	(1)	(2)	(3)	(4)	(5)	(6)
Structural quality:						
Share of children not speaking German at home	0.009*	0.007	-0.072**	-0.080	-0.033	-0.025
	[0.0048]	[0.0067]	[0.0339]	[0.0505]	[0.0279]	[0.0315]
Child-staff-ratio	0.127***	0.130***	0.078	0.090	0.076	0.060
	[0.0408]	[0.0423]	[0.2309]	[0.2264]	[0.1702]	[0.1750]
Share of staff holding advanced degree	0.002	0.001	-0.027	-0.029	-0.012	-0.010
	[0.0030]	[0.0033]	[0.0247]	[0.0242]	[0.0185]	[0.0185]
N	230	230	222	222	209	209
R^2	0.148	0.149	0.163	0.163	0.132	0.133

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). The results presented in this table are obtained from a regression-adjusted diff-in-diff matching including pretreatment covariates as well as exogenous indicators of structural quality. Models (2), (4), and (6) also include *share of children aged 3-6 with foreign nationality* as covariate. The *share of children aged 3-6 with foreign nationality* is obtained from Statistisches Bundesamt (2012) and provides information of share of child population (age group 3-6) with migration background on the county level.

Table 4.8b: Estimation of changes in children's outcomes and structural day care quality (control group)

	Change in overall health		Change in ability to concentrate		Change in ability to comprehend	
	(1)	(2)	(3)	(4)	(5)	(6)
Structural quality:						
Share of children not speaking German at home	0.002	-0.001	0.001	-0.018	-0.029	0.012
	[0.0050]	[0.0068]	[0.0328]	[0.0327]	[0.0236]	[0.0327]
Child-staff-ratio	0.050	0.054	0.250	0.270	0.002	-0.038
	[0.0459]	[0.0464]	[0.2211]	[0.2222]	[0.1598]	[0.1519]
Share of staff holding advanced degree	0.000	-0.001	-0.005	-0.009	0.007	0.015
	[0.0045]	[0.0047]	[0.0220]	[0.0232]	[0.0169]	[0.0174]
N	287	287	280	280	275	275
R^2	0.137	0.141	0.161	0.164	0.197	0.219

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). The results presented in this table are obtained from a regression-adjusted diff-in-diff matching including pretreatment covariates as well as exogenous indicators of structural quality. Models (2), (4), and (6) also include *share of children aged 3-6 with foreign nationality* as covariate. The *share of children aged 3-6 with foreign nationality* is obtained from Statistisches Bundesamt (2012) and provides information of share of child population (age group 3-6) with migration background on the county level.

The hypothesis of this chapter to estimate a potential causal effect of structural quality is supported by the estimates obtained in the control group (see Table 4.8b). Table 4.8b shows that all coefficients of structural quality are insignificant. Thus, separate analyses of changes in children's outcomes and day care quality seems to allow to estimate an average treatment effect of day care quality.

At the beginning of this chapter I argue that amount of time spent in day care and day care quality are important factors explaining how day care affects children's outcomes. Hence, in Table 4.8c I depict how changes in children's outcomes are related to full-time attendance and structural quality. The analyses shown in Table 4.8c are true just for the treatment group, as full-time attendance is investigated for those children attending day care at age four. Table 4.8c demonstrates that children's ability to concentrate significantly decreases if they spent a full day in day care (see model (3) and (4)). This negative association has already been determined in Table 4.7a.

In contrast to the previous estimates, Table 4.8c also includes structural quality indicators in the estimations. Controlling for structural day care quality on the county level does not eliminate the significant correlation of full-time attendance and changes in children's ability to concentrate. On the contrary, model (4) of Table 4.8c indicates that children's concentration not only decreases due to full-time attendance, but also if this day is spent in an institution where a higher *share of children not speaking German at home* exists. Even accounting for the *share of children aged 3-6 with foreign nationality at the county level* does not eliminate this negative relationship (see model (4) of Table 4.8c). This correlation might suggest that too many different languages spoken in a day care group might hamper children's ability to concentrate. Yet, the coefficient is marginally significant at the 10 per cent level. Thus, apart from examining structural quality it matters how long a child attends a particular institution, at least with regard to changes in their ability

to concentrate.

For changes in children's overall health Table 4.8c shows that full-time attendance is no longer significantly correlated (compared to result in Table 4.7a). With regard to structural quality, children's overall health is positively associated with a higher *child-staff-ratio*. Attending a day care center with a larger number of children per teacher significantly increases children's likelihood of suffering from ear infections or eczema (see model (1) and (2) of Table 4.8c). The correlation between *child-staff-ratio* and changes in children's overall health is persistent in all model specifications, suggesting that this structural quality measure matters for children's likelihood of infectious illnesses during early years. This finding is in line with findings from the pedagogical/psychological literature (for an overview of studies and results see Bradley and Vandell, 2007). No significant correlation is found for changes in children's ability to comprehend.

Table 4.8c: Estimation of changes in children's outcomes and structural day care quality (treatment group)

	Change in overall health		Change in ability to concentrate		Change in ability to comprehend	
	(1)	(2)	(3)	(4)	(5)	(6)
Full-time attendance	0.131	0.137	-1.567**	-1.536**	0.244	0.209
	[0.1340]	[0.1360]	[0.6273]	[0.6032]	[0.4260]	[0.4250]
Structural quality:						
Share of children not speaking German at home	0.009*	0.006	-0.068**	-0.083*	-0.033	-0.019
	[0.0052]	[0.0071]	[0.0296]	[0.0442]	[0.0290]	[0.0322]
Child-staff-ratio	0.139***	0.142***	0.256	0.280	-0.034	-0.062
	[0.0483]	[0.0494]	[0.2404]	[0.2431]	[0.1990]	[0.2026]
Group size	0.014	0.014	0.109	0.113	-0.066	-0.071
	[0.0184]	[0.0186]	[0.1148]	[0.1170]	[0.0782]	[0.0755]
Share of staff holding advanced degree	0.004	0.003	-0.010	-0.013	-0.016	-0.012
	[0.0038]	[0.0039]	[0.0243]	[0.0242]	[0.0208]	[0.0209]
N	222	222	214	214	201	201
R^2	0.159	0.160	0.181	0.183	0.154	0.156

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). The results presented in this table are obtained from a regression-adjusted diff-in-diff matching including pretreatment covariates as well as exogenous indicators of structural quality. Models (2), (4), and (6) also include *share of children aged 3-6 with foreign nationality* as covariate. The *share of children aged 3-6 with foreign nationality* is obtained from Statistisches Bundesamt (2012) and provides information of share of child population (age group 3-6) with migration background on the county level.

In addition, the analyses depicted in Table 4.8, 4.8a and 4.8b all include just three out of four described structural quality indicators (see Section 4.3.4). I omitted *group size* from the specification, as this indicator is most likely correlated with the indicator *child-staff-ratio*. To address multicollinearity of the structural quality indicators, I run separate regressions for each indicator plus different specifications, e.g. controlling for *group size* and *child-staff-ratio* simultaneously, for all three dependent variables.

Table 4.9 depicts the results for children's ability to concentrate (comparable to Table 4.8)[37]. Besides *share of children not speaking German at home*, the *child-staff-ratio* is significantly correlated with changes in children's ability to concentrate if it is the only structural quality indicator included in the analysis (see model (3) of Table 4.9). However, a larger *child-staff-ratio* increases children's concentration. This correlation is counterintuitive as a higher number of children per teacher leads to less interaction between children and teacher. In order to further disentangle this counterintuitive result Table A.4.9 in Appendix interacts *child-staff-ratio* with *share of staff holding advanced degree* in the estimation of structural quality and children's ability to concentrate[38]. The correlation of *share of staff holding advanced degree* with changes in children's ability to concentrate is only marginally significant if the model includes *share of children not speaking German at home* and the *child-staff-ratio* as additional indicators suggesting that the interaction effect found in Table A.4.9 distorts the estimation in model (6) and (7) of Table 4.9 or model (3) and (4) of Table 4.8 for that matter.

[37]The different model specification for health and the ability to comprehend are shown in Table A.4.7 and Table A.4.8 respectively.

[38]Table A.4.9 shows that the correlation of child-staff-ratio and children's ability to concentrate is linked with teachers educational level. A larger share of teachers holding an advanced degree increases children's ability to concentrate. If these teachers are those supervising more children (in larger groups) the correlation becomes negative, reducing the positive effect, i.e., the increase in children's ability to concentrate of child-staff-ratio.

Interestingly, if *child-staff-ratio* and *group size* are included in the analysis simultaneously, group size marginally increases children's concentration (see model (10) of Table 4.9). Again this correlation is counterintuitive, as a higher number of children per group increases rather than decreases children's ability to concentrate. However, Table A.4.9 in Appendix shows that this marginal statistical effect vanishes if *group size* is interacted with teachers' education (*share of staff holding advanced degree*). A possible interpretation of these findings is that teachers, who are "better" trained, are able to react and response more sensitive to children's needs – even in large groups.

If the estimations of Table 4.9 are run separately for treatment and control group the findings of Table 4.8a and 4.8b remain[39]. Changes in children's overall health are increased by higher child-staff-ratios, i.e., children's chances of illnesses augment. As mentioned before a higher number of children per teacher provides a larger group of potential "infectious children", which increases children's likelihood of suffering from ear infections[40]. For children in the control group none of the structural quality indicators are significant.

In sum, quantity of day care and structural quality of day care explain part of the variation in children's health changes as well as in changes in children's ability to concentrate. By applying conditional difference-in-differences matching this chapter shows that accounting for unobserved heterogeneity and for omitted variable bias is necessary to obtain robust results of day care (quality). Analyses performed in the matched sample indicate that quantity and quality rather than attendance of day care are important for children's development between age three and age six. Already the broader measure of quality, i.e., quantity of day care

[39]These tables are available from the author upon request.
[40]Bradley and Vandell (2007) provide an overview of studies and results finding similar relationships for "static" health outcomes.

(full-time attendance), suggests that quality should be considered when assessing day care effects on child outcomes. Since all analyses are based on dynamic child outcomes, I perform some sensitivity checks using children's outcome at age six and regressing these "static" outcomes or "levels" on day care attendance and day care quality.

Table 4.9: Estimation of changes in children's ability to concentrate and structural quality of day care (cDiD)

	Change in ability to concentrate		Change in ability to concentrate			Change in ability to concentrate		Change in ability to concentrate		Change in ability to concentrate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Day care attendance	0.161	0.166	0.163	0.183	0.167	0.180	0.178	0.198	0.199	0.211	0.208
	[0.3060]	[0.3076]	[0.3111]	[0.3107]	[0.3125]	[0.3102]	[0.3116]	[0.3067]	[0.3084]	[0.3085]	[0.3103]
Structural quality:											
Share of children not speaking German at home	-0.043**	-0.039				-0.042*	-0.044	-0.054***	-0.054**	-0.041*	-0.045
	[0.0188]	[0.0255]				[0.0224]	[0.0288]	[0.0186]	[0.0268]	[0.0220]	[0.0286]
Share of children aged 3-6 with		-0.018					0.009		0.003		0.017
foreign nationality on the county level[1]		[0.0710]					[0.0719]		[0.0702]		[0.0701]
Child-staff-ratio			0.247**			0.151	0.154			0.252	0.258
			[0.1108]			[0.1391]	[0.1385]			[0.1596]	[0.1595]
Group size				0.089				0.108	0.109	0.142*	0.143*
				[0.0621]				[0.0683]	[0.0685]	[0.0754]	[0.0758]
Share of staff holding advanced degree					-0.014	-0.028*	-0.028*	-0.013	-0.013	-0.014	-0.015
					[0.0138]	[0.0144]	[0.0146]	[0.0162]	[0.0164]	[0.0162]	[0.0164]
N	503	502	505	506	506	502	502	503	502	502	502
R^2	0.086	0.087	0.079	0.077	0.075	0.092	0.092	0.095	0.095	0.099	0.099

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). The results presented in this table are obtained from a regression-adjusted diff-in-diff matching including pretreatment covariates plus indicators of structural quality including *share of children attending day care (age 3-6)* in respective youth welfare office district. [1] *Share of children aged 3-6 with foreign nationality* is obtained from Statistisches Bundesamt (2012) and provides information of share of child population (age group 3-6) with migration background on the county level.

4.6 Sensitivity analysis

Comparing my obtained results to the literature is difficult, since all studies investigate children's outcomes after treatment without incorporating the level of development prior treatment (day care attendance). In order to verify whether day care attendance relates similarly to children's skill level at age six, this section presents ordinary least squares estimates and propensity score matching estimates of "static" child outcomes.

4.6.1 Day care attendance

The sample used in this chapter comprises only 9 per cent of children which suffer from atopic eczema at age six, whereas 32 per cent of children are exposed to ear infection (see Table 4.1). Thus, the following sensitivity analysis of "static" child outcomes measured at age six examines ear infections as dependent variable and not neurodermatitis. These additional analyses might provide some added value to the economic literature, since ear infections or personality characteristics have not been estimated with respect to day care quality or using propensity score matching to identify an effect of day care attendance for that matter.

If the incidence of otitis media at age six is regressed on day care attendance at age 4 without accounting for ear infections at age three a marginally significant correlation is found (see column 1 of Table 4.10) suggesting that day care attendance increases children's chances of illnesses[41]. When I control for children's incidence of ear infection at age three in the analysis, the marginally significant correlation with day care attendance remains. This result also shows that the

[41]This is line with findings discussed in the pedagogical/psychological literature, see for example the study by Bradley and Vandell (2007); Chen (2012).

pre-treatment level of ear infection is significantly correlated with their level at age six. It also explains a large part of the variance of the outcome level at age six, as the R^2 increases from 0.038 to 0.157 (see column 1 and 2 of Table 4.10). Table 4.10 shows that children's ability to concentrate marginally increases if children attend day care at age four (see column 3 and 4)[42]. The estimates of day care attendance on children's ability to comprehend are both statistically insignificant (see column 5 and 6 of Table 4.10).

Apart from the outcome measures discussed in this chapter, I also analyze children's socio-emotional behavior at age six. Children's socio-emotional behavior is surveyed using the "Strengths and Difficulties Questionnaire (SDQ)" in the German Socio-Economic Panel Study. This non-cognitive skill of children is often used in the economics literature to assess the effects of day care attendance (see for example the studies by Datta Gupta and Simonsen, 2010, 2011). Hence in order to assess if different measures and an alternative estimation strategy might render different results, I regress children's SDQ on day care attendance at age four (see column 7 of Table 4.10). Table 4.10 depicts no significant association of children's socio-emotional behavior with day care attendance in the sample used in this chapter. Yet, the estimation of children's SDQ does not account for omitted variable bias and thus cannot be fully compared to the study by Datta Gupta and Simonsen (2010) who apply an instrumental variable approach.

In contrast to other studies on day care attendance, I utilize propensity score matching to control for omitted variable bias. When I examine the models shown in Table 4.10 in the post-matching environment, all outcome variables are insignificantly correlated with day care attendance at age four (see Table A.4.10 in the Appendix)[43]. This might be due the choice of treatment (day care attendance

[42]This correlation remains if I again include children's outcome level measured at age three.
[43]These findings differ from previous studies which find a significant effect of day care attendance

at age four) in this chapter or due to unobserved heterogeneity which might still distort the estimations. All outcome variables used in the sensitivity analysis only comprise the level measured at age six and not changes over time, which limits the estimation strategy to propensity score matching without combining it with a difference-in-differences estimator.

on children's socio-emotional behavior (Datta Gupta and Simonsen, 2010).

Table 4.10: Estimates of children's outcomes at age six and day care attendance (OLS)

	Ear infection	Ear infection	Ability to concentrate	Ability to concentrate	Ability to comprehend	Ability to comprehend	SDQ
Day care attendance	0.064*	0.070*	0.400*	0.349*	0.013	0.020	-0.203
	[0.0389]	[0.0368]	[0.2267]	[0.2130]	[0.1908]	[0.1777]	[0.4801]
Outcome measured at age three:							
Ear infection		0.384***					
		[0.0432]					
Ability to concentrate				0.355***			
				[0.0384]			
Ability to comprehend						0.328***	
						[0.0549]	
N	668	668	651	649	625	622	661
R^2	0.038	0.157	0.069	0.187	0.053	0.139	0.063

Note: SOEP v28 (2005-2011). Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row. Note that all models of include as covariates age of child, gender(female=1), migration background, age of mother, maternal years of education, maternal employment status (full time, part time, Ref. not employed), region(East Germany=1), partner present(yes=1), number of children <16 in HH, and time dummies.

4.6.2 Structural day care quality

In this sub section day care quality is related to children's health and non-cognitive skills *at age six* applying a post-matching analysis. In Table 4.11 the estimates of children's "static outcomes" controlling for structural day care quality are presented. These models are run in the common support sample examining children in day care at age four and "nearly" identical controls. As Table 4.10 already shows how important children's level of illness or ability at age three are to explain children's outcome at age six, they are included in the specifications.Table 4.11 depicts different correlations of structural quality with children's outcomes. For example, the ability to concentrate at age six decreases with a higher *share of staff holding advanced degree*[44]. Apart from a marginal significant correlation of *share of children not speaking German at home* with children's ability to comprehend, no other significant associations are found. Thus, accounting for changes in children's outcomes over time might shed further light on potential "effects" of day care (quality).

[44]This counterintuitive correlation might again reflect multicollinearity among the chosen structural quality indicators (see Section 4.5 for an in depth discussion).

Table 4.11: Estimates of children's outcomes at age six and structural day care quality (Propensity score matching)

	Ear infection	Ear infection	Ability to concentrate	Ability to concentrate	Ability to comprehend	Ability to comprehend	SDQ
Day care attendance	0.063	0.062	0.624**	0.543**	-0.001	0.042	-0.357
	[0.0438]	[0.0409]	[0.2466]	[0.2382]	[0.2081]	[0.1883]	[0.5703]
Structural quality:							
Share of children not speaking German at home	-0.000	0.001	-0.018	-0.019	-0.014	-0.019*	-0.042
	[0.0022]	[0.0021]	[0.0135]	[0.0113]	[0.0115]	[0.0111]	[0.0324]
Child-staff-ratio	0.021	0.040	-0.196	-0.010	-0.190	-0.170	0.100
	[0.0404]	[0.0375]	[0.1914]	[0.1688]	[0.1557]	[0.1363]	[0.4588]
Share of staff holding advanced degree	0.004	0.004	-0.030**	-0.025**	-0.007	-0.008	0.022
	[0.0025]	[0.0023]	[0.0140]	[0.0128]	[0.0098]	[0.0087]	[0.0326]
Outcome measured at age three:							
Ear infection		0.373***					
		[0.0484]					
Ability to concentrate				0.338***			
				[0.0443]			
Ability to comprehend						0.327***	
						[0.0558]	
N	515	515	501	500	483	482	510
R^2	0.053	0.169	0.093	0.194	0.091	0.182	0.089

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). Note that all models of include as covariates age of child, gender(female=1), migration background, age of mother, maternal years of education, maternal employment status (full time, part time, Ref. not employed), region(East Germany=1), partner present(yes=1), number of children <16 in HH, and time dummies.

4.7 Conclusion

This chapter contributes to the small literature on day care quality and its potential association with children's health and children's personality characteristics. The effect of day care attendance on children's cognitive and non-cognitive skills as well as health problems has been examined widely. Yet quality of institutions and its influence on early human capital accumulation has been scarcely assessed by economists, although quality would be highly correlated with any day care effects. In addition, this chapter investigates changes in children's outcome arguing that the "starting level" of non-cognitive skill or health should be considered in the analyses even of day care attendance, as otherwise omitted variable bias might distort obtained results. Based on regional data from the statistics of child and youth welfare ("Kinder- und Jugendhilfestatistik") and data from the German Socio-Economic Panel Study (SOEP), I assess the effect of day care attendance, full-time attendance (quantity of day care), and structural day care quality on changes in children's health and personality characteristics.

The results of conditional difference-in-differences matching show that day care attendance at age four is not significantly correlated with changes in children's health, their ability to concentrate, or their ability to comprehend. Yet, if I examine the amount of time spent in day care, i.e., full-time attendance or structural quality for that matter and possible effects on changes in children's outcomes a different picture emerges. Including quantity of day care and structural quality indicators in the analyses explains part of the variation in children's differences. Full-time attendance significantly decreases children's ability to concentrate for children in the treatment group. Since the regional data provides day care quality on the county level, I estimate an intention-to-treat effect. In order to identify an effect of structural quality for the treated children, i.e., those attending day care at age four

for the first time, I estimate this relationship separately for children of treatment and control group. This renders significant coefficient of structural quality for the treated and no significant correlation for the untreated. Thus, separate analyses for treatment and control group allow to obtain an average treatment effect of day care quality.

Differences in children's health and personality characteristics are correlated with structural day care quality in a general intention-to-treat setting as well as in an attempted average treatment effect of the treated framework. Children's chances of illnesses between age three and age six increase with a higher *child-staff-ratio* and marginally increase with a larger *share of children not speaking German at home*. This finding indicates that children who share a teacher with more children have a greater risk of infection than children in a smaller group.

Children's ability to concentrate marginally decrease with a higher *share of staff holding advanced degree* and with a larger *share of children not speaking German at home*. The former correlation is counterintuitive, as teachers holding a degree are better trained to promote children's development. This association is most likely caused by multicollinearity, i.e., the indicator *share of staff holding advanced degree* is correlated with other structural quality indicators. The correlation of *share of staff holding advanced degree* with changes in children's ability to concentrate is only marginally significant if the model includes *share of children not speaking German at home* and the *child-staff-ratio* as additional indicators. Further specifications show that teachers educational level is correlated with the child-staff-ratio. Apart from significant associations between structural quality and changes in children's ability to concentrate, this chapter also demonstrates that a longer amount of time spent in day care, i.e., full-time attendance, significantly decreases children's concentration level between age three and age six.

Children's ability to comprehend is also marginally correlated with the *share of children not speaking German at home*. This personality characteristic of young children can be the least explained by day care (quality) in this chapter. Even in the sensitivity analysis relating children's outcome at age six instead of dynamics in outcomes to day care attendance and structural quality only variation in children's ability to concentrate and their chance of ear infection is explained.

The robustness checks further indicate that assessing changes in children's outcomes complement existing findings on early childhood development and day care (quality). The literature so far finds positive effects of day care attendance on non-cognitive skills and children's health around age six, but often without controlling for children's skills at an earlier age. Conditional difference-in-differences matching and ordinary least squares both demonstrate that skills prior treatment matter. Nonetheless, I only show that the choice of treatment in this chapter (day care attendance at age four) is not significantly associated with changes in children's health and personality characteristics. Further analyses should therefore also consider the influence of day care attendance at an earlier age on changes in child outcomes.

With regards to day care quality, already structural indicators of day care institutions explain part of the variance in child outcomes. This chapter uses regional data to analyze structural quality indicators on the county level, such as (1) child-staff-ratio, (2) group size, (3) share of children not speaking German at home, and (4) share of teachers holding advanced degree (educational level of staff). The estimations reveal that especially the *child-staff-ratio* and to a smaller extent the *share of children not speaking German at home* are significantly correlated with changes in child outcomes. Thus, future research should consider day care quality when assessing child development with respect to day care participation.

The possible mechanism linking structural quality and child health and personality characteristics could be the interaction between teachers and children. This hypothesis cannot be tested with the data used in this chapter, but data on process quality of day care centers often used in the pedagogical/psychological literature could shed further light on day care quality. In addition, my findings are limited to day care quality at the county level and the obtained results might still be biased due to omitted variables on the county level. A first attempt to account for county-specific variables in this chapter confirms this assumption for the *share of children not speaking German at home*.

Using advanced methods to reduce selection bias and to identify a causal effect, this chapter shows that analyzing differences in children's development compared to *static* outcomes at a particular age is important. Conditional difference-in-differences matching estimates of day care attendance are not significantly related to changes in children's health or personality characteristics. Yet, day care attendance is significantly correlated with children's ability to concentrate in the regression-adjusted propensity score matching approach. Day care quality is important for children's dynamic and static outcomes showing that day care attendance explains only part of the variation in children's development.

With regards to policy implications, this chapter shows that structural quality of day care institutions should not be neglected, as it is part of children's environment and supports early investment in human capital. The findings suggest that the *child-staff-ratio* is significant. Children's overall health is positively correlated with a higher child-staff-ratio meaning that children are more likely to suffer from ear infections or atopic eczema if a larger number of children per teacher are found in a day care institution. The literature outside the field of economics concludes the same negative relationship, i.e., a smaller child-staff-ratio is better for children's

health. This chapter provides further evidence that this indicator should be considered by policy makers. The indicator *share of children not speaking German at home* reflects a negative correlation with children's outcomes on the county level. For policy makers this might imply that in counties with a larger share of children with foreign nationality, children would benefit if additional teachers – eventually also with a foreign background – were hired in these counties to help promote children's development. However, the analyses presented in this chapter are limited, as I measure short-term changes in children's outcomes and define day care attendance rather narrow. On the one hand children might be able to catch up in the long run, and on the other hand different treatment cut-offs might provide additional insight. Thus, I suggest to further investigate day care quality and its relation to changes in child outcomes by explicitly examining long-term outcomes, day care quantity, and day care quality.

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Appendix

Table A.4.1: Children's care arrangement at age three and age six

Type of care	Mean	Std. dev.	Min	Max	N
Care settings at age 2/3					
Partner of mother	0.79	0.41	0	1	701
Grandparents	0.56	0.49	0	1	707
Siblings	0.13	0.33	0	1	714
Relatives	0.11	0.31	0	1	714
Day care institution	0.45	0.49	0	1	714
Family day care	0.04	0.20	0	1	716
Care settings at age 5/6					
Partner of mother	0.75	0.43	0	1	698
Grandparents	0.54	0.49	0	1	710
Siblings	0.18	0.39	0	1	716
Relatives	0.09	0.29	0	1	716
Day care institution	0.77	0.42	0	1	710
Family day care	0.01	0.08	0	1	715

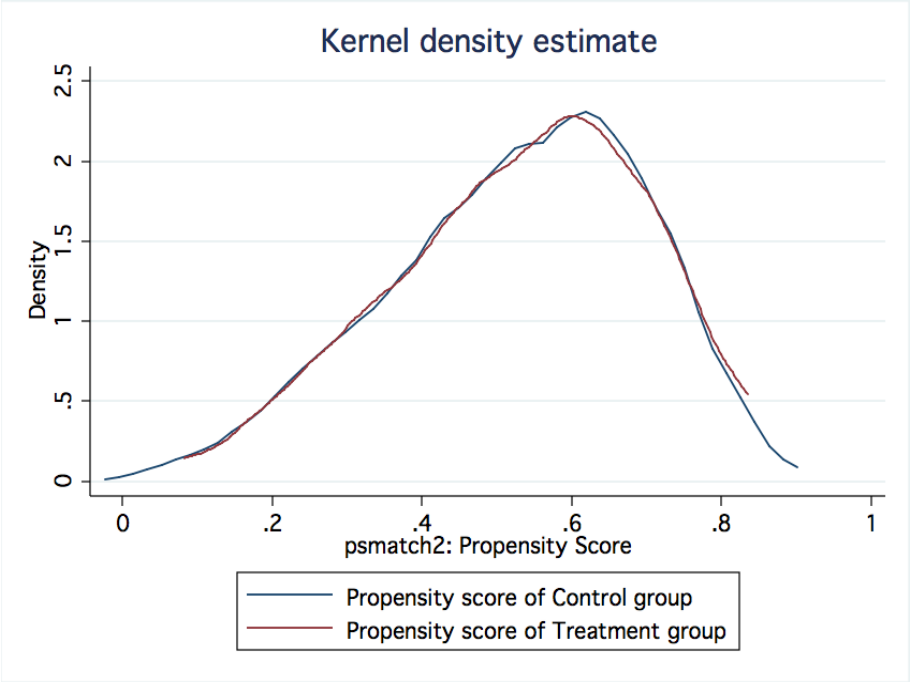
Note: SOEP v28 (2005-2011). Own calculations. The care categories are not mutually exclusive, i.e., a child attends a day care center and her grandparents also look after her during the week.

Table A.4.2: Summary of structural quality in statistics of child and youth welfare (2010)

Structural indicator	2010			
	Mean	Std. dev.	Min	Max
Share of children not speaking German at home	14.6	9.7	0.5	53.9
Child-staff-ratio[1]	8.9	1.5	6.2	14.8
Group size[1]	22.4	2.9	14	27
Educational level of teachers				
Share of teachers with no degree	24.5	12.4	2.4	52.3
Share of teachers with degree	75.5	12.4	47.7	97.6

Note: Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010). Own calculations. All indicators displayed in this table refer to the child population aged three to six (age group 3-6) in each county.

Figure A.4.1: Propensity score of treated and untreated children



Data Source: SOEP v28 (2005-2011), own calculations.

Table A.4.3: Balance of covariates between treatment and control group

	Mean		Bias	
	Treated	Untreated	|Bias|	p>|t|
Full time employed				
Unmatched	0.04	0.11	26.0	0.001
Matched	0.05	0.04	2.4	0.738
Part time employed				
Unmatched	0.19	0.19	0.1	0.986
Matched	0.20	0.19	3.4	0.714
Years of education				
Unmatched	12.59	13.19	21.6	0.006
Matched	12.63	12.48	5.2	0.557
Partnered				
Unmatched	0.93	0.89	12.6	0.103
Matched	0.94	0.92	4.4	0.582
Logarithmic household income				
Unmatched	7.78	7.77	0.6	0.934
Matched	7.78	7.78	1.0	0.8907
Number of children < 16				
Unmatched	1.96	1.89	6.7	0.384
Matched	1.98	1.97	0.3	0.976
Federal state				
Unmatched	6.72	9.05	62.2	0.000
Matched	6.82	6.59	5.9	0.450
Living in an urban community				
Unmatched	0.27	0.29	6.7	0.411
Matched	0.29	0.27	4.6	0.612
Maternal age at birth				
Unmatched	30.57	30.80	4.1	0.589
Matched	030.79	30.54	4.7	0.608
Satisfaction with being a mother				
Unmatched	0.13	0.18	14.3	0.075
Matched	0.11	0.14	7.5	0.374
Maternal personality traits				
Extraversion				
Unmatched	-0.05	0.04	8.8	0.266
Matched	0.00	0.04	4.3	0.623
Openness				
Unmatched	-0.02	0.04	5.9	0.455
Matched	0.00	-0.00	0.6	0.951
Conscientiousness				
Unmatched	0.02	0.02	0.4	0.961
Matched	0.00	0.01	0.2	0.982
Neuroticism				
Unmatched	-0.07	0.02	8.9	0.262
Matched	-0.07	-0.06	1.6	0.858
Agreeableness				
Unmatched	-0.00	0.1	1.0	0.901
Matched	0.03	0.08	4.9	0.587

Note: All variables are measured at age three of the child unless indicated otherwise. SOEP 28v (2002-2011). Own calculations.

Table A.4.3 continued

	Mean		Bias	
	Treated	Untreated	|Bias|	p>|t|
Child's gender				
Unmatched	0.54	0.51	5.7	0.455
Matched	0.55	0.53	3.2	0.723
Child's migration background				
Unmatched	0.25	0.18	16.7	0.026
Matched	0.26	0.28	4.6	0.645
Child's health around birth				
Unmatched	0.05	0.08	12.3	0.129
Matched	0.04	0.04	1.9	0.791
Child's "skills" at birth				
Low birth weight				
Unmatched	0.07	0.06	6.0	0.448
Matched	0.06	0.05	3.1	0.715
Child's skills at age three				
Verbal skills				
Unmatched	8.85	9.17	21.0	0.005
Matched	0.8.92	8.95	2.5	0.796
Motor skills				
Unmatched	7.92	8.18	14.7	0.053
Matched	7.99	8.06	4.0	0.796
Social skills				
Unmatched	8.57	8.99	27.6	0.000
Matched	8.69	8.75	3.9	0.680
Daily activities				
Unmatched	5.76	6.74	41.7	0.000
Matched	5.85	5.96	4.6	0.618

Note: All variables are measured at age three of the child unless indicated otherwise. SOEP 28v (2002-2011). Own calculations.

Table A.4.4: Estimation of changes in children's outcomes and day care attendance at age four (cDiD)

	Change in overall health	Change in ability to concentrate	Change in ability to comprehend
Day care attendance	0.065	0.213	0.063
	[0.0495]	[0.2904]	[0.2202]
N	549	533	508
R^2	0.057	0.033	0.056

Note: SOEP v28 (2005-2011). Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row. Note that all models include as covariates age of child, gender(female=1), migration background, age of mother, maternal years of education, maternal employment status (full time, part time, Ref. not employed), region(East Germany=1), logarithmic household income around age 3, partner present(yes=1), number of children <16 in HH, and time dummies.

Table A.4.5: Estimation of changes in children's outcomes and quantity of day care (OLS)

	Change in overall health	Change in ability to concentrate	Change in ability to comprehend
Full-time attendance	0.240**	-1.822***	-0.095
	[0.1165]	[0.6931]	[0.4611]
N	263	254	240
R^2	0.096	0.078	0.057

Note: SOEP v28 (2005-2011). Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row. Note that all models include as covariates age of child, gender(female=1), migration background, age of mother, maternal years of education, maternal employment status (full time, part time, Ref. not employed), region(East Germany=1), logarithmic household income around age 3, partner present(yes=1), number of children <16 in HH, and time dummies.

Table A.4.6: Estimation of changes in children's outcomes and structural day care quality (OLS)

	Change in overall health	Change in ability to concentrate	Change in ability to comprehend
Day care attendance	0.080*	0.290	0.050
	[0.0482]	[0.2757]	[0.2052]
Structural quality:			
Share of children not speaking German at home	0.004	-0.020	-0.032***
	[0.0023]	[0.0160]	[0.0115]
Child-staff-ratio	0.050	0.251	-0.246
	[0.0431]	[0.2005]	[0.1736]
Share of staff holding advanced degree	0.003	-0.019	-0.017*
	[0.0028]	[0.0142]	[0.0096]
N	602	585	566
R^2	0.050	0.038	0.061

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). Note that all models include as covariates age of child, gender(female=1), migration background, age of mother, maternal years of education, maternal employment status (full time, part time, Ref. not employed), region(East Germany=1), logarithmic household income around age 3, partner present(yes=1), number of children <16 in HH, time dummies, and *share of children attending day care (age 3-6)* in respective youth welfare office district.

Table A.4.7: Estimation of changes in children's overall health and structural day care quality (cDiD)

	Change in overall health		Change in overall health			Change in overall health		Change in overall health		Change in overall health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Day care attendance	0.031	0.029	0.029	0.029	0.030	0.029	0.026	0.029	0.027	0.031	0.028
	[0.0570]	[0.0574]	[0.0564]	[0.0577]	[0.0574]	[0.0568]	[0.0569]	[0.0576]	[0.0578]	[0.0572]	[0.0573]
Share of children not speaking German at home	-0.001	-0.004				0.004	0.002	-0.001	-0.002	0.004	0.001
	[0.0034]	[0.0045]				[0.0037]	[0.0047]	[0.0034]	[0.0049]	[0.0037]	[0.0047]
Share of children aged 3-6 with		0.010					0.012		0.007		0.013
foreign nationality on the county level[1]		[0.0115]					[0.0121]		[0.0119]		[0.0123]
Child-staff-ratio			0.072**			0.086**	0.089***			0.092***	0.096***
			[0.0294]			[0.0333]	[0.0340]			[0.0348]	[0.0357]
Group size				-0.009				-0.003	-0.003	0.009	0.010
				[0.0127]				[0.0145]	[0.0145]	[0.0140]	[0.0140]
Share of staff holding advanced degree					0.003	0.001	0.001	0.003	0.002	0.002	0.002
					[0.0023]	[0.0024]	[0.0025]	[0.0027]	[0.0027]	[0.0026]	[0.0027]
N	518	517	520	521	521	517	517	518	517	517	517
R^2	0.055	0.056	0.072	0.056	0.058	0.075	0.077	0.058	0.058	0.076	0.078

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). The results presented in this table are obtained from a regression-adjusted diff-in-diff matching including pretreatment covariates plus indicators of structural quality including *share of children attending day care (age 3-6)* in respective youth welfare office district. [1] *Share of children aged 3-6 with foreign nationality* is obtained from Statistisches Bundesamt (2012) and provides information of share of child population (age group 3-6) with migration background on the county level.

Table A.4.8: Estimation of changes in children's ability to comprehend and structural day care quality (cDiD)

	Change in ability to comprehend		Change in ability to comprehend			Change in ability to comprehend		Change in ability to comprehend		Change in ability to comprehend	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Day care attendance	-0.006	0.021	-0.006	-0.014	-0.003	-0.001	0.023	-0.008	0.016	-0.007	0.016
	[0.2378]	[0.2368]	[0.2400]	[0.2416]	[0.2406]	[0.2408]	[0.2388]	[0.2417]	[0.2403]	[0.2429]	[0.2408]
Share of children not speaking German at home	-0.034**	-0.011				-0.033*	-0.010	-0.035**	-0.010	-0.033*	-0.010
	[0.0155]	[0.0196]				[0.0189]	[0.0225]	[0.0168]	[0.0218]	[0.0188]	[0.0224]
Share of children aged 3-6 with		-0.109*					-0.109*		-0.112*		-0.112*
foreign nationality on the county level[1]		[0.0592]					[0.0636]		[0.0629]		[0.0644]
Child-staff-ratio			0.176*			0.067	0.036			0.040	0.004
			[0.0983]			[0.1230]	[0.1245]			[0.1285]	[0.1278]
Group size				-0.048				-0.042	-0.044	-0.036	-0.043
				[0.0468]				[0.0561]	[0.0537]	[0.0587]	[0.0557]
Share of staff holding advanced degree					0.001	-0.008	-0.003	-0.012	-0.007	-0.012	-0.007
					[0.0101]	[0.0106]	[0.0113]	[0.0117]	[0.0121]	[0.0118]	[0.0122]
N	485	484	487	488	488	484	484	485	484	484	484
R^2	0.102	0.110	0.094	0.091	0.089	0.101	0.108	0.102	0.110	0.102	0.110

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). The results presented in this table are obtained from a regression-adjusted diff-in-diff matching including pretreatment covariates plus indicators of structural quality including *share of children attending day care (age 3-6)* in respective youth welfare office district. [1] *Share of children aged 3-6 with foreign nationality* is obtained from Statistisches Bundesamt (2012) and provides information of share of child population (age group 3-6) with migration background on the county level.

Table A.4.9: Estimation of changes in children's outcomes and structural day care quality (cDiD)

	Change in ability to concentrate		Change in ability to concentrate	
	(1)	(2)	(3)	(4)
Day care attendance	0.140	0.135	0.209	0.205
	[0.3112]	[0.3135]	[0.3096]	[0.3108]
Structural quality:				
Share of children not speaking German at home	-0.031	-0.036	-0.047**	-0.053*
	[0.0239]	[0.0290]	[0.0195]	[0.0269]
Child-staff-ratio	3.493**	3.523**		
	[1.4931]	[1.5038]		
Share of staff holding advanced degree	0.325**	0.327**	0.132	0.142
	[0.1550]	[0.1557]	[0.1272]	[0.1271]
Child-staff-ratio*Education of staff	-0.038**	-0.039**		
	[0.0167]	[0.0168]		
Group size*Education of staff			-0.006	-0.007
			[0.0054]	[0.0054]
Group size			0.622	0.660
			[0.4746]	[0.4761]
Share of children aged 3-6 with foreign nationality on the county level[1]		0.022		0.028
		[0.0687]		[0.0717]
N	502	502	503	502
R^2	0.103	0.104	0.099	0.099

Note: SOEP v28 (2005-2011) and Statistisches Bundesamt: Statistiken der Kinder- und Jugendhilfe (2010), matched sample. Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row (clustered on the youth welfare office district). Note that all models include *share of children attending day care (age 3-6)* in respective youth welfare office district. [1] *Share of children aged 3-6 with foreign nationality* is obtained from Statistisches Bundesamt (2012) and provides information of share of child population (age group 3-6) with migration background on the county level.

Table A.4.10: Estimation of children's outcomes at age six and day care attendance (Propensity score matching)

	Ear infection	Ear infection	Ability to concentrate	Ability to concentrate	Ability to comprehend	Ability to comprehend	SDQ
Day care attendance	0.042	0.034	0.369	0.311	0.118	0.085	0.336
	[0.0439]	[0.0432]	[0.2439]	[0.2363]	[0.1936]	[0.1909]	[0.5307]
Outcome measured at age three:							
Ear infection		0.281***					
		[0.0546]					
Ability to concentrate				0.239***			
				[0.0504]			
Ability to comprehend						0.259***	
						[0.0574]	
N	551	551	536	535	511	510	516
R^2	0.100	0.159	0.194	0.240	0.201	0.255	0.174

Note: SOEP v28 (2005-2011). Own calculations. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Robust std. errors in second row. Note that all models of include as covariates age of child, gender(female=1), migration background, age of mother, maternal years of education, maternal employment status (full time, part time, Ref. not employed), region(East Germany=1), partner present(yes=1), number of children <16 in HH, and time dummies.

5 Conclusion

In our modern and complex society rises the demand for social skills and competencies. Accordingly, studying the development of non-cognitive skills gains in importance both in the field of the economics of education and in the public debate. In this dissertation I investigate different factors that influence non-cognitive development in early childhood and in adolescence by emphasizing the family environment and early education and care outside the home. Both are significant determinants of human capital accumulation in Economics and research so far has less examined their relation to non-cognitive skills and chances of illnesses.

In **Chapter 2** I show that multiple partnership transitions of mothers experienced by children from birth through age six increase preschool children's socio-emotional problems as well as the likelihood of adolescents believing that life depends on others or fate. These findings support my hypothesis that family instability rather than simply family structure affect non-cognitive development. Family instability captures the dynamics of today's partnerships which change over time, i.e., after a divorce/separation. Mothers are nowadays less likely to remain single for a longer period of time and the likelihood of re-partnering increases (see Cherlin, 2009). The idea of "marriage-go-around" comparing relationships to a carousel indicates that children's environment are more likely to change considerably than it used to in past times. In Germany remarriages represent a relatively high share of marriages: In 2010, 62,010 of 382,047 marriages in Germany are remarriages (16.2 per cent) and 246,052 are first-time marriages (Statistisches Bundesamt, 2012). Moreover, the incidence of multiple transitions indirectly shows that mothers are less likely to remain without a partner.

In principle the correlation of family instability with non-cognitive skills can be attributed to two links: either to stress theory or to social control theory (for an overview on these theories see Hill et al., 2001). Stress theory states that changes in the family following parental separation impose stress on parents and children, which affects emotional bonds. In social control theory adult supervision of children is an important means to restrain a child from negative behavior. Both theories are related to developmental psychology in which disruptions of family bonds in early childhood are considered to be "harmful". Although social control theory is related to family transitions in my analyses, I find evidence that stress theory is linked to non-cognitive skill formation. Yet, with a larger sample, one could have further disentangled mechanisms linking family instability and non-cognitive outcomes in Chapter 2.

Chapter 3 discusses potential causal effects of maternal involuntary job loss on children's non-cognitive skills. Job loss as disruption of employment is either defined by plant closure or by dismissal by employer. The results suggest that children whose mothers experience an involuntary job loss are more likely to have socio-behavioral problems and are less likely to believe in self-determination. Different motives aside from earning income might be linked to maternal involuntary job loss indirectly affecting children's outcomes. Mothers' life satisfaction is very likely to decrease after an involuntary job loss which in turn could deteriorate the emotional stability of the mother-child-relationship. The decrease in maternal life satisfaction after job loss can be attributed either to unemployment itself or to frustration of being "at home". Mothers might have re-entered the labor market to continue their career path or to contribute to the overall household income, so that a job loss not only affects the overall economic situation of the household, but also mothers' personal emotions.

Observed differences in maternal life satisfaction provide tentative support for

my hypothesis of maternal discouragement influencing the mother-child-bond and indirectly affecting children's socio-emotional behavior or internal locus of control. But although descriptive evidence shows that changes in life satisfaction might be a potential mediator of the job loss effect, it cannot completely explain the relationship with non-cognitive skills. Chapter 3 thus infers potential mechanisms in a limited way implying further research should address potential mechanisms.

Apart from changes in family environment becoming more apparent in economic research on human capital accumulation, effects of day care quality on children's outcome should be considered. Results shown in **Chapter 4** suggest that structural quality indicators such as the *child-staff-ratio* or the *share of children not speaking German at home* explain part of the variance of changes in children's health and personality characteristics between age three and age six. Combining data from the German Socio-Economic Panel Study (SOEP) and regional data on day care quality from the "Kinder- und Jugendhilfestatistik" (statistics on child and youth welfare) allows to investigate day care quality rather than day care attendance itself. Day care quality matters, as day care attendance is part of children's early education and represents an early investment in human capital accumulation.

In contrast to the previous chapters, Chapter 4 examines changes in children's health in addition to changes in non-cognitive skills. With regards to institutional environments studies in the psychological/pedagogical literature have shown that day care exposure leads to an increase in chances of illnesses such as colds, ear infections and the like (Chen, 2012). I examine changes in ear infections and in atopic eczema, as both illnesses are susceptible to environmental factors and day care quality, compared to day care attendance, might be more closely related to increases in children's likelihood of illnesses. Both, children's health and their ability to concentrate are correlated with structural quality of day care. The

estimations show that especially the *child-staff-ratio* is significantly associated with changes in children's overall health. The correlation of the *share of children not speaking German at home* vanishes when the analyses accounts for the share of child population aged 3-6 with foreign nationality on the county level. The findings in Chapter 4 demonstrate that further research should investigate day care *quality* and its effect on child outcomes.

5.1 Further research

The research presented in this dissertation sheds light on non-cognitive development with regard to changes in family environment and to early education and care outside the home. Yet, further research directions are thinkable. First, my work focuses on non-cognitive skills as outcome measure. Non-cognitive skills are often referred to as *soft skills*. This term contains a critique addressed to studies on non-cognitive skills: "how can one be certain to identify causal effects on such "broad" measures?" People phrasing these questions certainly think about reverse causality, omitted variable bias, or measurement error. Whilst this dissertation addresses reverse causality and omitted variable bias, larger data sets clearly could add to the robustness of my estimations of non-cognitive skills. In general, non-cognitive skills have just started to play an important part in economic research, and although the SOEP already surveyed non-cognitive measures such as personality traits, locus of control, or socio-emotional behavior as one of the first household surveys, more waves are needed to work with larger samples providing more statistical power to draw policy implications.

Moreover, non-cognitive skills evolve over time, especially during early childhood. And although they are more malleable at later stages in life, research

on dynamic non-cognitive outcomes would provide further insight into the "black box" of non-cognitive skill development. While children grow up they learn and acquire social skills and competencies, but little is known what influences the differences between early years and later years. Non-cognitive skills are not completely determined by children's genetic endowment, and to even better assess the influence of the social environment on these skills, further research could identify what effects the environment has on the level of children's skills. Accordingly, future research questions could examine how differences in non-cognitive skills during early childhood not only predict success later in life, but also non-cognitive skill levels in early adulthood. The "technology of skill formation" proposed by Cunha and Heckman (2007) shows that "skills beget skills", meaning that non-cognitive skills at an early age influence not only non-cognitive skills at a later childhood stage, but also cognitive skills are influenced by non-cognitive skill levels during the skill formation process. In order to assess non-cognitive outcomes dynamically, the same outcomes have to measured at different points in time, e.g. children's socio-emotional behavior should be measured using the same scale at age five, at age nine and so on.

Determining changes in non-cognitive skills could also be relevant for other future outcomes. So far studies mostly examine the effect of non-cognitive skills on labor market outcomes[1], but what about transitions into school or into higher education? It would be interesting to study whether children's non-cognitive skills at age six are related to school track outcomes in Germany. Or whether personality traits influence children's preferences for tertiary education.

Another research direction that can be derived from my work is the relationship between non-cognitive skills and possible influences of fathers, which I mostly

[1]These works often use non-cognitive skills of adults, but there exist also studies relating children's non-cognitive skills to future outcomes (see for example Blanden et al., 2007; Carneiro et al., 2007).

ignore in this dissertation. In Chapter 2, I at least indirectly assess how a "loss" of fathers correlates with children's outcomes. Whilst each chapter presents valuable arguments to analyze maternal partnership changes or involuntary job loss, future work should certainly address how paternal experiences are related to non-cognitive skills. So far research in Economics has focused, for example, on paternal job loss and children's educational attainment neglecting non-cognitive skills. Changes in parental leave regulations in Germany[2] affect young children's time spent with their fathers, and thus non-cognitive skills might no longer be influenced mostly by mothers.

The last aspect for further research that unfolds from my dissertation is related to early childhood education and care outside the home. In 2013 the German government aims at increasing the available day care spots for children under the age of three to 35 per cent[3]. The provision of day care for the very young is closely related to early investment in human capital. Parents choose day care not only as a place which "takes care of the children" during working time, but as a place which "promotes skill formation". Economic research should further address day care quality and its impact on child development, as on the one hand most children are likely to spend a considerable amount of time in institutional environments and quality differs over counties or day care centers. And on the other hand econometric techniques allow robust estimation of causal relationships. By continuing to examine day care quality using advanced econometric methods, other child outcomes could be related to the quality of children's care environment outside the home, e.g. cognitive skills – such as verbal skills or grades in primary school – or other non-cognitive skills.

[2]The German law on parental leave has been modified providing both parents the opportunity to be absent from work during the first year after childbirth: *Bundeselterngeld- und Elternzeitgesetz vom 5. Dezember 2006 (BGBl. I S. 2748)*.
[3]See "Kinderförderungsgesetz" – § *24a Abs. 5 SGB VIII über den Stand des Ausbaus für ein bedarfsgerechtes Angebot an Kindertagesbetreuung für Kinder unter drei Jahren*.

5.2 References

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Executive summary

In recent years the economic literature has begun to study non-cognitive skills in addition to cognitive skills in order to determine school or labor market success. Non-cognitive skills is a generic term enfolding traits that enable a person to communicate or interact with others, such as personality traits, socio-emotional behavior, locus of control, persistence, or motivation. Examining non-cognitive skills enables to determine "psychic cost", i.e., costs of a transaction that may cause stress or unhappiness to a person, which considerably complemented the literature on school and labor market success.

In general, the literature on non-cognitive skills in Economics demonstrates that cognitive outcomes, educational attainment, and labor market outcomes are affected by non-cognitive abilities at different stages in life, i.e., during early childhood, during adolescence, or in adulthood. The analysis of non-cognitive development provides possible intervention points for policy makers, as these skills are receptive for remedies later in life. The comprehensive research agenda of this dissertation focuses on children's non-cognitive skill formation during childhood until adolescence in different important environmental circumstances, such as changes in maternal partnerships, maternal involuntary job loss, and day care attendance and structural quality. In addition, children's health is examined, as early childhood health is a predictor of educational attainment later in life, of future health, and of acquisition of skills.

In the three chapters of this thesis I infer three non-cognitive outcome measures assessed at five/six and at age seventeen: socio-emotional behavior, locus of control, and personality traits. The soico-emotional behavior describes a child's behavior in terms of relationships with peers or of emotional problems

at age five/six. Locus of control captures whether an individual believes that life depends on one's own actions (internal locus of control) or whether an individual believes that life depends on others or fate (external locus of control) for adolescents at age seventeen. Personality traits are investigated for preschool children and for adolescents. For adolescents five dimensions describe an individual's personality traits: Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Personality traits for younger children can be measured from age four onwards mapping personality traits with the same five dimensions that describe adolescents' or adults' personality traits. Before age four a child's behavior is assessed and therefore, I utilize the term "personality characteristics" for simplification when referring to preschool children, as for children at age three the measured characteristics rather depict a child's temperament.

Apart from these three non-cognitive skills, I examine changes in children's health, as childhood health is likely to affect future outcomes, such as educational attainment or acquisition of skills. In order to infer changes in children's health, I asses whether children suffer from ear infection or atopic eczema. In the literature, both illnesses are known to be susceptible to environmental factors and to eventually impede a child's development.

Family Economics has long studied how family background affects opportunities of children. Among these studies family structure and its effect on children's educational attainment have been widely discussed. Moreover, a vast literature on children's health, mainly inferring premature birth or low birth weight and its potential effect on future outcomes, has emerged. Yet, the literature is rather silent about health investigated as early childhood outcome and its relation with day care (quality) for that matter. The labor force participation of mothers related to child well-being is another important aspect studied in Family Economics,

which has become more and more apparent in recent years due to a rise in maternal labor force participation. But the risk of job loss faced by mothers and its potential influence on children's non-cognitive skills has been scarcely assessed so far. An aspect of Education Economics is the educational environment, which supports child development, e.g. day care institutions or class size. Yet, the economic literature has so far scarcely examined the quality of day care institutions and its relation to children's non-cognitive skills or children's health. Therefore, the dissertation investigates changes in children's home environment (family) captured by family structure changes and maternal involuntary job loss and other care environments (day care institution) described by day care quality in reference to changes in children's health and personality characteristics. In three chapters these questions are examined empirically using rich and representative data from the German Socio-Economic Panel Study.

In Chapter 2 of this thesis, I analyze family instability and its effect on children's non-cognitive skills, i.e., socio-emotional behavior of preschoolers and locus of control and personality traits of adolescents. Compared to family structure, family instability accounts for sequential family experiences during childhood and provides more than a snapshot of children's living arrangements. Family instability captures a dynamic process of family structure events and is defined as maternal partnership change from one year to the next. A yearly change does not account for changes occurring in-between, but maternal partnership transitions happening on a monthly interval during the years are rare. The results in Chapter 2 indicate that experiences of maternal partner changes early in life (from birth through age six) determine not only early child outcomes but also non-cognitive skills at age seventeen. Multiple transitions are stronger correlated with preschoolers' socio-emotional behavior than single transitions. Furthermore, the findings indicate that non-cognitive skills of adolescents are negatively

correlated with multiple partnership transitions throughout childhood.

The estimates in Chapter 2 support the hypothesis that family instability rather than simply family structure affect non-cognitive development. Family instability captures the dynamics of today's partnerships which change over time. Moreover, the incidence of multiple transitions indirectly shows that mothers are less likely to remain without partner. From a policy perspective, the results in Chapter 2 indicate that children who experience maternal partnership transitions should have their non-cognitive skills addressed in order to reduce long-run negative effects. Institutions, other than the family, could assist children who lack support at home. Day care schools could play an important role in helping children's non-cognitive skill formation.

Chapter 3 of this dissertation infers the relation of maternal involuntary job loss to children's non-cognitive skills. The economic literature has shown that job loss of adults causes a considerable fall in income, persistence of unemployment, health, or divorce. Negative consequences of job loss of the adult are most likely to spread to their children. The identification of an effect of maternal job loss on children's non-cognitive skills depends indirectly on maternal employment decisions. The results in Chapter 3 indicate that children whose mothers experience an involuntary job loss, i.e., displacement by plant closure or by dismissals by employer, are more likely to have socio-behavioral problems and are less likely to believe in self-determination, i.e., they are less motivated or striving for success.

Maternal involuntary job loss has negative effects on children's non-cognitive skills and thus may impede children's progress in school or in the labor market. The findings in Chapter 3 suggest that mothers stress or frustration due to displacement affect socio-emotional behavior of preschoolers and internal

locus of control of adolescents. Different motives aside from earning income might be linked to maternal involuntary job loss indirectly affecting children's outcomes. Mothers' life satisfaction after job loss is very likely to decrease after experiencing a job loss. The drop in life satisfaction can be attributed either to unemployment itself or to frustration of being "at home". Mothers might have re-entered the labor market to continue their career path or to contribute to the overall household income. Job loss might thus not only affect the overall economic situation of the household, but also mothers' personal emotions. Observed differences in maternal life satisfaction provide tentative support for the hypothesis of maternal discouragement influencing the mother child-bond and indirectly affecting children's non-cognitive skills.

With regards to policy implications, Chapter 3 shows that further research is necessary to disentangle potential influences of maternal job loss on children's non-cognitive skills. The evidence found in Chapter 3 indicates that financial support should not be the only means to help mothers who experience a displacement. For example, job centers could provide additional help during job search for mothers, as mothers' life satisfaction decreases after job loss. Supporting mothers to be less stressed after job loss could be beneficial for their children's non-cognitive skills.

In Chapter 4 of the dissertation, potential causal effects of day care attendance and day care quality on changes in children's personality characteristics and in children's health. Other than the previous chapters, changes in children's outcomes are assumed to be related to day care environments. Participation in day care between age three and age six can be regarded as early investment in children's human capital accumulation and quality of institutional environments matter alongside family environments. Day care facilities vary in terms of their structural quality, e.g. child-staff-ratios, group size, or educational level of staff.

The results of Chapter 4 show that day care attendance itself is not significantly correlated with changes in children's health and changes in personality characteristics. But the inclusion of structural quality indicators in the analyses explains part of the variation in children's differences. The estimates of day care quality on changes in children's outcomes suggest that the child-staff-ratio is an important structural quality indicator: Children's chances of suffering from ear infections or atopic eczema are increased if they attend day care institution at age four with a large number of children per teacher. Further, the results of Chapter 4 show that children's ability to concentrate significantly decreases if a higher share of children not speaking German at home are found in day care institutions. Yet, the inclusion of share of child population aged 3-6 with foreign nationality on the county level renders the correlation insignificant.

Beside these findings, Chapter 4 sheds light on the relationship of the amount of time spent in day care and dynamic child outcomes, i.e., changes in health and personality characteristics from age three through age six. Full-time attendance, which captures that a child spends the whole day (more than five hours) in an institution, at age four is significantly correlated with changes in health and personality characteristics. If children spend a full day in a day care institution their likelihood of suffering from ear infection or atopic eczema marginally increases, and full-time attendance significantly decreases children's ability to concentrate.

The findings in Chapter 4 suggest that policy makers should not neglect structural quality of day care institutions, as it is part of a child's environment and supports early investment in human capital. The findings suggest that the child-staff-ratio is significant. Children's overall health is positively correlated with a higher child-staff-ratio meaning that children are more likely to suffer from illnesses, if a larger number of children per teacher are found in day care institutions. The

literature outside the field of economics concludes the same negative relationship, i.e., smaller child-staff-ratio is better for children's health. The indicator share of children not speaking German at home reflects a negative correlation with children's outcomes on the county level. For policy makers this might imply that in counties with a larger share of children with foreign nationality, children would benefit if additional teachers – eventually with foreign background – were hired in these counties to promote children's development.

The research presented in this dissertation sheds light on non-cognitive development with regard to changes in family environment and to early education outside the home. Yet, further research directions are thinkable. First, non-cognitive skills are "soft measures", so that analyses might be distorted by reverse causality, omitted variable bias, or measurement error. Whilst this dissertation addresses reverse causality and omitted variable bias, larger data sets clearly could add to the robustness of the estimations of non-cognitive skills. In general, non-cognitive skills have just started to play an important role in economic research and larger samples providing more statistical power are needed to draw policy implications.

Moreover, non-cognitive skills evolve over time, especially during early childhood. Research on dynamic non-cognitive outcomes would provide further insight into the "black box" of non-cognitive development. While children grow up they learn and acquire social skills and competencies, but little is known what influences the difference between early years and later years. Future research questions could examine how differences in non-cognitive skills during early childhood predict success later in life, but also non-cognitive skill levels in early adulthood. In addition, determining changes in non-cognitive skills could also be relevant for other future outcomes. It would be interesting to study whether children's non-cognitive skills at age six are related to school track outcomes

in Germany. Or whether personality traits influence children's preferences for tertiary education.

Another research direction that can be derived from this dissertation is the relationship between non-cognitive skills and possible influences of fathers. Whilst each chapter presents valuable arguments to analyze maternal perspectives, future work should certainly address how paternal experiences are related to child development. So far research in Economics has focused on paternal job loss and children's educational attainment neglecting non-cognitive skills.

The last aspect for further research that unfolds from this thesis is related to early childhood education and care outside the home. The provision of day care for the very young is closely related to early investment in human capital. Parents choose day care not only as a place which "takes care of the children" but as a place which "promotes skill formation". Economic research should further address day care quality and its impact on child development, as most children are likely to spend a considerable amount of time in institutional environments, and as quality differs over counties or day care centers.

German summary

In den letzten Jahren haben immer mehr ökonomische Studien den Zusammenhang von nicht-kognitiven Fähigkeiten – neben kognitiven Fähigkeiten – mit dem Schulerfolg und dem Erfolg auf dem Arbeitsmarkt untersucht. Nicht-kognitive Fähigkeiten sind ein Überbegriff für Eigenschaften bzw. Fähigkeiten, die es einem Individuum ermöglichen mit anderen Personen zu kommunizieren oder zu interagieren. Zu diesen Fähigkeiten zählen die Persönlichkeitsmerkmale, das sozio-emotionale Verhalten, die Kontrollüberzeugung, Ausdauer und Motivation. Die Analyse nicht-kognitiver Fähigkeiten dient dazu die sogenannten "psychic cost", die Kosten einer Transaktion, die einem Individuum Stress oder Unzufriedenheit verursachen, zu bestimmen. Die Approximierung dieser Kosten durch nicht-kognitive Fähigkeiten hat die ökonomische Literatur zu Schul- und Arbeitsmarkterfolg wesentlich komplementiert.

Im Allgemeinen hat die ökonomische Literatur gezeigt, dass kognitive Fähigkeiten, Bildungserfolg, und Arbeitsmarkterfolg von nicht-kognitiven Fähigkeiten in unterschiedlichen Lebensabschnitten – in der frühen Kindheit, in der Jugend und im jungen Erwachsenenalter – beeinflußt werden. Analysen nicht-kognitiver Fähigkeiten weisen gleichzeitig auch auf mögliche Interventionsansätze für Politikmaßnahmen hin, da diese Fähigkeiten auch zu einem späteren Zeitpunkt noch mit Maßnahmen zu korrigieren oder zu verändern sind. Die umfassenden Analysen dieser Dissertation konzentrieren sich auf die Entwicklung nicht-kognitiver Fähigkeiten in unterschiedlichen Umfeldern in der frühen Kindheit und in der Jugend. Als Umfeldfaktoren untersucht die vorliegende Arbeit zum einen mütterliche

Partnerschaftswechsel und den unfreiwilligen Arbeitsplatzverlust der Mutter, und darüber hinaus die Betreuungspartizipation und die strukturelle Qualität der Kinderbetreuungseinrichtungen. Ferner wird auch die kindliche Gesundheit analysiert, da in der ökonomischen Literatur mehrfach gezeigt wurde, dass die Gesundheit in der frühen Kindheit ein guter Prädiktor für den späteren Bildungserfolg, für den zukünftigen Gesundheitszustand und die damit verbundene Produktivität eines Individuums, und für die Aneignung von Fähigkeiten ist.

Im 2., 3. und 4. Kapitel untersuche ich drei nicht-kognitive Fähigkeiten als abhängige und zu erklärende Größe für Kinder im Alter von fünf/sechs Jahren und für Jugendliche im Alter von siebzehn Jahren. Dabei handelt es sich bei den Fähigkeiten um (1) das sozio-emotionale Verhalten, (2) die Kontrollüberzeugung, und (3) die Persönlichkeitsmerkmale. Das sozio-emotionale Verhalten erfasst das kindliche Verhalten in Bezug auf seine Beziehungen zu Gleichaltrigen oder auf emotionale Probleme im Alter von fünf/sechs Jahren. Die Kontrollüberzeugung beschreibt ob ein Individuum glaubt, dass sein Leben von ihm selbst und seinen Handlungen abhängt (interne Kontrollüberzeugung), oder dass sein Leben von anderen oder dem Schicksal bestimmt wird (externe Kontrollüberzeugung). Die Kontrollüberzeugung wird in der vorliegenden Arbeit bei Jugendlichen im Alter von siebzehn Jahren analysiert. Persönlichkeitsmerkmale werden sowohl für Vorschulkinder, als auch für Jugendliche untersucht. Bei Jugendlichen werden die Persönlichkeitsmerkmale durch fünf Dimensionen beschrieben: Offenheit für Erfahrung, Extraversion, Gewissenhaftigkeit, Verträglichkeit, und Neurotizismus. Bei jüngeren Kindern kann die Persönlichkeit ab dem Alter von vier Jahren gemessen und ebenfalls von diesen fünf Dimensionen dargestellt werden. Vorher spricht man in der Persönlichkeitspsychologie von dem kindlichem Verhalten, so dass die vorliegende Arbeit den Begriff “Persönlichkeitscharakteristika”

verwendet anstatt Persönlichkeitsmerkmale, wenn die Vorschulkinder analysiert werden.

Neben den nicht-kognitiven Fähigkeiten von Kindern werden auch die Veränderungen in der kindlichen Gesundheit zwischen dem Alter von drei und sechs Jahren untersucht. Die ökonomische Literatur hat gezeigt, dass die frühkindliche Gesundheit einen Einfluss auf den zukünftigen Bildungserfolg oder den Erwerb von Fähigkeiten hat. Um die kindliche Gesundheit abzubilden, wird die Erkrankung von Kindern an Mittelohrentzündung oder an Neurodermitis analysiert. Studien haben gezeigt, dass beide Krankheiten durch das kindliche Umfeld beeinflusst werden können und dass beide die kindliche Entwicklung erschweren können.

In der Familienökonomie wird seit längerem untersucht wie der familiale Hintergrund die Chancen von Kindern beeinflusst. Ein Großteil dieser Literatur analysiert Familienstrukturen und ihre Auswirkung auf den kindlichen Bildungserfolg. Weniger wird in Hinblick auf nicht-kognitive Fähigkeiten und dynamische Familienstrukturen gesagt. Darüber hinaus existiert eine umfangreiche Literatur im familienökonomischen Bereich zu kindlicher Gesundheit. Hier werden meist die Auswirkungen einer Frühgeburt oder eines niedrigen Geburtsgewichts auf spätere Erfolge analysiert. Die Literatur sagt jedoch wenig darüber aus, inwiefern die Gesundheit in der frühen Kindheit von der formellen Betreuung und deren Qualität beeinflusst werden kann. Die Arbeitsmarktbeteiligung von Müttern und ihr Effekt auf das kindliche Wohlergehen machen einen weiteren wichtigen Teil der Forschung in der Familienökonomie aus. Nicht zuletzt durch den Anstieg der mütterlichen Erwerbsbeteiligung in den letzten Jahren. Hierbei ist anzumerken, dass der mögliche Effekt des Risikos eines Arbeitsplatzverlustes auf nicht-kognitive Fähigkeiten von Kindern und Jugendlichen bis jetzt nur wenig erforscht ist.

In der Bildungsökonomie ist dagegen das Bildungsumfeld eine relevante Forschungsgröße, da dieses Umfeld, wie formelle Betreuungsinstitutionen oder Klassengrößen, die kindliche Entwicklung beeinflusst. Die ökonomische Literatur hat jedoch die Qualität formeller Betreuungsinstitutionen und ihren Effekt auf nicht-kognitive Fähigkeiten und kindliche Gesundheit wenig bis gar nicht analysiert. Daher setzt die vorliegende Arbeit ihren Forschungsschwerpunkt zum einen auf das familiäre Umfeld und zum anderen werden Veränderungen in der kindlichen Gesundheit und den kindlichen Persönlichkeitscharakteristika in Bezug auf externe Betreuungsumfelder (Kindertageseinrichtungen) analysiert. In allen drei Kapiteln werden diese Fragen empirisch erörtert. Die empirischen Auswertungen basieren auf den Daten des Sozio-Oekonomischen Panels und im 4. Kapitel zusätzlich auf den Daten der Kinder- und Jugendhilfestatistik.

Im 2. Kapitel der vorliegenden Dissertation, wird der Zusammenhang von Familieninstabilität und den nicht-kognitiven Fähigkeiten von Kindern und von Jugendlichen untersucht. Im Vergleich zu Analysen der Familienstruktur, erfasst die Familieninstabilität sequentielle Familienstrukturerfahrungen in der Kindheit, so dass nicht nur ein Auszug des Familienumfeldes untersucht wird, sondern dynamische Prozesse dargestellt werden. Jährliche Partnerschaftswechsel der Mutter definieren hierbei Familieninstabilität. Ein Wechsel der zwischen einem Befragungsjahr erfolgt, kann hierbei nicht erfasst werden. Allerdings sind Partnerschaftswechsel, die in einem kürzeren Intervall (z. B. monatlich) erfolgen sehr selten. Die Ergebnisse des 2. Kapitels zeigen, dass die Erfahrung von mütterlichen Partnerschaftswechseln in der frühen Kindheit (von der Geburt bis zum Alter von sechs Jahren) nicht nur frühkindliche nicht-kognitive Fähigkeiten beeinflussen, sondern auch die nicht-kognitiven Fähigkeiten im Alter von siebzehn Jahren. Mehrfache Partnerschaftswechsel korrelieren stärker mit dem sozio-emotionalen Verhalten von Vorschulkindern als einfache Wechsel, z. B. eine

Scheidung/Trennung oder ein neuer Partner. Des Weiteren deuten die Resultate daraufhin, dass nicht-kognitive Fähigkeiten von Jugendlichen mit mehrfachen Partnerschaftswechseln negativ korrelieren.

Die Ergebnisse im 2. Kapitel unterstützen damit die Hypothese, dass Familieninstabilitäten eher die nicht-kognitiven Fähigkeiten beeinflussen als einfach nur die Familienstruktur an sich. Familieninstabilität erfasst die Dynamik der heutigen Partnerschaften, die sich über die Zeit verändern. Darüber hinaus zeigen die mehrfachen Partnerschaftswechsel indirekt, dass Mütter heutzutage nicht unbedingt Single bleiben nach einer Trennung. In Hinblick auf Politikimplikationen, zeigt Kapitel 2, dass Kinder die Familienstrukturwechsel erfahren in ihren nicht-kognitiven Fähigkeiten gestärkt werden sollten. Institutionen, ausserhalb der Familien, könnten Kinder unterstützen, wenn eine Unterstützung in der Familie fehlt oder nicht möglich ist. Betreuungsinstitutionen könnten hiefür ein wichtiger Ort sein, an dem Kindern bei der Entwicklung ihrer nicht-kognitiven Fähigkeiten geholfen wird.

Im 3. Kapitel wird der Zusammenhang von einem unfreiwilligen Arbeitsplatzverlust der Mütter auf die nicht-kognitiven Fähigkeiten von Kindern und Jugendlichen untersucht. Die ökonomische Literatur hat gezeigt, dass der Arbeitsplatzverlust negative Auswirkungen auf die Betroffenen hat, wie z.B. einen erheblichen Einkommensverlust, Persistenz der Arbeitslosigkeit, schlechtere Gesundheit, oder Scheidung. Diese negativen Konsequenzen für Erwachsene können dabei auch Auswirkungen auf die Kinder haben. Die Resultate des 3. Kapitels zeigen, dass Kinder, deren Müttern ihren Arbeitsplatz entweder durch eine Betriebsstilllegung oder durch die Kündigung des Arbeitgebers verlieren, eher sozio-emotionale Verhaltensprobleme aufweisen und eher glauben, dass das Leben nicht selbstbestimmt ist, i.e. diese Jugendlichen sind weniger motiviert und streben weniger danach sich ihren Erfolg zu erarbeiten.

Der unfreiwillige Arbeitsplatzverlust von Müttern hat einen negativen Einfluss auf die nicht-kognitiven Fähigkeiten von Kindern und Jugendlichen, dies könnte den Erfolg von Kinder und Jugendlichen in der Schule und auf dem Arbeitsmarkt erschweren. Die Ergebnisse in Kapitel 3 deuten darauf hin, dass Stress oder Enttäuschung, die Mütter über den Arbeitsplatzverlust empfinden können, sich auf das sozio-emotionale Verhalten von Vorschulkindern und auf die interne Kontrollüberzeugung von Jugendlichen auswirken. Neben einem Einkommensverlust können andere Ursachen nach einem Arbeitsplatzverlust der Mutter die nicht-kognitiven Fähigkeiten beeinflussen. Denn die allgemeine Lebenszufriedenheit von Müttern sinkt nachdem diese ihren Arbeitsplatz verloren haben. Dieses Absinken der Lebenszufriedenheit kann zum einen durch die Arbeitslosigkeit selbst und zum anderen durch die Enttäuschung "wieder zu Hause zu sein" entstehen. Denn Mütter können den Wiedereinstieg in die Erwerbstätigkeit vollzogen haben, um ihre Karriere fortzusetzen oder um zu den finanziellen Ressourcen des Haushaltes beizutragen. Ein Arbeitsplatzverlust kann somit die allgemeine finanzielle Situation der Familie beeinflussen, aber auch die persönliche emotionale Balance der Mutter. Beobachtete Unterschiede in der Lebenszufriedenheit von Müttern vor und nach dem Arbeitsplatzverlust unterstützen die Hypothese, dass die Enttäuschung der Mutter vor allem die Mutter-Kind-Bindung beeinflusst und somit indirekt die nicht-kognitiven Fähigkeiten von Kindern.

Kapitel 3 dieser Arbeit zeigt, dass weitere Analysen notwendig sind, bevor Politikimplikationen robust abgeleitet werden können. Die Resultate deuten jedoch darauf hin, dass eine finanzielle Unterstützung nicht das einzige Mittel sein sollte, um Mütter nach einem Arbeitsplatzverlust zu helfen. Die Jobcenter z.B. könnten zusätzlich zu der finanziellen Hilfe auch eine intensive Begleitung bei der Arbeitssuche für Mütter mit kleinen Kindern anbieten,

da die Lebenszufriedenheit für diese Gruppe nach einem Arbeitsplatzverlust deutlich sinkt. Eine Unterstützung in dieser Hinsicht könnte den Stress oder die Enttäuschung von Müttern mildern und sich somit positiv auf die nicht-kognitiven Fähigkeiten von Kindern und Jugendlichen auswirken.

Im 4. Kapitel der vorliegenden Dissertation werden mögliche Kausaleffekte der formellen Betreuung und der Qualität von Kindertageseinrichtungen auf Veränderungen in kindlichen Persönlichkeitscharakteristika und in der kindlichen Gesundheit analysiert. Im Gegensatz zu den Analysen in den anderen Kapiteln, werden im 4. Kapitel Veränderungen in den abhängigen bzw. in den zu erklärenden Größen in Bezug zum Betreuungsumfeld des Kindes untersucht. Die Teilnahme an formeller Betreuung im Alter von drei bis sechs Jahren ist eine Investition in das Humankapital und dabei ist die Qualität der Betreuungsinstitutionen eine wichtige Komponente, die in der ökonomischen Literatur bisher wenig Beachtung gefunden hat. Betreuungsinstitutionen unterscheiden sich in der messbaren Strukturqualität. Diese erfasst unter anderem die Gruppengrößen, den Kind-Betreuer-Schlüssel oder das Bildungsniveau der Erzieher.

Die Ergebnisse des 4. Kapitels zeigen, dass formelle Betreuung im Alter von vier Jahren nicht signifikant korreliert mit Veränderungen in der Gesundheit und in den Persönlichkeitscharakteristika. Wenn aber die Strukturqualität der Kindertageseinrichtung auf Jugendamtsbezirksebene in meinen Analysen berücksichtigt wird, werden Teile der Varianz der abhängigen Variablen erklärt. Der Kind-Betreuer-Schlüssel ist hierbei ein wichtiger Indikator: Die Wahrscheinlichkeit, dass ein Kind an Mittelohrentzündung oder an Neurodermitis erkrankt, erhöht sich signifikant, wenn ein Kind eine Kindertageseinrichtung besucht, in der der Kind-Betreuer-Schlüssel höher ist, d.h. in der mehr Kinder von einem Erzieher betreut werden. Des Weiteren zeigt Kapitel 4, dass die

Konzentrationsfähigkeit von Kindern sich signifikant verringert, wenn in einer Kindertageseinrichtung ein hoher Anteil von Kindern, die zu Hause kein deutsch sprechen, vorzufinden ist. Allerdings verschwindet diese Korrelation, wenn ich in den Analysen den Anteil der Kinder zwischen drei und sechs Jahren auf Kreisebene bzw. Jugendamtsbezirksebene berücksichtige, die eine andere Nationalität haben. Die Untersuchungen der Qualität im 4. Kapitel sind alle auf Kreisebene, denn die Jugendamtsbezirksebene überlappt zum einen mit den Kreisen und zum anderen mit den Gemeinden. Die Jugendamtsbezirke, die mit der Gemeindeebene überlappen wurden aus den Analysen ausgeschlossen. Dies ist notwendig, da in den Analysen auch andere Kreischarakteristika, wie z. B. der Anteil der Kinder zwischen drei und sechs Jahren mit einer anderen Nationalität, berücksichtigt werden.

Neben den Resultaten zur Strukturqualität untersuche ich auch die Länge der Betreuung pro Tag und ihren Einfluss auf die kindliche Gesundheit und die Persönlichkeitscharakteristika. Mit der Ganztagsbetreuung erfasse ich, ob ein Kind den ganzen Tag (mehr als fünf Stunden) in einer Kindertageseinrichtung verbringt. Es zeigt sich, dass wenn ein Kind eine Kindertageseinrichtung ganztags besucht, dies signifikant die Wahrscheinlichkeit an einer Mittelohrentzündung zu erkranken oder die einer Neurodermitiserkrankung erhöht. Ferner wird die Konzentrationsfähigkeit signifikant verringert, wenn ein Kind ganztags in einer Kindertageseinrichtung ist.

Die Ergebnisse des 4. Kapitels machen deutlich, dass Politikmaßnahmen die Strukturqualität einer Kindertageseinrichtung nicht ausser Acht lassen sollten. Ein relevanter Indikator für die Politik ist dabei der Betreuer-Kind-Schlüssel, denn dieser korreliert positiv mit dem Maß für kindliche Gesundheit. Dies bedeutet, dass ein zu hoher Kind-Betreuer-Schlüssel die Erkrankungswahrscheinlichkeit von Mittelohrentzündung oder Neurodermitis erhöht. Die Literatur findet

ebenfalls, dass ein niedriger Kind-Betreuer-Schlüssel gut für die kindliche Gesundheit ist. Der Indikator "Anteil der Kinder, die zu Hause kein deutsch sprechen" spiegelt die Korrelation zwischen der Gesundheit und den Persönlichkeitscharakteristika mit dem Anteil der Kinder mit einer anderen Nationalität auf Kreisebene wieder. Dies könnte bedeuten, dass in diesen Kreisen Kinder davon profitieren könnten, wenn Kindertageseinrichtungen mehr Erzieher – eventuell ebenfalls mit Migrationshintergrund – einstellen würden, um somit die kindliche Entwicklung zu fördern.

Die vorliegende Arbeit komplementiert die Forschung zu nicht-kognitiven Fähigkeiten und kindlicher Gesundheit im Zusammenhang mit Veränderungen im familialen Umfeld und mit der frühkindlichen Betreuung ausserhalb der Familie. Aus dieser Dissertation ergeben sich aber auch weitere Forschungsfragen. Zum einen sollten die Analysen nicht-kognitiver Fähigkeiten noch mehr die möglichen Verzerrungen der Analysen dieser "weichen Faktoren" korrigieren. Denn auch wenn diese Arbeit inverse Kausalität und Endogenität adressiert, so erlauben größere Stichproben robustere Schätzungen, in denen diese korrigiert werden. Dadurch können auch Politikimplikationen besser abgeleitet werden.

Des Weiteren sollten nicht-kognitive Fähigkeiten auch dynamisch analysiert werden, insbesondere die Veränderungen der nicht-kognitiven Fähigkeiten über die Zeit. Denn zum einen bringt eine solche Analyse weitere Erkenntnisse über die nicht-kognitive Entwicklung und zum anderen wird durch eine dynamische Schätzung die Kompetenzerweiterung von Kindern in der frühen Kindheit erfasst. Die Forschung weiß allerdings noch zu wenig über potenzielle Einflüsse auf den Fähigkeitserwerb. Daher sollten zukünftige Arbeiten untersuchen inwiefern die Unterschiede in nicht-kognitiven Fähigkeiten während der frühen Kindheit sich auf den späteren Erfolg auswirken können.

Neben den Müttern sollten auch Erfahrungen und Erlebnisse von Vätern in Bezug zu nicht-kognitiven Fähigkeiten gesetzt werden. Bisher hat die ökonomische Literatur den Arbeitsplatzverlust von Vätern nur im Zusammenhang mit Bildungserfolg oder Einkommen von Kindern untersucht.

Der letzte Aspekt bezieht sich auf die frühkindliche Bildung und Betreuung ausserhalb der Familie. Frühkindliche Betreuung ist zunehmend relevant für die Humankapitalakkumulation. Eltern entscheiden sich nicht mehr nur für eine "Betreuung in der Kindertageseinrichtung" während der Arbeit, sondern auch für eine "Förderung von Fähigkeiten" ihrer Kinder. Die Familien- und Bildungsökonomie sollte daher die Qualität der Kindertageseinrichtungen weiter erforschen, da die meisten Kinder einen Großteil ihrer Kindheit in diesen Institutionen verbringen, und da es große regionale Differenzen bezüglich der Qualität gibt.

Curriculum vitae

For data protection purposes the CV is not included in the online version.

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