Child Well-Being in Post-Separation Families

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Vorgelegt von

Pauline Kleinschlömer

Dekan der Fakultät für Sozialwissenschaften
Prof. Dr. Michael Diehl

Betreuerinnen
Prof. Dr. Katja Möhring
Prof. Dr. Katharina Loter

Gutachterinnen
Prof. Dr. Katja Möhring
Prof. Dr. Katharina Loter
Prof. Dr. Irena Kogan

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Authorship Contribution

Table 1: Table of Authorship contribution

Contribution	Chapter 2	Chapter 3	Chapter 4	Chapter 5
Conception	PK, MK, LB, TV & SK	PK		PK, SK & JW
Projekt administration	PK	PK	PK	SK
Data management	PK & LB	PK& SK	PK	PK & SK
Data analysis	PK	PK	PK	PK
Data visualization	PK	PK	PK	PK
Writing - original draft	PK	PK	PK	SK
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PK: Pauline Kleinschlömer, SK: Sandra Krapf, MK: Mine Kühn, LB: Lara Bister, TV: Tobias Vogt, JW: Jonathan Wörn

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1 Introduction

1.1 Why study child well-being in post-separation families?

Family structures in advanced societies have changed significantly in recent decades. The post-World War II era was dominated by stable nuclear families consisting of two parents and their biological children. Today, family arrangements increasingly include post-separation families such as single-parent families and stepfamilies (Thomson, 2014a). This change in family patterns is often attributed to the Second Demographic Transition (SDT). According to the SDT, one of the main drivers of this change in family patterns is the evolution of attitudes and norms favoring greater individual freedom and self-realization (Van de Kaa, 2001). This change affects the entire family. As a result, the share of children growing up with two biological parents is declining, while the proportion of children living in a single-parent family or stepfamily during their childhood is increasing (Kleinschlömer & Krapf, 2023).

Living in post-separation families has profound consequences for children's well-being. Children who live in post-separation families tend to fare worse in various areas of well-being than children who live with their two biological parents (see Amato (2014), McLanahan et al. (2013), or Raley and Sweeney (2020) for reviews, as well as the overview of the research strand in this chapter of the book). Hence, given that children's life courses depend on their parents' relationship choices, they undergo significant changes after a family transition over which they have little control. McLanahan (2004) further elaborates on children's experience of family instability in her concept of 'diverging destinies'. She discusses that family transitions, such as parental separation, differ a) in their likelihood of occurrence *(selection effect)* and b) in their consequences *(causal effect)* between families with high and families with low socioeconomic resources, making union dissolution to a "stratified and stratifying life event" (Raley & Sweeney, 2020, p. 81). This may lead to an overall "inequality of opportunities" (Bernardi & Boertien, 2017, p. 183) for children who grow up in post-separation families. However, striving for equality of opportunity for all children is socially commendable, as it promotes social justice and enhances social cohesion. This is also codified in the UN Convention on the Rights of the Child (United Nations, 1989), which

grants all children the right to equality of opportunity, regardless of factors such as social background and other status. Consequently, social research should not solely concentrate on the deficit perspective and identify discrepancies between children residing in a two-biological parent family and a post-separation family. Instead, it should also strive to identify protective factors that can offset the adverse effects of changes in family structure on children's well-being, given that family instability is likely to persist as a common phenomenon in many Western societies.

Although it is well established that child well-being is affected by parental separation, there are still some open questions (Härkönen et al., 2017). Firstly, most research on the consequences of parental separation on child well-being that takes a causal approach is based on data from the United States. However, the United States differs from other welfare states in terms of family support. The U.S. welfare system places a significant burden on families, suggesting that they bear the primary responsibility for caring for their children. In contrast, in other welfare states, such as social democratic or conservative welfare states, family welfare is perceived as a public responsibility (Esping-Andersen, 1990; Kamerman & Kahn, 2001). Thus, there may be differences in the consequences of family complexity when studying child well-being outside the United States. However, many studies of countries other than the US use cross-sectional non-causal methods (McLanahan et al., 2013). Without causal analyses, we cannot rule out the alternative explanation that observed child outcomes are caused by factors that are more common in families experiencing parental separation. Therefore, I use causal methods to control for unmeasured variables by drawing on data from Germany and Norway, which serve as representatives for the social democratic and conservative welfare states. Conducting research *beyond cross-sectional analyses* will improve our understanding of the consequences of family change. Secondly, so far previous research has primarily focused on parental separation and child well-being (Härkönen et al., 2017). However, parental separation is not the only family transition children can experience. To gain a more comprehensive understanding of the effects of the changing family landscape on children's well-being, it is necessary to extend the focus of research *beyond union dissolution* (Härkönen et al., 2017; Sweeney, 2010). In my dissertation, I acknowledge the diversity of post-separation families and analyze children's well-being after transitioning to a stepfamily. Thirdly, all children react differently to family structure transitions,

which is not reflected in the average effects reported in most studies (Härkönen et al., 2017). Therefore, it is crucial to identify subgroups for which the effects appear to be more limited compared to other groups. So far, research has mainly focused on the role of children's socio-economic background as a source of heterogeneity (Bernardi & Boertien, 2016). In my dissertation, I extend research in this regard and aim to identify protective factors that can mitigate the negative consequences of family instability. This encompasses the age at which the family structure transition occurs and the quality of the parent-child relationship. To this end, I conduct research *beyond homogeneous effects*. Taking all these open research fields into account, I formulate the following overarching research question of this dissertation:

How do changes in family structure influence different dimensions of child well-being?

I utilize data from a multitude of sources to answer the research question, including medical data (Chapter 2), survey data (Chapter 2 and Chapter 3) and register data (Chapter 4 and Chapter 5), which allow for the application of data-intensive causal research methods. This approach enables me to incorporate a diverse array of dimensions related to children's well-being, thereby facilitating the mapping of a broad range of children's well-being. This encompasses a biomarker related to stress (Chapter 2), psycho-social development (Chapter 3) and educational outcomes (Chapter 4 and Chapter 5). I consider all these outcomes as indicators for children's well-being because all outcomes address risks and factors that enable children to flourish (Moore & Lippman, 2005). Furthermore, I address the impact on children's well-being across a range of family structures, including those affected by parental separation and stepfamily formation. The most commonly used definition of a single parent is someone who lives with one or more dependent children without a partner or spouse residing in the same household, although other family members may be present (Duncan & Edwards, 1997). That means that a single parent may have a partner, as long as the partner does not share the same household. The rationale behind this distinction is that if the child resides solely with one parent, they are deprived of the supplementary advantages that an additional parent could potentially offer. These include financial resources, as well as emotional and timely related resources (Manning & Lamb, 2003; Sweeney, 2010). In this context, stepfamilies are formed when one or both partners have children from previous rela-

tionships and they remarry or co-reside with a new partner (Raley & Sweeney, 2020). These definitions are used throughout all chapters in the present dissertation.

Before discussing my research questions in more detail, I will introduce the overarching theory of this dissertation. Following this, I will present prior research on the well-being of children in post-separation families and identify the corresponding research gaps. Thereafter, I present the subordinate research questions in this book to answer the overarching research question. Subsequently, I will provide an overview of family demographics, family policies and family norms in Germany and Norway to better understand the context of this research, before summarizing the pertinent studies, which are printed in full length following this overview chapter. The main substantive insights are then carved out, and open questions and directions for future research as well as implications for family researcher and policy makers are highlighted.

1.2 Theoretical Background

The theoretical framework I use is based on family system theory, which acknowledges that a large portion of an individual's socialization occurs within the family. The theory helps to explain how changes in the family structure can impact children's well-being (Broderick, 1993; Murry & Lippold, 2018). Family system theory assumes that changes within the family have consequences for all family members. According to this perspective, interparental conflicts or the move of a resident parent to another household are not limited to the mother-father dyad but also affect other subsystems, such as the parent-child dyad (Erel & Burman, 1995). Family system theory also enables the incorporation of various patterns of family research. It considers selection processes into family types and acknowledges that the effects of family structure may vary across social groups and countries due to contextual factors such as social norms, family values, and family policies. Furthermore, family system theory postulates that a change in family structure may affect children's development over the life course. Consequently, the consequences are not merely temporary, but rather, they persist over an extended period. In addition, it incorporates mediators that drive the effects of family structure changes on children, such as children's psychological distress or family resources. The role of these main mediators is presented in the next paragraphs.

1.2.1 Resource Perspective

The resource perspective is one common approach that helps to understand reduced well-being in children who experienced a change in family structure. If a parent moves out of the home following a separation, children may lose the benefits of the additional income and social support that a second parental figure can provide (Manning & Lamb, 2003; Sweeney, 2010). The loss of income is reflected in the at-risk-of-poverty rates. Single mothers are disproportionately affected by income poverty in Europe (Hübgen, 2018). As research has shown a negative association between family income and children's well-being (Cooper & Stewart, 2021), it can be argued that financial strain may result in a decline in children's well-being for children living in single-parent families. In addition, parents under economic stress may struggle to provide adequate levels of support and control (Conger et al., 2010; Wadsworth & Berger, 2006), which may lead to reduced emotional resources in children. Single parents often face the dual demands of fulfilling both caregiving and breadwinning roles, which may limit the amount of time they can spend with their children (Magnuson & Berger, 2009). This may result in less time for playing together and less time for assistance with homework or shared bedtime routines. J. S. Coleman (1988) views parents' time with their children as a type of social capital, allowing for the intergenerational transmission of parents' economic resources, including human and financial capital. This transmission may be systemically reduced in single-parent families. Furthermore, single-mothers often experience feelings of depression and anxiety following a divorce, while their children may become more demanding (Hetherington & Stanley-Hagan, 2002). These dynamics may interfere with their ability to function as effective parents, which may exacerbate their children's difficulties in adjusting to the new family structure and, in turn, reduce their children's well-being (Hetherington et al., 1992).

In stepfamilies, the household's financial resources may increase due to the additional income of the new partner (Dewilde & Uunk, 2008). Additionally, women who enter into new partnerships may be more likely to re-enter or increase their participation in the labor market, as it may be easier to reconcile work and family life with a partner in the household. As a result, the proportion of poor children is lower in stepfamilies than in single-parent families. In Germany, 31 percent of children in single-parent families

live below the poverty threshold, compared to 15 percent in stepfamilies and 10 percent in nuclear families (Heintz-Martin & Langmeyer, 2020). As the stepparent may provide support with household duties or schoolwork, the time resources that the resident parents can devote to each child increases, which in turn may increase children's emotional resources and positively affect their well-being (Li & Guo, 2023). Further, union formation can also increase parents' well-being (Soons et al., 2009), which may lead to positive child outcomes. However, research has also shown that stepparents invest less in stepchildren than in their biological children (M. Coleman et al., 2000). Hence, the extent to which children's well-being benefits from increased resources in a stepfamily remains unclear. However, resources can serve not only as mechanisms that help to explain the lower well-being of children living in post-separation families but also as moderators. In the role of "shock absorbers" (Amato, 2000, p. 1272) emotional and financial resources are receiving increased attention. Their presence or absence may moderate the negative effects of parental separation on children's well-being. Consequently, family structure transitions may have a different impact on children's well-being, depending on whether the moderator strengthens or weakens the relationship between family structure transitions and child well-being.

1.2.2 Stress Perspective

Family transitions are often considered a stressful event for children, which can lead to worse well-being. Amato (2010) set up a divorce-stress-adjustment model and identified five groups of potential stressors that may lead to lower well-being in children living in a single-parent family: (1) financial strain; (2) parental conflicts; (3) decline in parenting skills due to excessive demands on the parent; (4) lack of contact with the nonresident parent; (5) possible further changes due to moving, changing schools, or loss of friends. Not only a transition to a single-parent family, but also a change to a stepfamily can increase children's stress. This is because it discontinues the existing household composition, and the role of each family member must be adapted and re-established. Additionally, stress may increase because children may fear competing with the parent's new partner for their parent's time and attention (Ganong & Coleman, 2017). Children in stepfamilies may experience conflicting loyalties as they try not to upset their biological parent by forming a close bond with their stepparent. Studies have

shown that some adolescents struggle to accept a new authority figure in the household (King et al., 2015). Step- and half siblings can increase complexity within stepfamilies and cause additional stress for children (Halpern-Meekin & Tach, 2008). Therefore, growing together as a stepfamily is a complex and demanding process that might increase children's stress, which in turn may decrease their well-being.

The arguments concerning stress and resources are interconnected to some extent. Conger et al. (2010) emphasized that inadequate financial resources can cause stress. At the same time, high levels of stress in children can lead to their withdrawal from social interactions with parents and difficulty in benefiting from emotional and social resources (Ulmer-Yaniv et al., 2018). However, it is important to note that stress and resources can also independently affect children's well-being. For instance, a child may miss the other parent after a separation, resulting in psychological distress, which is unrelated to the family's resources. In summary, both stress and resource mechanisms lead to the same theoretical expectation that the well-being of children decreases after parental separation compared to before.

These changes can have long-lasting consequences on children's development throughout the life course. In this context, the life course perspective can be employed as a framework to comprehend the process of transitioning to a new family form and to identify timing effects.

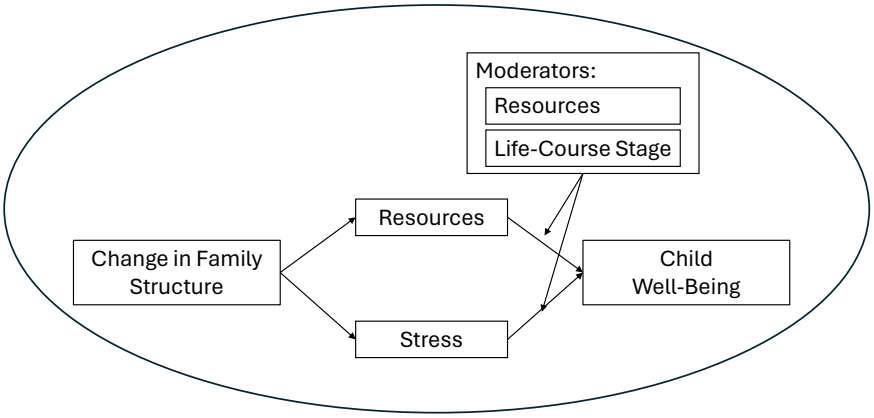
1.2.3 Life Course Perspective

As outlined in family system theory, children are embedded in the social structure and their life course trajectories are influenced by changes in other family members (Elder et al., 2003, 2015). Adopting a life-course perspective on family trajectories enables a more nuanced understanding of developmental processes over time. Consequently, the development of a life-course perspective can be conceptualized as a response to the challenges that arise from following children into young adulthood, middle age, and late life. Taking parental separation as an example for a challenging life event, this means that a parental separation during childhood or adolescence sets the stage for later in life (Crosnoe, 2021). In line with the family system theory, this implies that research

should not only focus on its impact on short-term effects on children's well-being but also on long-term effects and its consequences for adults, such as earlier family formation (Raab, 2017) and a higher probability of separation in children's own partnerships (Dronkers & Härkönen, 2008; Feldhaus et al., 2015; Wagner & Weiss, 2006). In addition, the life course perspective underscores that that the timing of events or experiences can differentially impact individuals across the lifespan (George, 1993). When looking again at the example of parental separation, this means that a different age at the time of the change in family structure may lead to heterogeneous outcomes. Consequently, age can serve as a moderator in the relationship between family structure transitions and child well-being.

Figure 1.1 illustrates the interplay of each theoretical approach. The circle demonstrates that the overarching concept of all studies is based on the family system theory. This theoretical framework recognizes that children's experience of changes in family structures is shaped by many factors. Following a family transition, children's life courses often undergo significant changes over which they have little control. Research has shown that these changes often have negative consequences for children's well-being. Family system theory mentions children's stress and resources as mechanisms that may explain children's reduced well-being after these change in family structure (Murry & Lippold, 2018). However, resources can also act as a moderator in this framework. Depending on the level of children's emotional or financial resources, the negative effect of family structure change on children's well-being may be accelerated or buffered. This raises the question of heterogeneous effects in the research area. In addition, the framework emphasizes the importance of analyzing heterogeneous effects in the long term, thus allowing for the inclusion of the life course perspective. The life-course perspective claims that life trajectories should be analyzed in a larger time frame, because the consequences of family structure transitions may differ depending on the time frame studied or the time of exposure. In the next chapter, I will present established findings based on this theoretical approach and identify research gaps from which I will derive the subordinate research questions for this dissertation.

Figure 1.1: Graphical overview of the theoretical approaches



1.3 Established Findings, Unknowns and Research Questions

1.3.1 Parental Separation and Children's Well-Being

The rise in the number of divorces and the subsequent increase in stepfamilies, has raised concerns, as children's well-being is negatively affected by the experience of parental separation. In addition, research has shown that separation in childhood or adolescence not only has immediate effects on well-being, but also has consequences into adulthood (Amato, 2010, 2014; McLanahan et al., 2013; Raley & Sweeney, 2020). This was analyzed using various well-being indicators. The most commonly discussed variables related to well-being can be classified into three groups: psychosocial well-being, educational achievement, and health indicators.

Psychosocial well-being encompasses different aspects of children's emotional well-being and behavioral problems (Baxter et al., 2011; Bzostek & Berger, 2017; S. E. Cavanagh, 2008; S. E. Cavanagh & Huston, 2006; Entleitner-Phleps & Walper, 2020; Fomby & Cherlin, 2007; Magnuson & Berger, 2009; Mandemakers & Kalmijn, 2014;

Nilsen et al., 2018; Rattay et al., 2018). It is a universal finding of all these studies that, on average, children's psychosocial well-being is lower in single-parent families than in families with two biological parents. The Strengths and Difficulties Questionnaire (SDQ) (R. Goodman, 1997)subscales are commonly used to assess this dimension of children's well-being (Baxter et al., 2011; Entleitner-Phleps & Walper, 2020; Nilsen et al., 2018; Rattay et al., 2018).

Educational success is a second, central dimension of children's well-being in post-separation literature. This dimension includes school grades (Bernardi & Boertien, 2016; Frisco et al., 2007; Grätz, 2015; Nilsen et al., 2020; Sigle-Rushton et al., 2014), children's cognitive achievements (Aughinbaugh et al., 2005; Kim, 2011; Magnuson & Berger, 2009; Mandemakers & Kalmijn, 2014; Shaff et al., 2008), and educational attainment (Jonsson & Gähler, 1997; Steele et al., 2009), divided into the probability of obtaining secondary (Bernardi & Comolli, 2019; Brand et al., 2019; Grätz, 2015), tertiary or academic education (Bernardi & Boertien, 2016; Bernardi & Comolli, 2019; Brand et al., 2019), and the probability of dropping out of school (Karhina et al., 2023) or retaking a year (Bernardi & Comolli, 2019). However, irrespectively of the specific indicator, research overall indicates that children who have experienced a parental separation have on average lower educational success, than children who remain in their two-biological-parent family (McLanahan et al., 2013).

A third frequently discussed dimension of children's well-being is their health. This covers indicators such as children's general health (Bzostek & Beck, 2011), alcohol and drug consumption (Bjarnason, Andersson, et al., 2003; Brown & Rinelli, 2010; Ledoux et al., 2002; Rattay et al., 2018; Rüütel et al., 2014; Tomcikova et al., 2009), smoking (Bjarnason, Davidaviciene, et al., 2003; Griesbach et al., 2003; Rattay et al., 2018), Body Mass Index (Goisis et al., 2019), stress markers (Gaydosh & Harris, 2018; Lacey et al., 2013; Suor et al., 2015) or diagnoses of illnesses (Bockelbrink et al., 2006; O'Connor et al., 2000) (including adverse mental health diagnoses (Behere et al., 2017; Perales et al., 2017)). Regardless of the health indicators used, the results indicate an association between living in a single-parent family and negative health outcomes. However, only a few studies analyze the effect of parental separation on children's health using longitudinal data, making it challenging to eliminate selection effects. Neverthe-

less, the results of the studies using longitudinal data (Bzostek & Beck, 2011; Goisis et al., 2019; Suor et al., 2015) suggest that family instability is related to worse health outcomes.

The negative impact of parental separation on well-being persists throughout an individual's life, not just during childhood. Research shows that experiencing parental separation is linked to lower levels of employment in adulthood (Corak, 2001; Gruber, 2004). Additionally, there is evidence that children of separated parents tend to form families earlier than children with both biological parents. This includes earlier home-leaving and first cohabitation (Raab, 2017) as well as earlier childbearing (Ermisch & Francesconi, 2001; Ermisch et al., 2004; Raab, 2017). Another common finding is that children of separated parents are more likely to experience instability in their own relationships and to divorce (Dronkers & Härkönen, 2008; Feldhaus et al., 2015; Wagner & Weiss, 2006).

1.3.2 Stepfamily and Children's Well-Being

While research on the effects of parental separation is extensive and consistent, the impact of living in a stepfamily on children's well-being is less well understood.

There is strong evidence that children living in stepfamilies have worse outcomes compared to those living in two-biological-parent families (M. Coleman et al., 2000; Sweeney, 2010). This, again, is associated with educational outcomes (Biblarz & Raftery, 1999; Gennetian, 2005; Manning & Lamb, 2003), psychosocial well-being (Entleitner-Phleps & Walper, 2020; Heintz-Martin & Langmeyer, 2020; Hofferth, 2006; Manning & Lamb, 2003; Mednick et al., 1990; Rattay et al., 2018) and health indicators (Barrett & Turner, 2005; Bjarnason, Davidaviciene, et al., 2003; Gath, 2022; Perales et al., 2017; Rattay et al., 2018; Rüütel et al., 2014). However, the negative effect is particularly evident in more complex stepfamilies, such as those with stepsiblings (Entleitner-Phleps & Walper, 2020; Gennetian, 2005). Only few studies have shown that children living in stepfamilies have a similar well-being than children living with their two-biological parents (Artis, 2007; Brown, 2004; Shaff et al., 2008). In general, this research area lacks studies using longitudinal data, with some exceptions (Gath,

2022; Gennetian, 2005; Mednick et al., 1990; Shaff et al., 2008).

Research comparing single-parent families and stepfamilies has also not definitively answered the question whether staying in a single-parent family or transitioning to a stepfamily is more or less beneficial for children's well-being. While some studies have shown that stepfamily formation after living in a single-parent family can be harmful to child well-being (Baydar, 1988; Biblarz & Raftery, 1999; Brown, 2006; Brown & Rinelli, 2010; Gath, 2022; Robson, 2009), others show the opposite, i.e., that joining a stepfamily can be beneficial for children compared to staying in a single-mother family (Ryan et al., 2015; Wen, 2008). Again other studies suggest that there is no significant difference in the well-being of children living in a stepfamily compared to those living in a single-parent family (Fomby et al., 2021; Manning & Lamb, 2003; Sweeney et al., 2009). The reasons for the different results may be attributed to the specific outcome studied. Research suggests that family instability has a greater effect on children's socioemotional development than on their cognitive achievement or health (Lee & McLanahan, 2015; Sweeney, 2010; Sweeney et al., 2009). Additionally, studies have shown that factors such as race (Lee & McLanahan, 2015) and the distinction between comparing outcomes with married or cohabiting stepparents (Brown, 2006; Manning & Lamb, 2003) influence the results. Overall, it should be noted that both research on the consequences of parental separation and research on the consequences of stepfamily formation is based primarily on US data and little on European data. The few existing studies based on European data often suffer from small sample sizes (Amato, 2014).

An increase in children's stress and a decline in emotional or financial family resources are often mentioned as an explaining mechanism for decreased child well-being in post-separation families. However, in general, empirical support for this argument is modest (S. Cavanagh & Fomby, 2019). The stress argument has mainly been tested with questionnaire items that use adverse emotional symptoms as a measure of subjective stress (Baxter et al., 2011; Cherlin et al., 1998; Rattay et al., 2018; Strohschein, 2005). De Los Reyes et al. (2015) and Eiser and Morse (2001) have noted that subjective stress measures are prone to bias. This is particularly the case for younger children (Michels et al., 2013). Investigating the consequences of changes in family structure on children's stress using an objective measure, i.e. a biomarker collected in children's

blood, represents a pioneering approach in family research. Therefore, using medical data I aim to answer the first research question:

RQ1: Do stress marker in children's blood increase after a change in family structure?

Recent studies have emphasized the need for a more detailed examination of subgroups in family research (Turney, 2015). Socio-economic status is a commonly investigated factor in this context (Härkönen et al., 2017). Two competing hypotheses have been proposed: The more-to-lose hypothesis suggests that children from higher socio-economic backgrounds may suffer more due to the higher risk of losing more resources. Alternatively, the compensatory hypothesis suggests that families with higher socio-economic status may compensate for the negative effects of family dissolution on their children. Empirically, studies have found support for both hypotheses. While some studies find support for the "more-to-lose hypothesis" (Bernardi & Boertien, 2016; Biblarz & Raftery, 1999; McLanahan & Sandefur, 1994), other studies support the "compensatory hypothesis" (Augustine, 2014; S. E. Cavanagh & Huston, 2006; Grätz, 2015). Hence, the role of financial resources as a moderator remains unclear due to these contradicting findings. A second source of heterogeneity is family relationship quality, more specifically interparental conflicts. The dissolution of a high-conflict family may be a relief for the children and beneficial for their well-being while, the break-up of a low-conflict family may be unexpected for the child, leading to more stress and feelings of loss, which in turn negatively affect their well-being (Amato & Hohmann-Marriott, 2007; Amato et al., 1995; Booth & Amato, 2001; Dronkers, 1999; Hanson, 1999). Independent of the respective family structure, research has shown that a high-quality parent-child relationship is positively associated with child well-being. Therefore, in the context of family relationship quality as a source of heterogeneous effects, parent-child relationship quality may constitute another potential moderator that mitigates the negative consequences of parental separation on children's well-being. However, this relationship has not yet been studied and is the focus of my second research question:

RQ2: How does the impact of parental separation on children's well-being vary depending on the quality of the resident parent-child relationship?

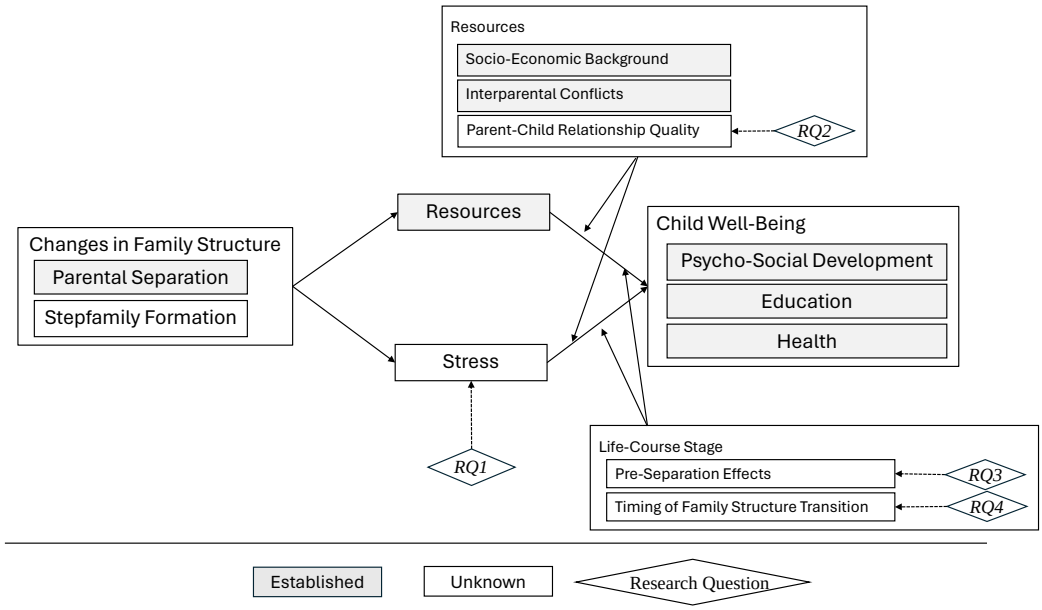
A third source of heterogeneity is children's anticipation of their parents' separation. The results of Brand et al. (2019) indicate that parental divorce has adverse effects on children's education only when the children did not anticipate the change in their family structure. However, the well-being of children in the years leading up to parental separation is not well understood, and it is unclear whether children's well-being reflects the anticipation of parental separation. As in the time leading up to parent's union dissolution, family routines may change, parent-child interactions may decrease, and family conflict may grow, child well-being may already deteriorate in the years prior to parental separation. Thus, the focus of research question three is on pre-separation effects:

RQ3: Are children's school outcomes already deteriorating in the period before separation?

While some research has been conducted on the heterogeneous effects of children living in single-parent families, little is known about the heterogeneous effects of living in a stepfamily on child well-being. Studies on the moderating role of resources in stepfamilies have yielded mixed results. Regarding financial resources, one study suggests that children from low-income families are more adversely affected by living in a stepfamily (Ryan et al., 2015), while another study finds the opposite (Biblarz & Raftery, 1999). However, it is important to note that both studies were based on a small sample size. Regarding emotional resources, a longitudinal model supports the buffering effect of resources by demonstrating that a positive relationship between a mother and a child, as well as between a stepparent and a child, is linked to improved mental health outcomes during adolescence and early adulthood (Jensen & Harris, 2017). Given the inconsistent findings on children's well-being in stepfamilies, it is crucial to examine heterogeneous effects within stepfamilies, as they may explain the discrepancies. The timing of the family structure transition could be a potential source of heterogeneity in stepfamily formation. The impact of stepfamily formation may vary depending on the age of the children, which is a crucial aspect of research question four:

RQ4: Does the age at family structure transition affect children's final grade point average?

Figure 1.2: Established findings, unknowns and research questions



1.3.3 Summary of Research Questions and their Contribution to Pertinent Research

Based on these research questions, I aim to assess children's well-being with longitudinal data and highlight the relevance of heterogeneous effects in family research. From past research we know that in line with family system theory, a change in family structure (such as parental separation or stepfamily formation) affects not only parents' but also children's well-being. This applies to children's health outcomes, their psychosocial development and their educational attainment. However, there are still some unknown research questions. In Figure 1.2, I sum up the key findings of previous research as well as the questions I address in the book. The shaded boxes illustrate the established starting points of my research. The white boxes refer to patterns and outcomes that are unknown so far. The diamond shapes represent the four research questions resulting from these unknown factors. The subordinated research questions in this book can be grouped into three subcategories: moving beyond cross-sectional analyses, exploring beyond union dissolution, and investigating beyond homogeneous effects. These three subcategories summarize the substantial contribution of this book.

Beyond Cross-Sectional Analyses The research presented in this book draws on a variety of data sources, including medical data (Chapter 2), survey data (Chapter 2 and Chapter 3), and register data (Chapter 4 and Chapter 5). These data sources enable the use of data-intensive causal methods, such as fixed-effects analyses. Previous studies in Europe have mainly analyzed child well-being with cross-sectional data (Härkönen et al., 2017). However, we cannot rule out alternative explanations for the observed child outcomes without causal research designs. It is possible that other factors, such as financial deprivation or mental health may have influenced the results. For instance, the mental well-being of parents can impact both their likelihood to repartner (Margareta et al., 2019) and their parenting skills (Dix et al., 2004; S. H. Goodman, 2007), which can subsequently affect their children's well-being (Newland, 2015). The same applies to financial deprivation. Research suggests that parents with limited financial resources are more likely to separate (Amato, 2010; Lyngstad, 2004). Additionally, children from families with lower socioeconomic status experience worse health outcomes (Bradley & Corwyn, 2002) and lower academic achievement (Sirin, 2005). Therefore, for all research questions that are part of the current dissertation project, I apply a causal research design that allow for greater control for selection effects and unobserved heterogeneity compared to cross-sectional analyses, resulting in more robust claims (Wooldridge, 2010).

Beyond Union Dissolution Previous research has primarily focused on single-parent families. Understanding the consequences of stepfamily transitions for children is crucial to comprehend the well-being of children living in post-separation families, as this group continues to grow (Kleinschlömer & Krapf, 2023). This is especially important because the literature has shown mixed results regarding the effects of stepfamily formation on children's well-being. To achieve the objective of this book, which is to conduct research that goes beyond union dissolution, RQ1 and RQ4 focus on both, parental separation and stepfamily formation as changes in family structure. This approach makes the research both comprehensive and conclusive. In addition, R1 sheds light on stress as an explaining mechanism for reduced child well-being in post-separation families. We are among the first to answer this question using a causal approach with objective marker of stress for both the transition to a stepfamily and the transition to a single-parent family. The results of RQ1 and RQ4 can be found in Chapter 2 and 5.

Beyond Homogeneous Effects Previous research has often treated children who have experienced a change in family structure as a homogenous group. However, in recent years, a number of studies have called for a more nuanced exploration of subgroups in family research (Turney, 2015). Instead of analyzing whether a change in family structure is generally beneficial or detrimental to children, research in this book focuses on findings beyond homogeneous effects. This includes analyzing the role of resources and life course stages as potential moderators. In doing so, the identification of protective factors (e.g. parent-child relationship quality) may also help to shift the focus away from the deficit perspective, which emphasizes problems that children or families may face after parental separation, and toward resources that may help children to better cope with the new family structure. This is the focus of RQ2 in Chapter 3. Besides heterogeneity between two groups (e.g. families with a low and families with a high parent-child relationship quality), heterogeneous effect may also occur within a time frame studied. According to the life-course perspective, taking a long-term perspective helps to understand developmental processes over time. For RQ3, I aim to explore whether children's well-being deteriorates in the years prior to parental separation by analyzing children's cognitive abilities in the time frame up to four years before parental separation until the year of parental separation (see Chapter 4). In doing so, I do not make a simple before-and-after comparison but extend the time span and allow for heterogeneity in children's well-being in the years before parental separation. A different source of heterogeneity studied in this book is children's age in Chapter 5. According to the life-course perspective, the timing of certain events can affect individuals differently throughout their life course. Therefore, depending on the age of the children at which the family structure transition occurs, they may be at a different developmental stage in their life and may adapt to the new family structure differently. In this vein, the study presented in Chapter 5 aims to answer RQ4 whether the timing of family structure transitions matters.

All these three research focuses overlap with the open questions raised by Härkönen et al. (2017) and underline the contribution of this book to the field of family sociology. The next section briefly discusses the extent to which the data sets I work with in this book are comparable.

1.4 Context on Family Demography and Policies in Germany, Norway and the United States

The majority of causal analyses have been conducted using data from the United States. This raises the question of the extent to which results from the United States can be compared to those from Europe. As my dissertation is based on data from Norway and Germany, it is necessary to consider to what extent the results from the two countries can be combined in order to answer the overarching research question. The question of comparability is addressed in this chapter by describing the family demographics and family policies and family values in each country.

Andersson et al. (2017) provided an overview of children's experiences of family disruption and formation, using national surveys in Europe and the United States. Table 1 maps family demographics in each country and shows that the proportion of post-separation families in Germany and Norway is similar, while the proportion in the USA is considerably higher. In Germany, 18% of all children up to the age of 15 experience parental separation, while in Norway this affects 24% of children. Union instability among parents is more prevalent in the USA, where 44% of all children experience parental separation by the age of 15. A similar pattern can be seen in the formation of stepfamilies. Within six years of parental separation, 34% of children in Germany live in a stepfamily, compared to 41% in Norway. In the USA, however, the proportion is considerably higher at 65%. The discrepancies suggest that children in the United States may be more adversely affected by parental separation than those in Germany and Norway. This is because the consequences of divorce on child well-being are more pronounced in countries where divorce is more prevalent. For instance, while parental separation is associated with a 2 percentage point reduction in the probability of graduating from university in countries with a low divorce rate, the disadvantage increases to almost 10 percent in countries with a high divorce rate (Kreidl et al., 2017).

In addition, difference in family welfare support may indicate disparities in child well-being. The U.S. welfare system places a significant burden on families, suggesting that they bear the primary responsibility for caring for their children with a relative lack of public transfers available to single-parent families (**rot**; Brady et al., 2017).. In contrast, in Germany and Norway, family welfare is perceived as a public respon-

Table 1.1: Children's experience of family structure transitions

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	Germany	Norway	United States
Parental separation by age 15	18	24	44
Stepfamily formation within 6 years after parental separation	34	41	65

Note: Figures (in per cent) adopted from Andersson et al. (2017).

sibility (Esping-Andersen, 1990; Kamerman & Kahn, 2001). In Norway, the norm of the dual-earner family has been established due to the provision of highly subsidized childcare and schools, in addition to generous parental leave rights. In this context, fathers are encouraged to maintain their involvement with their children even after separation. For example, since 2002, separated parents have been required to share the children's travelling expenses in order to reduce the financial burden on non-resident parents seeking to maintain contact with their children (Kitterød & Wiik, 2017). Additionally, in the case of divorce, custodians receive support through tax deductions, cash allowances, and child support (Breivik & Olweus, 2006). In Western Germany the male-breadwinner model has been the norm for many years. However, recent research shows a strong polarization in dual-earner and male-breadwinner type clusters among younger cohorts (Möhring & Weiland, 2022). This is important as German family policies prioritize earnings-related social insurances. Therefore, individuals without a lifelong employment face a systematic disadvantage (Hübgen, 2018). This particularly affects mothers who interrupt their careers due to childcare arrangements after a union dissolution. However, employed women who become single mothers through childbirth are relatively well protected in Germany, at least for the first year (Zagel & Hübgen, 2018). Germany offers a range of family policy measures to support separated parents, such as financial transfers, time policies, and childcare infrastructure (BMFSFJ - Federal Ministry for Family Affairs, 2021). In particular, advance payment rights for child maintenance are comparatively generous in Germany (Zagel & Hübgen, 2018). Consequently, despite the differences in the exact organization of family welfare support between Germany and Norway, both countries offer a comprehensive and extensive social safety net, in contrast to the United States. The divergence in family policies between these three countries is reflected in the sources of income on which single-mother households depend. In the United States, single-mother households are particularly dependent on earnings, which account for approximately three-quarters of

disposable income. Conversely, earnings account for slightly more than half of single-mother households' disposable income in Norway and Germany. In these countries, public insurance benefits (Norway) or universal benefits (Germany) serve as an important supplement to single mothers' incomes (Harkness, 2022).

In addition to the welfare policies and family demographics, the stigma associated with divorce may vary considerably between countries. In a country where divorce is widely accepted and the stigma associated with it is diminished, children may have greater social support from their peers and teachers. This, in turn, may mitigate the negative consequences of divorce. Nevertheless, research has indicated that the potential stigma associated with divorce is relatively low in all three countries. In the United States, 28% of respondents indicated that divorce is never justifiable, while in Norway and Germany, this figure was 23% (Kalmijn, 2010). Consequently, the stigma of divorce may not result in divergent outcomes in the respective countries.

In summary, while the United States differs from Norway and Germany in terms of welfare state support and family demographics, all countries do have similar attitudes towards divorce. Despite the observed differences, Amato (2014) concludes that the effect sizes on the consequences of family instability on children's well-being obtained with European data are moderate in magnitude, but large enough to be nontrivial and generally in agreement with studies conducted in the US. This suggests that the welfare system with paid income supplements and childcare infrastructure in Norway and Germany may not fully compensate for deficits that arise after parental separation. This is supported by a European comparison of the poverty ratios of lone mothers (Hübgen, 2018). On average, single mothers in Europe have a 2.8 higher poverty risk compared to partner mothers. However, this risk is even more pronounced in Norway (poverty ratio = 4.29) and Germany (poverty ratio = 4.26) with a poverty ratio exceeding 4, indicating that single mothers in both countries are over four times more likely to face poverty compared to their partnered counterparts.
With regard to Germany and Norway, it can be stated that although both countries follow different welfare states, they are similar in terms of the proportion of single-parent families and stepfamilies, poverty rates of single-parent families and attitudes. Consequently, the findings of the studies are not limited to the country from which the data was

collected; rather, they can be combined to address the overarching research question: How do changes in family structure affect different dimensions of child well-being?

1.5 Summary of the Four Studies

The individual studies used to answer the overarching research question are presented in the following sub-sections and are printed in full length in the subsequent chapters. An overview can be found in Table 1.2.

1.5.1 Analyzing the Impact of Family Structure Changes on Children's Stress Levels Using a Stress Biomarker

Objective: In this joint work with Mine Kühn, Lara Bister, Tobias Vogt, and Sandra Krapf, we examined whether there was a change in children's stress-related biomarker levels following a family structure transition (RQ1). In doing so, we focused on (1) the change to a single-parent family and (2) the change to a stepfamily.

Background: In the literature, increased stress has often served as an explanatory mechanism for the declining well-being of children living in post-separation families. However, this hypothesis has rarely been explicitly tested, especially with longitudinal data that include objective measures of stress.

Method: We relied on data from the German Health Interview and Examination Survey for Children and Adolescents (KiGGS), conducted by the German Robert Koch Institute. In addition to a questionnaire, the data include the results of a medical examination, including a blood sample, in the baseline survey (KiGGS0, 2003 - 2006) and the second wave (KiGGS2, 2014 - 2017). Our final sample included 1,462 children aged 1 to 7 years in the baseline survey (KiGGS0) and 11 to 17 years in KiGGS2 (2014 - 2017). Between these waves, 117 children experienced parental separation and 80 children moved into a stepfamily. As a proxy for children's stress, we used C-reactive protein (CRP) as an outcome variable, which can be measured in children's blood samples. CRP is a biomarker of inflammatory processes that correlates with stress and depressive episodes (Johnson et al., 2013). Using a First-Difference regression, we compared children's CRP-level before and after the change in family structure.

Results: The results show that children's stress significantly increased after the change to a single-parent family. However, children who were living in a single-parent family or a two-parent family in the baseline study and who had changed to a stepfamily by Wave 2 had no statistically significant change in their CRP-level before and after the change in family structure.

Conclusion: The study provides novel and strong evidence for differences in children's stress responses to different family structure changes, which is particularly important for understanding potential life course inequalities among children living in post-separation families.

1.5.2 Parental Separation and Children's Well-Being. Does the Quality of Parent-Child Relationships Moderate the Effect?

Objective: This joint work with Sandra Krapf pursued two main objectives: First, using German longitudinal data, we analyze whether children experience increased emotional and behavioral problems after parental separation. Second, we argued that parent-child relationship quality can serve as an important moderator in the association between parental separation and child well-being. To test this assumption, we analyzed whether the impact of parental separation on children's well-being varies depending on the quality of the resident parent-child relationship (RQ2).

Background: Research on the consequences of parental separation has mainly been analyzed with German cross-sectional data and an analysis with longitudinal data is missing. In addition, we wanted to turn away from the prevailing deficit perspective, which focuses on children's disadvantages after parental separation. In contrast, examined factors that support children's adjustment to family change and analyze heterogeneous effects based on the parent-child relationship quality.

Method: We used data from the German Family Panel (pairfam), release 13.0, waves 2 to 13 (Brüderl et al., 2021). The data provide rich individual-level panel data on children between the ages of 7 and 15 and their resident parents. Our final sample included 2,057 children, of whom 99 children experienced parental separation during the observation period. For our analysis, we applied an individual fixed-effects regression. To

estimate the heterogeneous effects after parental separation depending on the quality of the parent-child relationship, we added an interaction between parental separation and our two measures of relationship quality (intimate disclosure and conflict) to our fixed effects regression model.

Results: Emotional and behavioral problems among children in Germany increased after parental separation. However, the effect was only significant for behavioral problems. To estimate the heterogeneous effects after parental separation depending on the quality of the parent–child relationship, we added an interaction between parental separation and our two measures of relationship quality (intimate disclosure and conflict) to our fixed-effects regression model. We found partial support for our argument that good parent–child relationship quality can buffer children's negative outcomes after parental separation. Children who had a high level of conflict with the resident parent had significantly more emotional problems after parental separation, whereas children who had few conflicts with the resident parent had significantly fewer emotional problems after separation. Similarly, we find that only children in a parent–child dyad with a low level of intimate disclosure had more behavioral problems after parental separation than before.

Conclusion: Despite the mixed results, this study supports the claim that not all children respond identically to parental separation and that we should focus on buffering factors to support children's well-being after parental separation, rather than only investigating the potential negative effects of parental separation.

1.5.3 Do Kids See It Coming? Analyzing Children's School Outcomes in the Years Before Parental Separation in Norway.

Objective: The study examined whether children's cognitive abilities already decline in the years prior to parental separation, adopting a process-oriented approach (RQ3). In addition, the study explored heterogeneous effects based on children's socioeconomic background and gender.

Background: Existing research on the effect of family transitions on educational outcomes typically compares outcomes before and after parental separation. However, this

approach overlooks that parental separation is often preceded by a longer-term process of family decline. Therefore, the adverse impact on children's educational outcomes may occur even prior to the formal separation, resulting in social disparities in their educational development at an earlier stage. To close this gap, my study adopted a life course perspective, which suggests that research should take a long-term perspective to better understand the developmental process over time and analyzed the heterogeneity of children's educational outcomes resulting from the potential anticipation of parental separation.

Method: Utilizing Norwegian register data spanning the years 2007 to 2017, my study employed fixed effects regression to analyze math and reading scores of 185,721 children aged 9 to 15 years, of whom 6,593 had experienced parental separation.

Results: I found small pre-separation effects in the years before parental separation. Four years before parental separation, children had significantly better reading and math scores than in the year of separation or one year before parental separation. The difference between their scores one year before parental separation and the year of separation was not statistically significant, suggesting that children's math and reading scores are already declining in the period before parental separation. This pattern was mainly driven by boys, while no clear pattern emerged for heterogeneities by children's socioeconomic background.

Conclusion: The study underscored the need to regard parental separation as a gradual process rather than a discrete event, highlighting the early emergence of cognitive effects of separation on children and the importance of considering heterogeneous effects.

1.5.4 Adaptation, Cumulative Disadvantage, or Selection? Children's Age at Stepfamily Formation and School Achievement

Objective: In this study, together with Sandra Krapf and Jonathan Wörn, I examined the impact of the timing of stepfamily formation on children's educational achievement, focusing on age-specific effects (RQ4). Thereby, we aimed to analyze whether a life course stage can serve as a moderator in the relationship between family structure transition and child well-being.

Background: While prior research has extensively investigated the effects of single-parent families on children, comparatively less attention has been devoted to understanding the experiences of stepchildren. If children raised in stepfamilies face disadvantages, the growing prevalence of such family structures underscores the importance of addressing potential social inequalities stemming from family composition.

Method: Leveraging a large Norwegian register dataset, we employed a family fixed effects analysis to compare the educational achievement of sibling experiencing stepfamily formation at different ages. Additionally, we assessed the selection into stepfamilies by comparing them to children in two-biological parent families using an OLS regression analysis.

Results: In the family fixed effects model, we found that children experiencing stepfamily formation between ages 12 and 14 exhibited lower academic achievement than those experiencing it at age 16. Children in stable two-parent families had significantly higher academic achievement than those in stepfamilies and single-parent families, supporting the selection hypothesis.

Conclusion: The study highlighted age-specific effects of stepfamily formation and thus underscored the importance of life-course effects in the context of stepfamily formation. In addition, the study emphasized the complex interplay between selection processes and causal effects.

Table 1.2: Overview of all empirical studies that are part of the dissertation project.

	Chapter 2	Chapter 3	Chapter 4	Chapter 5
Title	Analyzing the impact of family structure changes on children's stress levels using a stress biomarker	Parental separation and children's well-being. Does the quality of parent-child relationships moderate the effect?	Do kids see it coming? Analyzing children's school outcomes in the years before parental separation in Norway.	Adaptation, Cumulative Disadvantage, or Selection? Children's Age at Stepfamily Formation and School Achievement.
Research question	Are changes in family structure associated with an increase in children's stress levels?	How does the impact of parental separation on children's well-being vary depending on the quality of the resident parent-child relationship?	Are children's math and reading scores already declining in the years prior to parental separation?	How does the age at stepfamily formation influence children's school achievement?
Analytical approach	First-difference regression	Individual fixed-effects regression	Individual fixed-effects regression	(1) Family fixed-effects regression (2) OLS-regression
Dependent variable(s)	C-reactive protei	(1) Emotional problems (2) Behavioral problem	(1) Math scores (2) Reading scores	Grade Point Average in grade 10
Independent variable	(1) Change to single-parent family (2) Change to stepfamily	(1) Change to single-parent family (2) Parent-child relationship quality	Years before parental separation	Age at stepfamily formation
Data	German Health Interview and Examination Survey for Children and Adolescents (KiGGS) (2003-2006 and 2014-2017)	German Family Panel (Pairfam) waves 2- 13 (2009/2010 - 2020/2021)	Norwegen register data (2007 - 2017)	Norwegian register data (2005 - 2007)
Authorship	With Mine Kühn, Lara Bister, Tobias Vogt and Sandra Krapf	With Sandra Krapf	Single authorship	With Jonathan Wörn and Sandra Krapf
Publication status	Published in Journal of Health and Social Behavior (2024) Impact Factor: 5.0 DOI:10.1177/00221465231223953	Published in Journal of Social and Personal Relationships (2023) Impact Factor: 2.8 DOI:10.1177/02654075231201564	To be submitted soon to Journal of Marriage and Family	To be submitted soon to Demography

1.6 General Discussion

1.6.1 Summary of the Findings and the Contribution

In this book, I focus on the overarching research question: How do changes in family structure influence different dimensions of child well-being. I formulate four specific research questions that address different subjects, including the role of stress, stepfamily formation heterogeneous effects. These research questions jointly contribute to three main areas of open research: Beyond cross-sectional analyses, beyond union dissolution and beyond homogeneous effects.

The application of data-intensive causal methods based on data sets from Germany and Norway enables me to replicate causal analyses that were often performed with US data. Overall, findings of the included studies in this dissertation show that children living in post-separation families fare worse than children living with their two-biological parents. The variety of data sets allows me to analyze a variety of well-being indicators. I identify a negative effect of parental separation for three outcome variables: children's emotional and behavioral problems, children's school outcomes and children's stress level. However, overall, the effect sizes are quite small. Nevertheless, by controlling for unobserved heterogeneity and selection effects, I contribute to the understanding of the consequences of family structure transitions, which go beyond cross-sectional analyses. In addition, the four subordinate research questions provide a nuanced understanding of the well-being of children living in post-separation families.

The first research question asks whether children's stress levels increase following a change in family structure. Increased stress is often cited in the literature as an explanatory mechanism for children's diminished well-being following family structure transitions. However, previous studies have either relied on longitudinal data with a subjective measure of stress (Cherlin et al., 1998; Rattay et al., 2018; Strohschein, 2005) or cross-sectional data with a stress-related biomarker (Gaydosh & Harris, 2018; Lacey et al., 2013). In my analyses I go *beyond cross-sectional analyses* by relying on two measures of a stress-related biomarker, namely C-reactive protein (CRP), in childhood. By introducing this longitudinal design, the results show that a change from a two-biological-parent family to a single-parent family significantly increases children's

CRP, whereas a change to a stepfamily does not significantly affect children's CRP. Thus, the findings support the theoretical claim that increased child stressmay serve as an explanatory mechanism for reduced child well-being following the transition to a single-parent family (Chapter 2).

However, the results in my book suggest, that parental separation is not uniformly disruptive for children's well-being. In my second research question, I focus on the role of relationship quality as a moderator in the relationship between parental separation and child well-being. I argue that having a good relationship with the resident parent can reduce the negative outcomes for children following the separation of their biological parents. Indeed, a good parent-child relationship quality can buffer children's negative outcomes after parental separation (Chapter 3). Thereby, I go beyond the deficit perspective and identify factors that might help to mitigate the negative consequences of separation on children's well-being. In addition, the findings underline the relevance of studying child well-being *beyond homogeneous effects*. In doing so, I contribute to the recent call in research for nuanced analyses of the consequences of family structure transitions (Härkönen et al., 2017; Thomson, 2014b).

A second source of heterogeneity that I discuss in this dissertation is time. Most studies have treated parental separation as a single event and compared children's outcomes before and after the formal parental separation. However, this approach neglects that parental separation is often preceded by a continuous process of family decline. According to this process perspective, negative effects may occur even before parental separation occurs, which is the starting point of my third research question. The results do indeed show small pre-separation effects: Children's math and reading scores start to decline in the years prior to parental separation. This finding represents an important first step toward understanding trajectories within a life course framework that recognizes the importance of modeling parental separation as a process. This heterogeneity in children's well-being before parental separation remains hidden when the average well-being in the years before and after separation is compared. In contrast, the process-oriented approach of my study compares the years before separation separately with the year of separation.

Another time dimension that serves as a source of heterogeneity is children's age at stepfamily formation. Thereby, I contribute to research that goes *beyond union formation*. The results indicate that those experiencing the transition at the age of 12 to 14 achieve slightly lower Grade Point Averages than those who experience stepfamily formation at the age of 16. No significant differences were observed between the younger and older age groups. Consequently, the findings indicate that children between the ages of 12 and 14 are more vulnerable than their older and younger siblings. This further supports the rationale of the life-course perspective, which posits that the period of exposure is crucial for children's well-being. However, the results also suggest that selection into a post-separation family plays a bigger role for children's educational achievement than the causal effect of a change in family structure.

Overall, the dissertation contributes to key areas of current research in family sociology. Survey, medical, and registry data suggest that parental separation has, on average, a negative effect on children's well-being. This is the case for children's stress levels, their emotional and behavioral problems, and their school outcomes. The magnitude of the effect is small, but not negligible. I am therefore able to replicate the results of causal analyses using data from the United States with research from Norway and Germany that goes *beyond cross-sectional analyses*. In addition, the studies underline the importance of studying consequences that go *beyond homogeneous effects*. In my analyses, I show that a good relationship with the resident parent buffers the negative consequences of parental separation. Timing is another source of heterogeneity, as the age at which children experience a change in family structure is important for their well-being. This finding is central to our general understanding of the SDT (Lesthaeghe, 1995). Thereby, this dissertation highlights the importance of not only studying differences in family structure and child well-being, but also of determining for whom and under what conditions family structure affects child well-being (Jensen & Sanner, 2021). My dissertation also underlines the importance of studying parental separation as a process as child well-being also deteriorates in the years before formal separation. This longitudinal perspective opens up new avenues for research that seeks to understand how children's well-being prior to separation affects their later well-being (Kreyenfeld & Trappe, 2020). The effect of stepfamily formation on children's well-being remains puzzling. While the analysis of children's stress levels does not show a significant in-

crease after stepfamily formation, children's GPA seems to be negatively affected by stepfamily formation. These different findings may be due a small sample size in the stress sample or due to the different outcome variables studied. However, as research that goes *beyond union dissolution* is still in its infancy, it is challenging to classify these diverging results. Further research is necessary to enhance the understanding of the current era of family complexity (Thomson, 2014b).

Hence, the dissertation has theoretical implications for family sociologists. Firstly, Chapter 2 contributes to the theory by showing that increased stress can serve as a mechanism for increased stress after parental separation. In addition, the dissertation highlights the moderating effect of soft variables, such as relationship quality. Considering the findings presented in Chapter 3, it can be concluded that, in addition to financial considerations, "soft" indicators have an impact on the reality of children's lives. Further, in light of the life-course perspective, future research should view parental separation as a process rather than an event (Chapter 4). Lastly, the dissertation emphasizes the significance of the life course as a potential moderator on the relationship between family structure changes and children's well-being (Chapter 5).

1.6.2 Limitations

The main results of this study should be considered against the background of limitations, which I address in the following. These limitations pertain to the bigger picture of the dissertation, whereas the more detailed limitations of studies are discussed in the respective chapters.

Firstly, as I have opted for a causal data analysis technique that relies on within-individual or within-family comparisons, this involves a data-intensive strategy. While the within approach has the advantage of producing a reliable estimator, this comes with a significant reduction in sample size compared to a between-approach. Therefore, the studies in this book that utilize German survey data rely on a limited number of children who have experienced a change in family structure. Hence, the studies with German data do not permit a comparison between East and West Germany, for instance. However, despite the reunification of the two German regions, they continue to diverge in

terms of family norms and childcare arrangements (Zoch, 2021). Therefore, it is crucial to examine the impact on children separately, which is not possible with the limited sample size. Register data circumvent the problem of small sample sizes. However, in Germany, for example, official data sources do not allow to follow family transitions (Kreyenfeld & Trappe, 2020). The sample sizes are large in the two studies of Norway, where I can rely on register data to study family structure transition and child outcomes in Chapters 4 and 5. However, it should be noted that this dataset is also not without limitations. In comparison to survey data, it does not contain "soft" variables such as relationship quality, emotional problems, or interparental conflicts. However, as my research with survey data has shown, such indicators matter for child well-being in post-separation families (see Chapter 3). Consequently, in the two studies in which I rely on register data, I cannot control for all relevant confounders. One example of such an unobserved confounder might be parent's personality. Individuals with high levels of neuroticism are more likely to experience separation than those with low levels of neuroticism (Roberts et al., 2007). At the same time, children of parents with high levels of neuroticism tend to exhibit lower levels of well-being (Fan et al., 2020). Hence, even if the adoption of advanced methods to control for unmeasured variables enhances our comprehension of the consequences of family change, none of the methodological approaches can entirely eliminate confounding by unobserved variables (Härkönen et al., 2017). It therefore remains challenging to provide a causal answer to the research question.

Furthermore, it is not possible to compare the effect sizes directly between Norway and Germany, as the studies (1) utilize different data sets and (2) examine different aspects of children's well-being. This does not allow for strong conclusions to be drawn regarding the differences in the consequences of family structure transitions on children's well-being in the two countries. A review of the literature on different indicators of each welfare state in this chapter reveals that the two countries are similar with regard to family demographics and attitudes towards separation. Therefore, it seems plausible that the results can be transferred to the other country. However, a direct comparison is beyond the scope of the empirical analyses of this dissertation.

In addition, it is possible that the results differ for certain subgroups. As the twenty-

first century is characterized by international migration, different migrant groups are one relevant subgroup (Castles & Miller, 1998). Migrants differ in terms of their cultural values, labor market participation and partnership behavior – both between the migrant and non-migrant group, but also within each migrant group (Andersson et al., 2015; Kosyakova & Kogan, 2022; Phinney et al., 2000). This is also the case for their family behavior. In Germany, large migrant groups tend to follow traditional family behavior. Among Turkish and ethnic German immigrants between 18 and 40, around 80 percent are married. This is the case for only around 30 percent of the native German population (Kuhnt & Krapf, 2020). In addition, the partnership behavior differs between endogamous and exogamous partnerships. Research has shown that marriages between immigrants from the same country are only half as likely to break-up as endogamous marriages between natives (Milewski & Kulu, 2014). Given the considerable heterogeneity among migrant groups, it is essential that research considers the country of origin, as well as exogamy and endogamy, in order to analyze the consequences of parental separation on migrants. These differences may lead to divergent outcomes in relation to changes in family structure. However, sample size limitations do not allow for nuanced analysis, even for large migrant groups. Given that even in the majority population, family transitions are limited in our current data, an analysis of the impact of parental separation on child well-being would be limited by a lack of statistical power. For this reason, I have chosen not to differentiate further between the experiences of migrants and those of individuals in interethnic partnerships. Consequently, when interpreting the results, it is essential to bear in mind that they refer solely to the majority population.

To conclude, I am not able to examine cross-country differences or draw conclusions about the impact of family structure transitions in different migrant groups. However, given the methodological improvements over previous research, the variety of outcome variables examined, and the diversity of family structures analyzed in this dissertation, I am able to provide a broad picture of overall trends related to the consequences for children of family structure transitions.

1.6.3 A Look Ahead: Research Question for Future Research

By demonstrating the importance of family structure transitions for child well-being as well as the limitations of current research, this dissertation suggests avenues for three major areas of research:

In this book I was able to address the role of stress following parental separation. However, I have not been able to disentangle the two theoretical mechanisms underlying family transitions: stress and resources. This raises the important question of what drives child well-being in post-separation families. Since empirical support for emotional or financial resources as potential drivers remains surprisingly modest, there is a need to further investigate the role of these mechanisms (S. Cavanagh & Fomby, 2019). However, to date, no study has analysed the effect of financial or emotional resources and stress on child well-being after family structure transition jointly. This would require a large, longitudinal data set that includes child outcomes as well as detailed information on family income and household composition. However, while register data include reliable data on financial resources, they lack information on stress and emotional resources. Survey data lacks statistical power due to a limited number of children who experience family structure transitions. Hence, given the currently available data, it is not possible to perform a direct mediation analysis which would be the optimal method for testing the mechanisms in question. This underscores the necessity to expand surveys on children and not solely focus on adults in questionnaire designs. Given the potential for retrospective reports on experiences such as parental separation to be biased, it is crucial to inquire children in the immediate temporal context of the perception of the event. In a hypothetical scenario where data collection is not constrained by any external factors, this survey would be conducted in multiple countries to facilitate cross-country comparisons using the same dataset. This would allow for a comparison of children's well-being across different welfare states, thereby enabling an answer provided to the question of which welfare system performs best in mitigating the negative consequences of family structure transitions.

In light of the results of this dissertation with regard necessity for further research *beyond homogeneous effects*, a multitude of additional research questions emerge. One

study included in this dissertation underlines the importance of parent-child relationship quality as a moderator in the relationship between child well-being and parental separation (Chapter 3). Therefore, it would be beneficial to adopt this setting to the stepparent-child relationship quality when transitioning to a stepfamily. A further source of heterogeneity may arise due to the proximity and relationship quality with the non-resident parent following parental separation. Does the child experience conflict of loyalty if they have a good relationship with the resident parent following parental separation? How does this change if a stepparent enters the picture? And does the relationship between the non-resident parent and the stepparent moderate these effects? Including these moderators may contribute to a more comprehensive understanding of the relationship between stepfamily formation and child well-being, which remains a topic of ongoing research.

Lastly, family structures continue to diversify, underscoring the need for research that reflects this diversity beyond union dissolution. Joint physical custody, which means that a child lives with each parent for at least 25-50% of the time after separation or divorce (Smyth, 2017), is becoming increasingly popular. In Norway, the share of families residing in joint custody arrangements has risen from less than 10% at the turn of the millennium to 25% in 2012 (Kitterød & Wiik, 2017). Although the results of studies on this topic tend to vary, some evidence suggests that children in joint custody arrangements may have better outcomes than those in sole custody arrangements (Steinbach, 2019). However, research in this area is still in its infancy and represents an important field for further work. This is especially important for stepfamilies as the introduction of a stepparent for children who equally live at each parent's house may lead to increased conflicts of loyalty. Another interesting comparison emerges from the growing number of women who have chosen to become mothers without the involvement of a partner, so called 'single mothers by choice' (Jadva et al., 2009). These women have relied on fertility clinics to become pregnant and have subsequently become single mothers. Consequently, these children have experienced a single-parent family structure without the experience of a parental separation. A comparison between children living in single-parent families due to the results of a parental separation and children born into single-parent families would enhance our understanding of whether the lack of resources contributes to children's diminished well-being or whether the experience

of a parental separation itself influences child well-being.

1.6.4 Implications for Policy Makers

My findings not only enhance our comprehension of family structure diversity but also have significant implications for family policies. As evidenced by my dissertation, living in a post-separation family has a modest impact on various dimensions of child well-being. Hence, children's well-being depends on their parents' decisions about their relationship over which children have little control. This introduces an additional dimension of social inequality, which is why sociologists refer to single-parent families as a new social risk (Hübgen, 2018). However, as codified in the UN Convention on the Rights of the Child (United Nations, 1989), all children have the right to equality of opportunity, regardless of their family background. Therefore, tailored policy interventions are necessary to buffer these social inequalities arising from different family forms. Family support is a complex system of social control and social support (Arránz Becker & Loter, 2021). Consequently, Crosnoe (2021) refers to the challenge as a policy dilemma, noting that "things that most powerfully influence adolescent development are also the most difficult to manipulate through large-scale policy intervention" (p.1146). Nevertheless, there are a few starting points that I would like to suggest to policy makers.

Today, many policies primarily address the needs of adults following a divorce or separation (e.g. through monetary benefits and access to the labor market). Children benefit through these policies indirectly as they target an increase of household income in post-separation families. However, as evidenced in chapter 4, the potential protective effect of income on the adverse consequences of separation is small. Conversely, I demonstrate in chapter 3 that a positive parent-child relationship quality can mitigate the negative consequences of parental separation. One way to support a positive parent-child relationship would be through psychosocial counseling. The current counselling services in Germany tend to focus on the resident parent, with an emphasis on reflection on parenting skills and relationships with ex-partners or new partners (Hegemann et al., 2022). In Norway, family counselling is mandatory for both parents involved in a divorce or separation, with the aim of resolving parental conflicts and discussing post-

divorce arrangements. These include decisions regarding where the children should live and the frequency of contact with the non-resident parent (James et al., 2010). However, these services seem to focus more on the parents and less on children. In light of the finding that the parent-child quality is essential, psychosocial counselling with the resident parent and the children would help to enhance their relationship. Jointly, they can discuss, what support they need, in which areas they currently struggle and how they want to structure their new daily routines. Such an offer may not only be relevant for single-parent families, but also for stepfamilies. Although family counselling is more frequently sought by stepfamilies and single-parent families than by two-biological parent families, many postseparation families in Germany are unaware of these services (Hegemann et al., 2022). This underlines the importance of low-threshold counselling services and effective public relations work. In addition, this work demonstrates that post-separation families are systematically different from two-parent families even prior to the family transition (see Chapter 5). This indicates that these families require psychosocial support in the form of counselling services even before the transition to a new family structure. The provision of mediation after the decision to separate, as is the case in Norway, may be too late in the process of family decline to avoid disadvantages compared to children who grow up in stable two parent families. A psychology service at school could provide low-threshold counselling services for children and parents to discuss strategies for managing increased negative emotions and stress. The acquisition of these behavioral patterns prior to the family transition could serve to mitigate the adverse effects of family instability.

In essence, this book highlights the social stratification perspective in terms of children's well-being in the context of family structure transitions. In the United States and in Europe, changes in family structure have a negative effect on children's well-being. This is of particular concern as children in low-income families are particularly vulnerable to experiencing family instability (McLanahan, 2004). Therefore, the consequences of family transitions represent an additional risk dimension of social inequality, on top of the poverty risk, making family structure transition a social risk in our society (Hübgen, 2018). However, the dissertation demonstrates that the obtained effect sizes are relatively modest, and that parents and children can work together to mitigate these negative consequences.

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2 Analyzing the Impact of Family Structure Changes on Children's Stress Levels Using a Stress Biomarker

Pauline Kleinschlömer, Mine Kühn, Lara Bister, Tobias C. Vogt, Sandra Krapf

Abstract

Changes in family structure (e.g., parental separation or stepfamily formation) are associated with a deterioration in children's well-being. Most researchers have focused on the impact of such changes on children's educational and psychosocial outcomes, whereas the effects on children's biological processes have been studied less often. We analyze the effects of changes in family structure on children's stress levels using data from the German Health Interview and Examination Survey for Children and Adolescents study (2003–2006 and 2014–2017). Our outcome variable is the biomarker c-reactive protein (CRP), which correlates with psychological distress and is collected from blood samples. Calculating first-difference estimators, we analyze whether children have higher CRP levels after changing to (1) single-parent families (n = 117) or (2) stepfamilies (n = 80). Our findings suggest that changing to a single-parent family significantly increases children's stress, whereas changing to a stepfamily does not. These observations are important because increased stress in childhood can negatively affect well-being later in life.

Keywords

biomarker, child well-being, parental separation, stepfamily formation, stress

2.1 Introduction

The prevalence of two-biological-parent family households is declining in most Western societies, and this arrangement is increasingly being replaced by alternative family forms. In Germany, the share of underage children living with a single parent or a stepparent has risen in recent decades, from 17% among children born in 1971 to 1973 to 32% among children born in 1991 to 1993 (Kleinschlömer & Krapf, 2023). Most of these children have experienced their parents' separation (Andersson et al., 2017).
The consequences of this experience have been widely studied. Previous research suggests that on average, children living in postseparation families fare worse than children living with both biological parents (Amato, 2000; Raley & Sweeney, 2020) because they tend to have more behavioral and emotional problems, lower academic test scores, more problems with social relationships, and a higher risk of developing childhood obesity and asthma (Amato, 2014; Bzostek & Beck, 2011; Goisis et al., 2019). Most studies attribute these adverse health outcomes to increased psychological distress because the effects of changes in family structure on a child's personal life may lead to major adjustment problems and thus to increased psychological stress (Amato, 2000). Clearly, changes in the family can also relieve stress in children, allowing them to escape the daily parental conflicts from before the separation (Booth & Amato, 2001). However, on average, children's stress increases with separation (Amato, 2000).

Analyzing the association between changes in family structure and children's stress levels is particularly important because increased stress during childhood can negatively affect many key areas of later cognitive development and physical health (Baumeister et al., 2016; Danese et al., 2009; Harkness et al., 2006). Due to a lack of data, only a few studies have used biomarkers to measure children's stress when examining the consequences of changes in family structure even though biomarkers can serve as objective measures that reflect underlying changes in stress without any reporting bias (Eiser & Morse, 2001). In particular, there is a lack of longitudinal studies on the effects of family changes on child well-being in which biomarkers have been sampled more than once over time.

This study aims to fill this gap by testing whether changes in family structure are

associated with an increase in children's stress levels using two survey waves. We are also the first to consider stepfamily formation and its consequences for children's stress-related biomarkers, in addition to studying the effects of single-parent family formation. Given that more and more children are experiencing their parents' repartnering (Feldhaus, 2016), our study makes an important contribution to the current body of research on children's outcomes in postseparation families.

We use data from the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) conducted by the Robert Koch Institute, which collected information on the health of children and adolescents living in Germany (Mauz et al., 2020; Seeling et al., 2018). These data provide information about selected biomarkers that were measured in two survey waves in 2003 to 2006 (KiGGS0) and 2014 to 2017 (KiGGS2). We use c-reactive protein (CRP) as our objective outcome variable. CRP is a biomarker of inflammatory processes and can be detected in children's blood samples. The biomarker correlates with depressive symptoms and stress (Johnson et al., 2013) and serves as a proxy for children's stress levels in our study. There are many potential mechanisms linking changes in family structure to changes in children's CRP, such as financial hardship or weight gain. Effects might also vary by gender or socioeconomic group. However, our aim is to analyze the direct effects of a change in family structure on children's CRP levels in a longitudinal setting. Because CRP correlates with psychological distress, we use it as a proxy variable to infer whether children age 1 to 17 had higher stress levels in the years after the change in family structure than in the years before.

We focus on the change from (1) a two-parent family to a single-parent family and on the change from (2) a two-parent family or a single-parent family to a stepfamily. Because of the small number of repartnering events of single parents in the first observation period, we have combined the transitions from a two-parent family and a single-parent family to a stepfamily.[1] Of course, stepfamilies are also two-parent families. However, in our data, we cannot clarify the genetic family relationships and therefore hesitate to talk about two-biological-parent families. In our study, we define a two-parent family as a family without (reported) separation experience and define a stepfamily as a two-parent family with a history of (reported) family instability. For our analyses, we use

a first-difference regression that allows us to estimate the changes in the CRP levels before and after the change in family structure within each child.

2.2 Theoretical Background

The Impact of Changing to a Single-Parent Family on Children's Stress Levels

A change in family structure disrupts previous family life and brings about new and potentially stressful circumstances for children. The instability hypothesis states that for children and adolescents, the departure of a parental figure creates uncertainties because they question whether they can still rely on the parent's emotional support (Wu & Martinson, 1993). Amato (2000) identified five groups of stressors that a child may experience following a parental separation: (1) financial strains; (2) parental conflicts; (3) excessive demands on the parent living with the child, which can affect the parenting style; (4) lack of contact with the nonresident parent; and (5) possible further changes in the child's living circumstances due to moving, changing schools, or the loss of the circle of friends. Based on the instability hypothesis, we argue that children will have higher stress levels after experiencing parental separation than before (Hypothesis 1).

Previous studies have used stress-related biomarkers to analyze the effects of adverse childhood experiences on individuals' stress levels later in life (Kuhlman et al., 2020). To our knowledge, however, only two existing studies have explicitly focused on the effects of parental separation as an adverse childhood experience (Gaydosh & Harris, 2018; Lacey et al., 2013). These studies reported mixed results. Gaydosh and Harris (2018) found no effects of parental divorce in childhood on health-related biomarkers in young adulthood, specifically on CRP, metabolic syndrome, body mass index (BMI), and hypertension.[2] By contrast, Lacey et al. (2013) found that parental separation had a positive impact on CRP in adulthood. Although both studies relied on longitudinal data to obtain information on family structure, they both measured biomarkers only once. Repeated measurements of stress-related biomarkers have been rare in previous research.

Only one study has analyzed the impact of family instability on a stress-related biomarker in children, namely, cortisol, using two stress measurements (Suor et al.,

2015). The authors found that family instability predicted a stronger stress response in two-year-old children. However, they did not explicitly analyze parental separation. Instead, their definition of family instability included not only changes in the caregiver's intimate relationship but also family events such as a change in the child's caregiver's job, financial losses, and the loss of a family member — with no clear distinction between these factors. For these reasons, it is difficult to derive any conclusions about children's stress reactions to changes in family structure. In addition, the study analyzed low-income families only, which complicates the generalizability of the findings. Other longitudinal studies tried to capture stress in children following a change in family structure by measuring their adverse emotional symptoms (Cherlin et al., 1998; Rattay et al., 2018; Strohschein, 2005). The questionnaires asked children whether they are currently unhappy, worried, feeling distress, or feeling anxious. The results uniformly showed that children who experienced the separation of their biological parents had lower emotional well-being than children of the same age who did not experience parental separation (Baxter et al., 2011; Rattay et al., 2018; Strohschein, 2005).

The Impact of Changing to a Stepparent Family on Children's Stress Levels

A child can also experience uncertainty when a parent enters a new relationship and potentially introduces the child to a new family situation, for example to a stepfamily (Coleman et al., 2000; Shafer et al., 2017; Sweeney, 2010). Stepfamily formation interrupts daily routines, which can, in turn, lead to uncertainties about family roles and confusion about parenting responsibilities. In addition, research has shown that complex dynamics between half- and stepsiblings can have negative effects on a child's wellbeing (Halpern-Meekin & Tach, 2008). Hence, coming together as a stepfamily is a demanding and complex process that may be associated with instability and ambiguity, which could, in turn, cause children's stress levels to rise (Coleman et al., 2000; Wu & Martinson, 1993). In line with these findings, we argue that the repartnering of the resident parent can lead to an increase in children's stress levels (Hypothesis 2).

Previous empirical studies that examined the impact of the formation of a stepfamily on children's stress levels used mainly subjective markers. Only one study has explicitly analyzed the change to a stepfamily formation using biomarker and found no associa-

tion between parental repartnering in childhood and CRP levels in young adulthood (Gaydosh & Harris, 2018). Research based on subjective markers shows a positive effect of stepfamily formation on children's stress. Hetherington and Kelly (2003) concluded that children have increased stress levels up to five to seven years after stepfamily formation. Shafer et al. (2017) showed that retrospective reports of feelings of stress after parental separation and after stepfamily formation were associated with depressive symptoms among young adults. In addition, their findings indicated that participants who perceived both parental separation and stepfamily formation in their childhood or adolescence as stressful reported higher levels of depressive symptoms than participants who perceived only one of the two changes as stressful. These results suggest that stepfamily formation may be an additional stressor on top of the stress caused by parental separation.

Using Biomarkers to Measure Children's Stress Responses to Changes in Family Structure

Our literature review has shown that previous studies often relied on subjective measures of children's stress (e.g., emotional problems). However, subjective stress measurements might be biased. Whereas validated emotion self-report questionnaires are almost exclusively completed by children older than age nine, the measurement of stress in children younger than nine has been more complicated (Michels et al., 2013). In some studies, parents responded for their children. However, it has been shown that the answers of parents and children are often not identical (De Los Reyes et al., 2015). Thus, because parents' reports are prone to reporting bias (De Los Reyes et al., 2015; Eiser & Morse, 2001), using objective stress measures, such as biomarkers, has benefits when studying young children.

Research that used objective measures, including stress-related biomarkers, to study the impact of changes in family structure on children's stress levels often relied on only one measurement of stress variables (Gaydosh & Harris, 2018; Lacey et al., 2013). In such cross-sectional study designs, there is an increased risk of overlooking potential health selection effects (Gaydosh & Harris, 2018). This means that isolating the impact of experiences like parental separation during childhood from other stressors becomes

challenging. For instance, the parents of a child with a genetic predisposition or illness might be more likely to separate because a sick child places additional stress on the parents and on their relationship. Consequently, the differences we observe in cross-sectional studies may not solely be attributed to the experience of parental separation, but to factors that are more common in families that experience parental separation. By relying on repeated measures of stress, we are able to account (at least partly) for unobserved heterogeneity in our study.

Analyzing the effects of changes in family structure on children's stress levels is particularly important for understanding potential life course health inequalities among children living in postseparation families. Having negative experiences in childhood or adolescence may predispose individuals to later psychopathology by lowering the threshold for another stressor to be triggered in the future (Hammen et al., 2000; Harkness et al., 2006). The claim that such a sensitization can occur was confirmed in the context of divorce in an experimental study by Kraft and Luecken (2009). Their study examined the extent to which young adults' ability to cope with stress differed depending on whether they did or did not experience a parental divorce in childhood. The study found that even years after they experienced a parental divorce, the young adults' cortisol levels showed a stronger stress reactivity response to a stressful task than the cortisol levels of young adults who did not experience a parental divorce. Therefore, we argue that children can have increased stress levels not just immediately after a change in family structure but also years after the change.

Using the CRP to Measure Children's Stress Levels

Following biochemical explanations, increased stress in children after a family change can be attributed to a dysregulation of the inflammatory system (Johnson et al., 2013). An inflammatory response is a natural protective reaction to a threat, such as a virus, but also to psychological or emotional stressors. The immune system releases numerous inflammatory mediators to eliminate the harmful stimuli (Herold & Mrowka, 2019). A dysregulation of the inflammatory system occurs when the adaptive system is unable to resolve inflammation. As a result, further inflammatory responses are activated. The CRP, the biomarker that we use in this study, marks such reactions of the inflammatory

immune system (Baumeister et al., 2016; Johnson et al., 2013). In recent years, CRP has been recognized as a significant indicator of a growing number of stress responses that are triggered by, for example, economic, social, demographic, and psychological factors (Johnson et al., 2013). There is strong evidence that adverse childhood experiences, such as changes in family structure, have a small but significant impact on children's CRP levels, which may have long-lasting consequences for their risk of developing psychiatric and physical disorders (Baumeister et al., 2016; Kuhlman et al., 2020). Even after controlling for factors that strongly correlate with CRP, such as BMI, socioeconomic status, life events, substance use, and psychological distress, interpersonal stress involving family or friends is associated with increased CRP levels (Fuligni et al., 2009).

Our Study

In summary, we analyze the effects of changes in family structure on children's stress levels by measuring CRP as a stress-related biomarker in Germany. We consider the change (1) from a two-parent family to a single-parent family and the change (2) from a two-parent family or a single-parent family to a stepfamily. Previous studies that used biomarkers to investigate the effects of changes in family structure on child well-being were based on a cross-sectional research design with only one measure of the objective biomarker CRP, our proxy for stress in childhood. The uniqueness of our study is that we can rely on two measures of the objective stress marker as our outcome variable. Hence, we can add to the current literature a before–after design that more fully accounts for unobserved confounders and health selection. Previous longitudinal studies on this association often relied on subjective measures, even though they are more prone to bias than objective markers. In addition, our analysis of the effects of stepfamily formation on children's stress levels represents an important extension of previous research because much of the current research using biomarkers has analyzed only the change to a single-parent family.

Our study is based on German data. We expect that our findings can be transferred also to other countries. Like in other countries, German family patterns have become increasingly diverse during the last decades. Cohabitation is common, but the majority

of couples are married (Krapf, 2018), and cohabiting couples are more likely to separate than married couples (Krapf & Wagner, 2020). Children experience a comparably high level of parental separation (18% of German children experience their parents separating by age 15) and repartnering (9% of children experience union formation within six years after parents' separation; Andersson et al. (2017, p. 1092). Although these trends in family patterns extend to other countries, there might be differences in effects of family structure. One reason for this variation could be that welfare state support for single parents differs across countries (Zagel & Hübgen, 2018). Although family policies in Germany are more generous than in countries such as the United States or the United Kingdom, single mothers are much more likely to face financial burdens than coupled parents (32% of single mothers and 4% of coupled parents are poor; Härkönen (2018, p. 41).

2.3 Data and Method

2.3.1 Data and Sample

We used data from the German KiGGS study (German Health Interview and Examination Survey for Children and Adolescents) conducted by the Robert Koch Institute (Mauz et al., 2020; Seeling et al., 2018). The data provided us with information on the health of children and adolescents living in Germany. The survey is part of the health monitoring program for children and adolescents in Germany implemented by the German Federal Ministry of Health. The KiGGS baseline study was conducted from 2003 to 2006, Wave 1 was collected from 2009 to 2012, and Wave 2 was conducted from 2014 to 2017. The survey questionnaire covered various domains of children's physical and mental well-being. In addition, relevant demographic data and socioeconomic information on the family environment were collected. Parents were the main respondents of the KiGGS survey for children under age 11. After reaching this age, the children responded independently in the survey parts concerning them. We made use of two survey waves, KiGGS0 (2003–2006) and KiGGS2 (2014–2017), because in these waves, the questionnaire was supplemented by medical examinations, including blood sample analyses that measured the CRP. This combination of family demographic and health variables made the KiGGS data particularly suitable for our study.

In the KiGGS study, participants were recruited from 167 cities and municipalities across all German federal states with the aim of obtaining a stratified random sample of children age 0 to 17 (Mauz et al., 2020). In the baseline study (2003–2006), 17,640 participants answered the questionnaire. A total of 14,131 blood samples were provided in the baseline study of children above age 1. We imposed several restrictions on this sample to ensure that our final sample meets the theoretical and methodological requirements for our research question. First, to meet the requirements for longitudinal analysis, it is necessary to study two time points. Therefore, we restricted our sample to individuals who agreed to participate in the medical examinations twice, both in the baseline study (2003–2006) and in Wave 2 (2014–2017). This reduced our sample size to 4,743. Next, we did not consider children with missing information on relevant variables, resulting in a sample size of 1,922. Third, we considered only the 95th percentile of the CRP distribution. High CRP values indicate a likely acute infection or chronic disease rather than stress exposure, which could systematically bias our results (Sproston & Ashworth, 2018). To exclude extreme values (that are most likely to be related to acute or chronic diseases), we used the distribution up to the 95th percentile.[3] This reduced the number of cases by 97. In addition, we only kept children who were living with at least one of their parents in the same household and excluded children for whom the change to a single-parent family occurred because of the death of a parent (n = 26).[4] Lastly, we dropped observations of children who were living in a stepfamily from the baseline KiGGS wave onward.

After applying these restrictions, we had a sample of 1,462 children ages 1 to 7 in the baseline survey (KiGGS0; 2003–2006) and ages 11 to 17 in the second wave (KiGGS2; 2014–2016). When comparing the full sample with our analytical sample, the mean values of most of our variables were similar. Age and household income were on average higher in our sample than in the full sample. This was likely related to panel attrition. Given our longitudinal study design, our sample comprised only children who participated in both KiGGGS0 and KiGGS2; those who participated only in KiGGS0 were excluded. Children who participated in KIGGS2 were by definition older than those who participated only in KiGGS0. Given that income increases with parents' age and over calendar time, household income in the follow-up study 10 years later is higher than in the baseline study (see Appendix A in the online version of the article).

Table 2.1: Descriptive Overview of Number of Children Included in the Analysis.

	Family Structure (Wave 2)			
	Number of Children			
Family Structure (Baseline Study)	Two-Biological-parent family	Single-parent family	Stepfamily	Total
Two-biological-parent family	1,220 (87.46%)	117 (8.39%)	58 (4.16%)	1,395 (100%)
Single-parent family	0 (0.00%)	45 (67.16%)	22 (32.84%)	67 (100%)
Total	1,220 (83.45%)	162 (11.08%)	80 (5.47%)	1,462 (100%)

Source: German Health Interview and Examination Survey for Children and Adolescents data baseline study and Wave 2. Authors' own calculations.
Note: The rows indicate the family structure of the children at the time of the baseline study. The columns indicate in which family forms the children were living in Wave 2 and thus whether the children had changed to another family form or were still living in the same family structure as in the baseline study.

Table 2.1 provides a more detailed overview of the number of cases in our sample. A total of 117 children experienced a change from a two-parent family to a single-parent family between the baseline study and Wave 2. Because the number of children who experienced a change to a stepfamily between waves was limited, we considered children who experienced (a) change from a single-parent family to a stepfamily (n = 22) or (b) change from a two-parent family to a stepfamily (n = 58). A total of 80 children experienced a change to a stepfamily (Table 2.1), and 1,220 children continued living in a two-parent family, without any experience of family instability. This latter group did not influence the first-difference estimator. We included these children in our analyses because they serve as a useful control group for time-constant unobserved factors and allow us to obtain a more reliable estimator for the control variables (e.g., age effects; Brüderl 2010). For our second hypothesis, which focuses on switching from a two-parent family or a single-parent family to a stepfamily, children who consistently lived in a single-parent family between waves were also included in the control group (n = 45) to obtain more reliable estimators for the control variables because they were

also potentially at risk of switching to a stepfamily.

2.3.2 Method

To identify changes in a child's stress-related biomarker after a change in family structure based on two time points, we used a first-difference regression. This approach estimates the effect based on a comparison of changes within an individual after he or she experienced a treatment, which is, in our case, a parental separation or a parental repartnering. Thus, we analyzed the change in a child's stress levels from KiGGS0 to KiGGS2 while focusing on two family structure changes: the change from (1) a two-parent family to a single-parent family or the change from (2) a two-parent family or a single-parent family to a stepfamily (see Note 5 for the equation of our first-difference model).[5] Children living continuously in a stable family structure do not contribute to the within estimator. Thereby, our analysis did not estimate the differences in children's CRP levels between different family structures but, rather, the differences within a child's CRP level before and after the change in family structure. We ran separate regression models for each family structure change. The resulting within estimator accounts for time-constant unobserved heterogeneity (i.e., for factors that affect both the likelihood of experiencing a change in family structure and children's stress levels). One example of a potential unobserved time-constant confounder is children's gender. Parents with daughters have a higher risk of separation than parents with sons (Kabátek & Ribar, 2021). At the same time, girls have higher levels of CRP than boys (Cook et al., 2000). By automatically controlling for such timeconstant confounders, our approach took into account the problem of omitted variables, which makes any causal claims more robust (Wooldridge, 2010). Given that unobserved confounders may bias the estimated effects of changes in family structure on children's stress levels, the first-difference design we used, unlike cross-sectional studies, can account for such biases (Ní Bhrolcháin, 2001).

Outcome Variable

Our outcome variable was children's CRP, measured in mg/l and obtained from blood samples taken in the KiGGS baseline (2003 – 2006) and second wave (2014 – 2017).[6] Whether a child provided a blood sample was solely based on the informed

consent of the parents and not on any planned selection. We used the variable as a proxy for children's stress levels. Other stress-related biomarkers, such as cortisol levels, were not collected in the KiGSS study. High CRP values likely indicate an acute infection or chronic disease, which may occur independently of increased distress due to family systems changes and could thus systematically bias our results (Sproston & Ashworth, 2018). Because we did not have access to detailed infection-related information in KiGGS, we selected a healthy sample by excluding extreme CRP levels that were most likely associated with acute or chronic diseases. Because there is no clinically validated CRP cutoff value for acute infections or diseases in children, we selected only cases along the CRP distribution up to the 95th percentile.[7] From the comparison of different outlier detection methods by Li et al. (2020), percentile-based outlier removal is still one of the simplest and most effective methods for handling outliers to improve the reliability of the data. This restriction resulted in a right-skewed distribution of CRP with a maximum value of 6.37 mg/l and a mean value of .76 mg/l. Because of the skewness of the distribution, we used the log-transformed CRP variable in our regression analysis.

Explanatory Variable

Our key explanatory variable was family structure. Because the exact dates of all family changes were not surveyed in KiGGS, we used information on the parental constellation in the child's main residence for each wave. The variable was based on a question in which the respondent provided information on the child's main residence at the time of the interview.[8] The choices were whether the child was living with (1) both parents, (2) both separated parents, (3) the mother and her partner, (4) the father and his partner, (5) the mother, (6) the father, or (7) others. Using the provided information, we created our family structure variable with the following three categories: two-parent families, single-parent families, and stepfamilies. If the child was living with both parents, he or she was assigned to the "two-parent family" category. If the child was living with either the mother and her partner or the father and his partner, we operationalized the family structure as a "stepfamily." If a child was living solely with the mother or the father, he or she was classified as living in a "single-parent family." From the answering categories, we could not directly identify the biological parents because the category

"both parents" possibly included a social parent. Genetic ties were not relevant for our study, but the number of family structure changes are. In our study, we defined a two-parent family as a family without (reported) separation experience (i.e., "both parents") and a stepfamily as a family with a history of (reported) family instability (i.e., "the mother and her partner").

To test our two hypotheses, we used two different family structure variables. In Hypothesis 1, we were interested in the change from a two-biological-parent family to a single-parent family. For this change, we coded a dummy variable that takes the value of 0 if the child was living in a two-parent household and the value of 1 if the child was living in a single-parent household. In Hypothesis 2, we focused on the change to a stepfamily. Again, we created a dummy variable. It took the value of 0 if the child was living in a single-parent family or a two-parent family. The variable took the value of 1 if the child had experienced a transition to a stepfamily since the last survey. In our data, we were unable to distinguish between stepchildren who were living with a single parent or with both parents at the time of the first interview. This was unproblematic with regard to the instability argument because both groups of children experienced increased instability (albeit with variation in the level of instability).

Control Variables

We controlled for time-varying confounders by including in our regression model variables on the child's general health status and age, the family's socioeconomic status, and the mother's age. An important confounder is children's general health. Prior research has shown that children who experience a parental separation tend to have lower general health, for example, they gain more weight than children who are living with both of their parents (Goisis et al., 2019). At the same time, the CRP increases with weight (Cook et al., 2000; Ford, 2003). Despite the criticism that BMI has limitations as a measure of childhood obesity because it does not fully account for growth spurts and nonlinear height and weight developments during children's growth phases (Vanderwall et al., 2017), BMI also controls for children's general health (Schwimmer et al., 2003) and physiological cases of high CRPs (Cook et al., 2000; Ford, 2003). For this reason, we added children's BMI to our model as a continuous control variable, serving as a

proxy for general health. The variable ranges between 12.08 and 42.44.

In addition, we controlled for the child's socioeconomic status using the equivalent monthly household income in euros per 100 as a continuous variable. We included this control variable for two reasons: (1) because parents with fewer financial resources are more likely to separate (Amato, 2010) and (2) because children living in families with fewer economic resources generally have increased health risks compared to children living in families with a higher socioeconomic status (Bradley & Corwyn, 2002). The health disadvantage of individuals with a lower socioeconomic background may also be reflected in a higher CRP level (Muscatell et al., 2020). Moreover, we included the age of the mother in years as a categorical variable in our regression model because maternal age may be associated with health risks for the child (Carslake et al., 2017) and with the likelihood to experience changes in family structure (Lyngstad & Jalovaara, 2010; Sweeney, 2010). We divided the variable into three categories based on the terciles. Young mothers in the first tercile were up to 33 years old in the baseline study, 34 to 37 years comprise the middle age, and mothers over 38 years in the baseline study belong to the oldest age group. We added the age of the child as a continuous control variable to the models because CRP levels increase with age (Chiang et al., 2019; Ford, 2003). Lastly, we included the number of siblings living in the same household as the child. In single-parent families, siblings can provide each other with a safe and stable environment during the period of family structure change (Sheehan et al., 2004), which might mitigate the negative stress effects. However, in stepfamilies, complex sibship is negatively associated with child well-being (Halpern-Meekin & Tach, 2008). Prior research on changes in family structure has shown that having one child decreases the risk of parental separation, whereas having additional children increases the probability of separation (Lyngstad & Jalovaara, 2010).

2.4 Results

2.4.1 Descriptive Results

Table 2.2 summarizes the descriptive statistics for the total sample and for two-parent families, single-parent families, and stepfamilies separately. The descriptive analysis shows that in each family structure, children's CRP values varied. Consistent with our hypothesis, we find that children living in a single-parent family had a

Table 2.2: Descriptive Statistics for Variables Used in the Analyses in Our Samples.

Change to a single-parent family (Hypothesis 1)								
Variable	Total				Single-parent family		Two-biological- parent family	
	Mean	SD	Min	Max	Mean	SD	Mean	SD
C-reactive protein [mg/l]	0.76	0.98	0.1	6.37	0.81	0.85	0.76	0.99
Body Mass Index	18.56	3.94	12.08	42.44	21.38	3.41	18.43	3.92
Net equivalent monthly household income [in euro per 100]	14.47	7.67	1.02	62.5	12.19	6.42	14.57	7.70
Mother's age	40.00	7.27	17	60	45.75	4.83	39.74	7.26
Child's age	9.28	5.71	1	17	14.96	1.65	9.03	5.70
Number of siblings	1.28	0.96	0	9	1.55	1.07	1.27	0.96
Number of obs.	2,732				117		2,615	
% in obs.	100				4.28		95.72	
Number of children	1,395				117		1,278	
% in children	100				8.39		91.61	
Number Males	687				51		636	
In %	100				7.42		92.58	
Number Females	708				66		640	
In %	100				9.32		90.40	
Change to a stepfamily (Hypothesis 2)								
Variable	Total				Stepfamily		Two-biological-parent family/ single-parent family	
	Mean	SD	Min	Max	Mean	SD	Mean	SD
C-reactive protein [mg/l]	0.76	1.00	0.1	6.37	0.66	0.89	0.76	0.99
Body Mass Index	18.62	3.96	12.08	42.44	20.83	3.83	18.43	3.92
Net equivalent monthly household income [in euro per 100]	14.46	7.74	1.02	62.5	14.52	7.95	14.57	7.70
Mother's age	39.94	7.30	17	60	42.73	5.18	39.86	7.26
Child's age	9.38	5.70	1	17	14.46	1.56	9.03	5.7
Number of siblings	1.28	1.00	0	9	1.86	1.35	1.27	0.96
Number of obs.	2,690				80		2,610	
% in obs.	100				2.97		97.03	
Number of children	1,345				80		1265	
% in children	100				5.95		94.05	
Number Males	665				36		629	
In %	100				5.41		94.59	
Number Females	680				44		636	
In %	100				6.47		93.53	

Source: German Health Interview and Examination Survey for Children and Adolescents baseline study and Wave 2. Authors' own calculations.

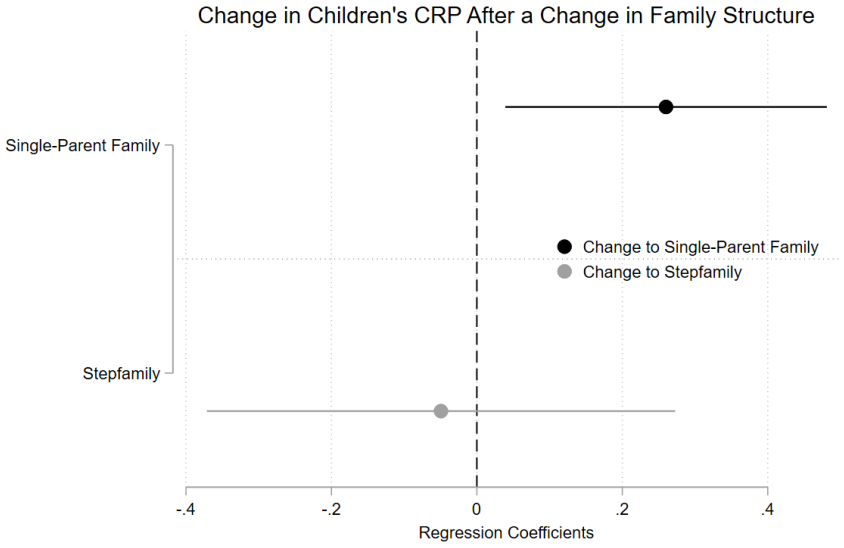
higher CRP level (mean = .81 mg/l) than children living in a two-parent family (mean = .76 mg/l) or a stepfamily (mean = .66). Moreover, children living in a single-parent family had the lowest financial resources (equivalent monthly income [in euro per 100] mean = 12.19). Children's financial resources increased when one parent entered a new relationship (mean = 14.52 in euro per 100), reaching a level similar to that in a two-parent family (mean = 14.57 in euro per 100). Children living in a single-parent family had a higher BMI (mean = 21.38) than children living in a stepfamily (mean = 20.83). The children's mean age was similar in stepfamilies (mean = 14.46 years) and in single-parent families (mean = 14.96 years), and the mother's mean age was lower in stepfamilies (mean = 42.73 years) than in single-parent families (mean = 45.75 years). Children who were living in a stepfamily had more siblings (mean = 1.86) than children who were living in a single-parent family (mean = 1.55).

2.4.2 Results of Multiple Regression

In Figure 2.1, we show the main effect of our two first-difference regressions. The vertical line in Figure 2.1 shows the average CRP level before the change in the new family structure. The gray dot represents children's CRP level before the change to a single-parent family, and the black dot represents children's CRP level after the change to a stepfamily.[9] For the regression table with covariates, see Appendix B in the online version of the article.

The results support our first hypothesis. Thus, we can confirm that experiencing a parental separation led to an increase in children's CRP levels. Children who were living in a two-parent family in the baseline study and had changed to a single-parent family in Wave 2 had a higher CRP value after the change to a single-parent family than before ($\beta = .26, p = .02$). However, the pattern among children who changed to a step-family is not as clear. Children who were living in a single-parent family or a two-parent family in the baseline study and who had changed to a stepfamily by Wave 2 had, on average, a lower CRP value than before the change in family structure. However, the effect was small ($\beta = -0.05$) and was not statistically significant. Thus, this result does not support our hypothesis about stepfamily effects.

Figure 2.1: First-Difference Regression Model Results. Regression Coefficients. Outcome Variable: Children's C-Reactive Protein (Log-Transformed).



Source: German Health Interview and Examination Survey for Children and Adolescents (KIGGS) baseline study and Wave 2. Authors' own calculations.

2.4.3 Additional Analyses

To assess the robustness of our results, we conducted some sensitivity analyses. First, we wanted to investigate whether children who experienced their parents' separation at an earlier point in time had adapted to the new situation. This would be demonstrated by a lower level of CRP among children who experienced their parents' breakup earlier (e.g., soon after the baseline study). Precise separation data are not available in KiGGS. Instead, for our additional analysis, we used household composition information from the telephone survey (KiGGS1) conducted in the wave between the baseline study (KiGGS0) and Wave 2 (KiGGS2). Although no blood sample was taken in KiGGS1, information about the family structure was collected. This additional information allowed us to divide children who experienced the separation of their parents into two groups: (a) children whose parents separated before the KiGGS1 and (b) children whose parents separated after KiGGS1. For children whose parents separated before KiGGS1, there was a longer period between the separation and the second

measurement of CRP levels in Wave 2 than for children whose parents separated after KiGGS1 and, hence, more time to adjust to the new family structure. The results of the sensitivity analysis showed that the increase in children's stress levels that we found in our main model was mainly caused by the children whose parents separated after the telephone interview (i.e., for whom a shorter period of time had elapsed since the separation). However, because of the small subgroups, the effect was not significant, and large confidence intervals indicate uncertainties in the results (see Appendix C in the online version of the article). Further subgroup analyses focused on the children's age and gender. The results suggest that CRP levels increased especially among younger children and girls (see Appendices D and E). However, due to our small sample size, these results should be viewed with caution because they give only a first indication of heterogeneity.

Moreover, because the two blood samples were 10 years apart, children may have experienced more than the one change in family structure that we observed in the data. To analyze the frequency of multiple family transitions after parental separation, we used the German Family Panel (2008–2021, Release 13.0; Brüderl et al., 2021). Pairfam provides partnership histories of Germans in the age group 15 to 50. It consists of a representative sample of persons born in 1971 to 1973, 1981 to 1983, and 1991 to 1993. Among single parents with minor children in the study, only 9% formed more than one new partnership within 10 years (results available on request). We therefore expect that only a small share of children experienced multiple stepfamily formations between the KiGGS survey waves.

2.5 Discussion

Using unique information about biomarkers and family structure from the KiGGS data on children ages 1 to 17, we applied first-difference estimators to analyze the effects of changes in family structure on children's stress levels. Specifically, we considered two separate events: (1) the change from a two-parent family to a single-parent family and (2) the change from a two-parent family or a single-parent family to a stepfamily. The biomarker CRP served as an objective measure of a proxy for stress in children. Our results indicated that children's stress levels increased significantly after

they experienced a change from a two-parent family to a single-parent family. We found no significant effects on children's stress levels after they experienced a change from a two-biological-parent family or a single-parent family to a stepfamily.

The results of our study confirm previous findings that parental separation has adverse consequences for children. The size of the effect of separation on stress estimated in our regression analysis was $\beta = 0.26$. To illustrate the magnitude of the effect on CRP levels, we compare our results with those of prior research that measured stress reactions using the CRP. For example, in their study of the effects of unemployment on CRP levels in adults in the United Kingdom, Hughes et al. (2015) showed that currently unemployed individuals had a CRP level that was .22 mg/l higher than that of working individuals. Clearly, comparing these effect sizes is difficult because of differences in the samples, the research design, the age structure, the operationalization, and the measurement of the CRP variable. Nevertheless, a comparison of the effect sizes seems to indicate that the increase in CRP in the aftermath of parental separation was nonnegligible.

With regard to stepfamily formation, our results did not comply with our expectations. We hypothesized that stepfamily formation would lead to increased stress because, for example, uncertainties about family roles tend to increase after a social parent enters a joint household. Contradicting our hypothesis, our empirical analysis found no increase in children's stress levels in response to stepfamily formation. This finding might be attributed to the considerable heterogeneity in children's experiences of stepfamily formation. Children's stress levels might differ depending on the time elapsed since the parental separation and the timing of the formation of the stepfamily. The KiGGS study only provides information about the family structure at the time of the survey. However, the timing of such changes can be a decisive factor because children might adapt to the new situation in the stepfamily (i.e., initial difficulties might disappear after new family roles and daily routines are established). In our study, we were unable to analyze such potential heterogeneity given the limited information in our data.

Hence, although our results showed that separation affected children's CRP levels, we also acknowledge that the data have several limitations. Most importantly, the num-

ber of observed changes in family structure in the data was relatively small. Only 117 changes to a single-parent family and 80 changes to a stepfamily are recorded in the KiGGS data for our study population. The small sample size limited our statistical power and did not allow us to analyze heterogeneity in children's stress responses to changes in family structure. However, heterogeneous effects (e.g., gender, depending on the child's socioeconomic situation or age at the time of the family structure change) should be taken into account given the evidence that children do not respond identically to a change in family structure (Härkönen et al., 2017). To assess potential moderation effects, larger longitudinal data sets that include information on children's stress levels are required. In addition, CRP can increase for a variety of reasons (e.g., chronic stress, chronic disease, virus, or obesity). To rule out some alternative explanations, we have excluded children with a chronic disease or acute infection by omitting the 95th percentile of outliers and controlled for BMI in our regression as a proxy for children's general health. However, we cannot fully adjudicate these different pathways. Moreover, due to sample size issues, we combined children who changed from a two-parent family to a stepfamily and children who changed from a single-parent family to a stepfamily. These children might differ in terms of the number of changes in family structure they have experienced. This could influence our results because not only the type of family structure changes but also the number of changes children experience affect their well-being (Wu & Martinson, 1993).

Participation in the medical examination may pose another selectivity problem because blood sampling depends on parental consent. However, the results of a logistic regression comparing the groups of parents who did and did not give their consent uncovered no evidence of selectivity regarding family structure. Both children living in single-parent families and children living in stepfamilies were as likely to participate in the survey as children living in two-biological-parent families (see Appendix G in the online version of the article). Nevertheless, regarding stepfamilies, selection effects may have played a role in our study. It is reasonable to assume that only parents with emotionally stable children will enter a new partnership. If parents have a child who is emotionally distressed, they might decide not to enter a new relationship to avoid overwhelming the child. However, the KiGGS data do not provide information on the children's emotional stability.

Despite these limitations, our findings are novel and contribute to the current literature on the effects of family changes on children in several ways. Our unique data from the longitudinal KiGGS study allowed us to rely on an objective biomarker as a proxy for stress levels in children: namely, the CRP obtained from the children's blood samples. Previous research with biomarkers was mainly based on cross-sectional measurements of biomarkers in adulthood (Gaydosh & Harris, 2018; Lacey et al., 2013). Our data offer the advantage of having two measurements of the biomarker in childhood. Although the measurements are 10 years apart and we do not have information about the exact timing of the family transition, we add to the literature with a short- to medium-term effect of family transitions on CRP. Although objective stress markers are associated with subjective stress measures (Michels et al., 2013), they still have an independent predictive validity (Christensen et al., 2019). Moreover, physiological measures such as CRP are more valid than self-rated stress levels because they are not subject to reporting bias. This is especially the case for younger children, who may not be able to clearly distinguish between the dimensions of stress surveyed in a questionnaire. Therefore, validated emotion self-report questionnaires are almost exclusively completed by children older than age nine (Michels et al., 2013). For younger children, researchers must rely on parental reports of child well-being. However, parents' and children's perspectives do not always align (De Los Reyes et al., 2015; Eiser & Morse, 2001). Our study was able to circumvent this bias by relying on a biomarker as a proxy for child stress.

Moreover, our use of an objective measure of stress implies that parental separation will have long-term effects on children. Prior research indicates that elevated CRP levels in children and adolescents are associated with an increased later-life risk of developing cardiovascular diseases (Cook et al., 2000; Ford, 2003; Fuligni et al., 2009), higher BMI and obesity (Cook et al., 2000; Ford, 2003; Nappo et al., 2013), and depressive episodes (Danner et al., 2003). From this perspective, our findings underline the value of studying the impact of changes in family structure during childhood on children's stress levels, which might have implications for their health later in life.

In addition, we are among the first to analyze the effects of parental separation on

children using a biomarker to measure children's stress levels before and after a family structure change has taken place. Prior research that examined the effects of changes in family structure on biomarkers have relied on only one measurement of the biomarker (Gaydosh & Harris, 2018; Lacey et al., 2013). Whereas in Great Britain, experiencing parental divorce in childhood was associated with higher levels of CRP in middle adulthood (Lacey et al., 2013), this was not found in the United States (Gaydosh & Harris, 2018). By contrast, in the United States, children of instable families had slightly lower risks of hypertension and metabolic syndrome than those in stable two-biological parent families (Gaydosh & Harris, 2018). With a focus on short- to medium-term effects in our analysis, we were able to identify negative effects of separation (but not stepfamily formation) on children in Germany. Most importantly, the KiGGS data include two CRP measurements during childhood and adolescence, enabling us to reduce the influence of potential selection effects. Given that child health might affect both parents' partnership decisions and CRP levels, the fixed effects model avoids bias related to such unobserved heterogeneity. Moreover, as family structures become more diverse, it is important that this diversity is reflected in research. We contributed to this research need by analyzing the effects of repartnering on children. Previous studies mainly focused on the effects of parental separation and less on the effects of stepfamily formation. Thus, our study provides further insights into the impact of changes in family structure on children's stress levels.

While taking all the limitations and strengths of our study into account, our results have implications for policymakers and point to directions for future research on the effects of changing family structures on stress levels in children. Policymakers in Germany are mainly concerned with addressing the needs of adults after they divorce or separate (e.g., through monetary benefits, access to the labor market; BMFSFJ - Federal Ministry for Family Affairs, Seniar Citizens, Women and Youth (2021). Based on our findings, we urge policymakers to consider more seriously the effects of parental separation on children's stress levels in order to reduce inequalities. For example, one promising approach to promoting the healthy regulation of children's physiological stress response systems after adverse childhood experiences is providing children with psychosocial support (Slopen et al., 2014).

Future research should complete the picture of stress in children by considering both subjective and objective markers of stress as dependent variables in order to compare the stress-related effects of the two measures on children. From a methodological point of view, this would show the overlap of the two measurement variants and provide information about their robustness. Future studies of larger data sets should take into consideration potential effect heterogeneity. This might also help to identify groups who are unaffected by their parents' separation and repartnering. As a starting point, our additional analyses on gender and age can serve as a reference (see Appendices D and E in the online version of the article). Although based on very small sample sizes, the results from these analyses indicate that CRP increases, especially for girls and young children. In terms of heterogeneity, it would also be interesting to analyze in future research how stress develops in the years after separation. Do stress levels remain high, or do they decrease in the years following separation? However, addressing this question would require researchers to measure the objective stress marker at more than two points in time. In addition, there are many potential mechanisms linking changes in family structure to changes in children's CRP (e.g., monetary resources, moving, interparental stress, contact with the nonresident parent, weight gain). Deciphering these mechanisms behind increased stress levels would allow researchers to improve our understanding of children's stress levels after they experience a change to a single-parent family.

Notes

1. Based on the literature, we expect that both separation and repartnering disrupt daily routines and lead to uncertainty about family roles, which should cause children's stress levels to increase. To reduce heterogeneity across children's experiences of forming a stepfamily, we conducted a separate analysis only for children who reported living in a two-parent family in the baseline study and in a stepfamily in Wave 2. We replicated our main findings in the subgroup analysis (see Appendix F in the online version of the article).

2. Gaydosh and Harris (2018) estimated also models where they used a composite measure of instability based on the count of parents' partnership transitions but also parental death, incarceration, adoption, and fosterage. Their results showed that instability during childhood was negatively related to hypertension and metabolic

syndrome in adult ages. The authors suggest that such protective effects of family transitions may occur, especially in conflictual families, where a change relieves stress in children. Another explanation would be that children in instable families develop strategies that support their well-being or buffer against stress exposure.

3. The results were robust regardless of whether we used the 90th or 95th percentile (see Appendix I in the online version of the article). To keep more observations, we utilized the 95th percentile of the distribution as our cutoff point.

4. The vast majority of children in our sample who were living in postseparation families were living with their mother (93.20%), which is in line with the official statistics. However, for sample size reasons, we also included in our sample children who were living with their father. Sensitivity analyses showed that the results were robust when we considered only children who were living with their biological mother (see Appendix H in the online version of the article).

5. The equation of our first-difference regression underlines our analytical strategy: $\Delta y_{it} = \theta \Delta d_{it} \cdot \beta \Delta X_{it} + \Delta \varepsilon_{it}$, where i is the index for individuals, t is the index for the time points (t_1 - t_2); Δy_{it} is the first-differenced outcome variable, children's CRP (difference between t_1 and t_2); θ is our treatment variable coefficient, the change in family structure; Δd_{it} is the difference in the treatment variable d between t_1 and t_2; $\beta \Delta X_{it}$ is the matrix of our first-differenced covariates, and $\Delta \varepsilon_{it}$ is our first-differenced error term.

6. In the baseline study of KiGGS (2003–2006), two different companies were involved in the CRP measurement from the blood samples: ROCHE and SCIL. Their measurement procedures differed, but the CRP values were converted to make them comparable (Truthmann et al., 2012).

7. In additional analyses (available on request), we excluded children above the 96th percentile, 97th percentile, and so on. With the respective samples, the coefficients of the variable change to single-parent family in our regression analyses were not statistically significant at p = .05. One reason for this might be that keeping children with very high CRP levels in the sample biased our results. This interpretation was supported when using more conservative cutoff values, (e.g.,

based on the 90th percentiles): In this sample, the point estimate of the variable change to single-parent family was statistically significant ($p < .05$; see Appendix I in the online version of the article).

8. Kuhlemann and Krapf (2022) have shown that the formation of a nonresidential partnership can also affect children's well-being. However, in KiGGS, information about parents' relationships with partners living in separate households was unavailable.

9. The effects are already significant at $p = .1$ in the null model, in which we analyze the relationship between family changes and CRP without any control variables. The addition of our controls increases the effect size and leads to a significance level of $p = .05$ (see Appendix J in the online version of the article).

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Appendix

Appendix A

Table 2.3: Comparison of our key variables in our original sample and final sample.

	Original Sample		Final Sample	
	Mean	SD	Mean	SD
Age of Child	13.04	6.69	9.39	5.70
Net equivalent monthly household income [in Euro per 100]	13.00	7.31	14.26	7.64
Age of Mother	41.97	7.79	39.97	7.30
Number of Siblings	1.06	1.15	1.29	1.00
BMI	19.53	4.43	18.61	3.95
CRP	1.38	3.77	0.76	0.99

Source: KiGGS data baseline study and wave 2. Author's own calculations.

Note: The table includes joint information for the sample for hypothesis 1 and hypothesis 2. Hence, it includes joint information on children living in two-parent families, single-parent families, and stepfamilies.

Appendix B

Table 2.4: Linear first-difference regression model results.

	(1) C-reactive protein	(2) C-reactive Protein
Family structure change		
No change	0	
Change to a single-parent family	0.26*	
	(0.02)	
No change		0
Change to a stepfamily		-0.05
		(0.76)
Child's age	-0.07***	-0.07***
	(0.00)	(0.00)
Body Mass Index	0.13***	0.13***
	(0.00)	(0.00)
Equivalent monthly household income [in euro per 100]	0.01	-0.01
	(0.24)	(0.21)
Mother's age		
17 – 33 years	0	0
34 – 37 years	-0.11	-0.1
	(0.14)	(0.22)
38 – 60 years	-0.11	-0.12
	(0.17)	(0.17)
Number of siblings	-0.04	-0.04
	(0.37)	(0.40)
Constant	-2.56***	-2.57***
	(0.00)	(0.00)
Observations	2754	2695
Adj. R2	0.11	0.11

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Regression coefficients. Outcome variable: children's c-reactive protein (log-transformed). Source: KiGGS data baseline study and wave 2. Author's own calculations.

Appendix C

Table 2.5: First-difference regression model results depending on the time of the change in family structure.

	Separation before wave 1		Separation after wave 1	
	(3)	(4)	(5)	(6)
	C-reactive protein	C-reactive protein	C-reactive protein	C-reactive protein
Family structure change				
No change	0		0	
Change to a single-parent family	-0.13		0.22	
Change to a stepfamily	(0.80)		(0.12)	
No change		0		0
		0.23		0.12
		(0.60)		(0.54)
Child's age	-0.07***	-0.07***	-0.07***	-0.07***
	(0.00)	(0.00)	(0.00)	(0.00)
Body Mass Index	0.14***	0.14***	0.13***	0.14***
	(0.00)	(0.00)	(0.00)	(0.00)
Equivalent monthly household income	0.01	0.01	0.01	0.01
[in euro per 100]	(0.26)	(0.23)	(0.25)	(0.28)
Mother's age				
17 – 33 years	0	0	0	0
34 – 37 years	-0.10	-0.10	-0.13*	-0.12
	(0.20)	(0.21)	(0.09)	(0.13)
38 – 60 years	-0.09	-0.09	-0.08	-0.10
	(0.31)	(0.30)	(0.34)	(0.24)
Number of siblings	-0.04	-0.04	-0.06	-0.03
	(0.36)	(0.32)	(0.18)	(0.44)
Constant	-2.65***	-2.64***	-2.56***	-2.65***
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	2491	2497	2638	2598
Adj R2	0.12	0.12	0.11	0.12

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Regression coefficients. Outcome variable: children's c-reactive protein (log-transformed). *Source:* KiGGS data baseline study and wave 2. Author's own calculations.

Appendix D

Table 2.6: First-difference regression model results by gender. Regression coefficients.

	Male		Female	
	(7)	(8)	(9)	(10)
	C-reactive protein	C-reactive protein	C-reactive protein	C-reactive protein
Family structure change				
No change	0		0	
Change to a single-parent family	0.02		0.44**	
	(0.89)		(0.01)	
No change		0		0
Change to a stepfamily		-0.30		0.18
		(0.22)		(0.41)
Child's age	-0.05***	-0.05***	-0.09***	-0.09***
	(0.00)	(0.00)	(0.00)	(0.00)
Body Mass Index	0.11***	0.11***	0.15***	0.15***
	(0.00)	(0.00)	(0.00)	(0.00)
Equivalent monthly household	0.002	0.002	0.01	0.01
income [in euro per 100]	(0.76)	(0.73)	(0.2)	(0.17)
Mother's age				
17 – 33 years	0	0	0	0
34 – 37 years	-0.20*	-0.22*	-0.10	-0.001
	(0.05)	(0.03)	(0.34)	(0.99)
38 – 60 years	-0.16	-0.18	-0.13	-0.09
	(0.14)	(0.12)	(0.29)	(0.48)
Number of siblings	-0.03	-0.03	0.04	-0.05
	(0.66)	(0.66)	(0.52)	(0.43)
Constant	-2.40***	-2.42***	-2.84***	-2.77***
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	1396	1333	1448	1362
Adj R2	0.11	0.12	0.12	0.13

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Outcome variable: children's c-reactive protein (log-transformed). Source: KiGGS data baseline study and wave 2. Author's own calculations.

Appendix E

Table 2.7: First-difference regression model results by age groups.

	Children >=6 years old		Children <=15 years old	
	(11)	(12)	(13)	(14)
	C-reactive protein	C-reactive protein	C-reactive protein	C-reactive protein
Family structure change				
No change	0		0	
Change to a single-parent family	0.49*		0.07	
	(0.02)		(0.70)	
No change		0		0
Change to a stepfamily		-0.26		-0.11
		(0.38)		(0.66)
Child's age	-0.03	-0.03	-0.08***	-0.08***
	(0.08)	(0.12)	(0.00)	(0.00)
Body Mass Index	0.10***	0.10***	0.13***	0.13***
	(0.00)	(0.00)	(0.00)	(0.00)
Equivalent monthly household	0.02	0.02	0.0003	0.001
income [in euro per 100]	(0.15)	(0.11)	(0.97)	(0.92)
Mother's age				
17 – 33 years	0	0	0	0
34 – 37 years	0.01	0.09	-0.08	-0.03
	(0.97)	(0.69)	(0.51)	(0.81)
38 – 60 years	-0.03	0.03	-0.16	-0.15
	(0.87)	(0.91)	(0.24)	(0.29)
Number of siblings	-0.04	-0.05	0.10	-0.01
	(0.68)	(0.70)	(0.20)	(0.82)
Constant	-2.77***	-2.71***	-2.59***	-2.51***
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	1700	1604	2012	1923
Adj R2	0.16	0.14	0.17	.18

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Outcome variable: children's c-reactive protein (log-transformed). *Source:* KiGGS data baseline study and wave 2. Author's own calculations.

Appendix F

Table 2.8: First-difference regression model for children who changed from a two-parent family to a stepfamily.

	(15) C-reactive protein
Family structure change	
No change	0
Change to a stepfamily	-0.05
	(0.76)
Child's age	-0.07***
	(0.00)
Body Mass Index	0.13***
	(0.00)
Equivalent monthly household	-0.01
income [in euro per 100]	(0.21)
Mother's age	
17 - 33 years	0
34 – 37 years	-0.10
	(0.21)
38 – 60 years	-0.12
	(0.17)
Number of siblings	-0.04
	(0.40)
Constant	-2.57***
	(0.00)
Observations	2673
Adj R2	0.11

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Regression coefficients. Outcome variable: children's c-reactive protein (log-transformed).
Source: KiGGS data baseline study and wave 2. Author's own calculations.

Appendix G

Table 2.9: Logistic regression to analyse selectivity of the sample.

	(16) Blood sample
Main residence:	
Two-biological-parent family	0
Single-parent family	0.37
	(0.24)
Stepfamily	0.01
	(0.99)
Sex	-0.03
	(-0.86)
Age at survey in years	0.04***
	(0.000)
Equivalent monthly household income [in euro per 100]	0.02
	(0.15)
Father's highest education (ISCED)	0.20
	(0.17)
Constant	2.17***
	(0.000)
Observations	6242
Pseudo R2	0.01

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Regression coefficients. Outcome variable: children's c-reactive protein (log-transformed).
Source: KiGGS data baseline study and wave 2. Author's own calculations.

Appendix H

Table 2.10: First-difference regression model for children who were living with their biological mother in a single-parent family or a stepfamily.

	(17) C-reactive protein	(18) C-reactive Protein
Family structure change		
No change	0	
Change to a single-parent family	0.27*	
	(0.02)	
No change		0
Change to a stepfamily		-0.08
		(0.63)
Child's age	-0.07***	-0.07***
	(0.00)	(0.00)
Body Mass Index	0.13***	0.13***
	(0.00)	(0.00)
Equivalent monthly household income [in euro per 100]	0.01	0.01
	(0.33)	(0.22)
Mother's age		
17 – 33 years	0	0
34 – 37 years	-0.13	-0.09
	(0.07)	(0.22)
38 – 60 years	-0.13	-0.11
	(0.12)	(0.19)
Number of siblings	0.01	-0.04
	(0.75)	(0.38)
Constant	-2.57***	-2.57***
	(0.00)	(0.00)
Observations	2830	2688
Adj. R2	0.11	0.11

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Regression coefficients. Outcome variable: children's c-reactive protein (log-transformed). Source: KiGGS data baseline study and wave 2. Author's own calculations.

Appendix I

Table 2.11: In the first-difference regression model results presented here, the upper 90th percentile is excluded from the CRP variable.

	(19) C-reactive protein	(20) C-reactive Protein
Family structure change		
No change	0	
Change to a single-parent family	0.22*	
	(0.05)	
No change		0
Change to a stepfamily		0.70
		(0.66)
Child's age	-0.06***	-0.06***
	(0.00)	(0)
Body Mass Index	0.11***	0.11***
	(0.00)	(0.00)
Equivalent monthly household income [in euro per 100]	0.01	0.01
	(0.08)	(0.06)
Mother's age		
17 – 33 years	0	0
34 – 37 years	-0.07	-0.04
	(0.34)	(0.57)
38 – 60 years	-0.10	-0.11
	(0.18)	(0.18)
Number of siblings	-0.06	-0.08
	(0.13)	(0.06)
Constant	-2.49***	-2.51***
	(0.00)	(0.00)
Observations	2454	2396
Adj. R2	0.10	0.11

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Regression coefficients. Outcome variable: children's c-reactive protein (log-transformed). Source: KiGGS data baseline study and wave 2. Author's own calculations.

Appendix J

Table 2.12: First-difference regression results showing the null model and the successive addition of the control variables.

	Change to a single-parent family					Change to a stepfamily				
	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
	Null model	+ Household Income	+ age (mother + child)	+ siblings	+ Body Mass Index	Null model	+ Household Income	+ age (mother + child)	+ siblings	+ Body Mass Index
Family structure changes										
No change	0	0	0	0	0			0	0	0
Change to a single-parent family	0.18	0.18	0.25*	0.25*	0.26*					
	(0.10)	(0.10)	(0.03)	(0.03)	(0.02)					
No Change						0	0	0	0	0
Change to a stepfamily						-0.27	-0.27	-0.19	-0.16	-0.05
						(0.09)	(.10)	(0.25)	(0.34)	(0.76)
Net equivalent household income (in euro per 100)		-0.002	0.003	0.002	0.01		-0.002	0.002	0.002	0.01
		(0.61)	(0.62)	(0.67)	(0.24)		(0.58)	(0.65)	(0.70)	(0.21)
Age child			-0.003	-0.001	-0.07***			-0.001	0.001	-0.07***
			(0.69)	(0.90)	(0.00)			(0.88)	(0.89)	(0.00)
Age of mother										
17 – 33 years			0	0	0			0	0	0
34 – 37 years			-0.12	-0.11	-0.11			-0.12	-0.10	-0.10
			(0.13)	(0.19)	(0.14)			(0.15)	(0.22)	(0.21)
38 – 60 years			-0.12	-0.11	-0.11			-0.14	-0.13	-0.12
			(0.18)	(0.21)	(0.17)			(0.12)	(0.15)	(0.17)
Number of siblings				-0.05	-0.04				-0.06	-0.04
				(0.25)	(0.37)				(0.21)	(0.40)
Body Mass Index					0.13***					0.13***
					(0.00)					(0.00)
Constant	-0.83***	-0.80***	-0.75***	-0.70***	-2.56***	-0.82***	-0.79***	-0.74***	-0.69***	-2.57***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	2754	2754	2754	2754	2754	2695	2695	2695	2695	2695
R-squared	0.002	0.002	0.006	0.006	0.116	0.002	0.002	0.006	0.007	0.117
Adj R2	0.001	0.001	0.004	0.004	0.114	0.002	0.001	0.004	0.005	0.115

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Regression coefficients. Outcome variable: children's c-reactive protein (log-transformed). Source: KiGGS data baseline study and wave 2. Author's own calculations.

3 Parental Separation and Children's Well-Being. Does the quality of parent-child relationships moderate the effect?

Pauline Kleinschlömer and Sandra Krapf

Abstract

A considerable body of literature takes a deficit perspective and shows that children who experience a parental separation have more disadvantages than children who live in a two-biological-parent family. This article argues that not all children respond identically to their parents' separation, and examines whether there are heterogeneous effects based on parent-child relationship quality. We expect that having a good relationship with the resident parent can buffer the potentially negative effects of parental separation on a child's well-being. Using longitudinal data from waves 2 to 13 (2009/2010 – 2020/2021) of the German Family Panel pairfam, we estimate fixed-effects models based on a sample of 2,057 children aged 7 to 15, 99 of whom experienced the separation of their parents. We find that children who had a high level of conflict with the resident parent had significantly more emotional problems after parental separation, whereas children who had few conflicts with the resident parent had significantly fewer emotional problems after separation. Similarly, we find that only children in a parent-child dyad with a low level of intimate disclosure had more behavioral problems after parental separation than before.

Keywords

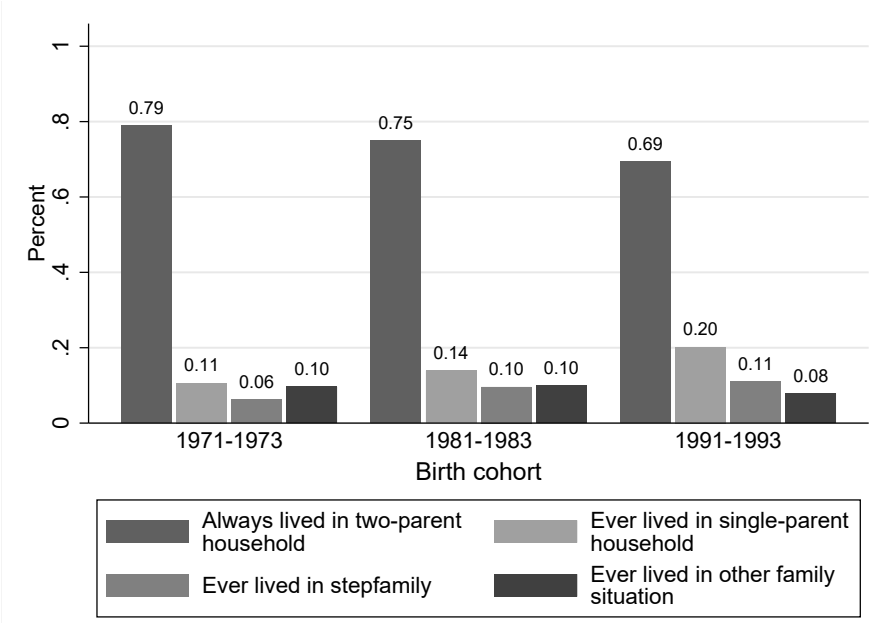
Family structure, parent-child relationship, well-being, emotional problems, behavioral problems, heterogeneous effects

3.1 Introduction

Family life and family arrangements in advanced societies have changed dramatically over the last few decades. Whereas most families in Germany in the post-WWII era could be characterized as stable, first-marriage, nuclear families (i.e., two parents and their biological children), one-parent families and stepfamilies have since become increasingly common. While 79% of the persons born between 1971 and 1973 lived continuously with their biological parents until age 18, only 69% of those born between 1991 and 1993 did so (see Figure 3.1). This decline has been accompanied by an increase in the share of individuals who have ever lived in a single-parent household or stepfamily by age 18. These trends are of sociological relevance, because a large body of research has consistently reported that children who grow up in post-separation families have less favorable cognitive, social, and health outcomes than children who are raised in two biological-parent families (Härkönen et al., 2017; McLanahan et al., 2013; Raley & Sweeney, 2020). Hence, investigating the effects of parental separation on child outcomes is crucial, as these effects can lead to inequalities that persist throughout adulthood (Amato, 2005, 2014; Bernardi, 2014; Lopoo & DeLeire, 2014; Sobolewski & Amato, 2007).

While many studies of the consequences of parental separation have adopted a deficit perspective, in this paper, we extend prior research by examining heterogeneous effects of parental separation based on parent-child relationship quality. In doing so, we contribute to a recent development in family research that not only examines differences in family structure and child well-being, but also determines for whom or under what conditions family structure affects child well-being (Jensen & Sanner, 2021). Specifically, we analyze how the impact of parental separation on children's well-being varies depending on the quality of the resident parent-child relationship. Prior research has shown that family relationship quality is associated with a range of children's well-being indicators (Li & Meier, 2017; Streit et al., 2020; Suldo & Fefer, 2013). Specifically, high levels of parental warmth, care and emotional support are associated with high levels of child well-being, in contrast to punishment, over control and parent-child conflict, which are associated with low levels of child well-being (Suldo & Fefer, 2013). In our study, we consider intimate disclosure and parent-child conflict as two dimensions of

Figure 3.1: Share of individuals who have ever lived in the respective family type by age 18, by birth cohort.



Source: Pairfam Release 13.0. Authors' own calculations.
Note: Individuals may have lived in single-parent families as well as in stepfamilies or other family forms up to the age of 18. This is why the percentages in the graph add up to more than 100%. The sample consists of adults and is not the same as the child sample we use in the main analyses of our study.

parent-child relationship quality. We argue that children who have a good relationship with the resident parent do not suffer from decreased well-being after the separation, whereas children with a poor relationship with the resident parent tend to have lower levels of well-being after the separation than before. In our study, the "resident parent" is the parent with whom a child lives after separation.

To the best of our knowledge, we are the first to analyze the moderating effect of parent-child relationship quality on children's well-being after parental separation. In our definition of separation, we focus not only on married but also on cohabiting parents. We refer to the personal information about the end of parents' coresidential partnerships. By utilizing waves 2 to 13 (2009/2010 – 2020/2021) of the German Family

Panel pairfam in our study, we are able to draw on panel data for children between 7 and 15 years old. For our analysis, we use a fixed-effects regression. In order to investigate the heterogeneous effects of parental separation on the well-being of children in families with different levels of parent-child relationship quality, we estimate interaction effects. In order to avoid biased estimates through confounding (Elwert, 2013), resident parent's depressive symptoms, child's perception of the economic deprivation of the family, child's age and resident parent's age serve as our control variables. Given the structure of our data, we focus on the short-term effects of parental separation in the year following the transition to a single-parent family.

3.2 Theoretical Background

Many researchers have studied the effects of parental separation on children by looking at the deficits in a variety of outcomes. The findings of these studies have uniformly shown that in virtually every area that is assessed, children and adolescents living in postseparation families fare worse, on average, than children and adolescents living with both of their biological parents (Amato, 2000, 2014; McLanahan et al., 2013; Raley & Sweeney, 2020). Compared to children with continuously married parents, children with divorced parents have more behavioral and emotional problems, obtain lower academic test scores, and have more problems with social relationships (Amato, 2014). A negative effect of parental separation has also been shown on physical health indicators such as the longer term development of BMI (Goisis et al., 2019) and c-reactive protein (Kleinschlömer et al., 2022). Two different theoretical perspectives are often discussed in the literature to explain the effects, (1) the stress-theoretical perspective and (2) the resource theory.

First, children might experience stress because a parent's partnership transitions change the overall family situation. Amato (2000) identified five subcategories of stressors that are associated with a parental separation: (1) financial insecurity; (2) interparental conflicts; (3) parental stress and changes in the parenting skills of the resident parent; (4) the lack of contact with the non-resident parent; and (5) possible further changes in the child's living circumstances due to moving, changing schools, or the loss of friends. Second, changes in family resources may also explain the different levels

of wellbeing in children before and after they experience a parental separation. If a parent moves out of the home following a separation, children lose the benefits of the income and social support that an additional parental figure can provide (Manning & Lamb, 2003; Sweeney, 2010). Moreover, single parents often face the dual demands of fulfilling both caregiving and breadwinning roles, which may limit the amount of quality time they can spend with their children (Magnuson & Berger, 2009). Hence, children's access to emotional, social, and financial resources may be more limited in single-parent than in two-biological-parent families.

The stress and the resources arguments are partly interrelated. The lack of financial resources can produce stress (Conger et al., 2010) and children with a high level of stress might withdraw from social interaction with their parents (Ulmer-Yaniv et al., 2018) and have difficulties to accept and profit from emotional and social resources. However, both stress and resources might affect children also independently. A child might simply miss the other parent after parents' have separated leading to psychological distress in the child, for instance. This is unrelated to resources of the family. In sum, both mechanisms, stress and resources, lead us to the same theoretical expectation. We hypothesize that the wellbeing of children is lower after a parental separation than before *(Hypothesis 1)*.

The existing empirical research that focused on the effects of divorce on children was mainly based on U.S. data. The findings of these studies provide a uniform picture: children living with both biological parents have, on average, higher well-being than children living in a post-separation family (e.g. single-parent family or stepfamily) (Amato, 2014; Hetherington et al., 1992; McLanahan et al., 2013; Raley & Sweeney, 2020). The negative effects of parental separation on child well-being have been found in other countries as well (Amato, 2014). A number of studies that focused on the German context found small, but non-negligible effects of living in a post-separation family: namely, that these children have more emotional and behavioral problems than children who live with their two biological parents (Entleitner-Phleps & Walper, 2020; Heintz-Martin & Langmeyer, 2020; Walper & Wendt, 2005). However, most of these German studies were based on cross-sectional data (Feldhaus, 2016). Without longitudinal analyses, we cannot rule out the alternative explanation that the observed child

outcomes were caused by factors that are more common among families who experience parental separation.

Going beyond this deficit perspective, we are interested in the adaptation to the situation after parental separation. Protective factors can mitigate the negative effects of a parental separation on children's well-being. Such "shock absorbers" Amato, 2000, p. 1272 can moderate the effects of parental separation (i.e., their presence or absence can lead to heterogeneous effects of parental separation on children's well-being). One protective factor is the quality of the parent-child relationship. Prior research has shown that positive parent-child relationships are associated with higher levels of emotional security in children (Suldo & Fefer, 2013). In a family with positive parent-child relationships, the parents might continue to have thoughtful and honest conversations with their child even after their union has dissolved. Parents can make it clear that their separation does not change their love for the child. The child might feel more involved in the decision-making process, which can help him/her accept the new family constellation. We expect to find that a positive resident parent-child relationship buffers the possible negative consequences of parental separation. Therefore, we argue that the well-being of children who have a good relationship with the resident parent is less negatively affected after a parental separation than that of children who have a poor relationship with the resident parent *(Hypothesis 2)*.[1]

Research that explicitly took heterogeneous effects into account mainly focused on the socio-economic background of the family (Augustine, 2014; Bernardi & Boertien, 2017; Grätz, 2015; Härkönen et al., 2017; Mandemakers & Kalmijn, 2014). The studies based on cross-sectional data (Dronkers, 1999) and on longitudinal data (Amato & Hohmann-Marriott, 2007; Amato et al., 1995; Booth & Amato, 2001; Brand et al., 2019; Hanson, 1999) that considered heterogeneous effects based on family relationships were mainly focused on interparental relationship quality, more specifically on interparental conflicts (Booth & Amato, 2001; Brand et al., 2019). Instead, in our study, we focus on the relationship quality between parent and child rather than the relationship between parents.

To our knowledge, no previous study has analyzed parent-child relationship quality

as a moderator of children's well-being before and after separation using longitudinal data. The few studies that have analyzed the role of parent-child relationship quality in the association between family structure and children's well-being have yielded mixed results. One study that examined the effects of parental breakup during childhood on the well-being of adults in the U.S. found no support for a moderating effect of parent-child closeness (Sobolewski & Amato, 2007). This study measured parent-child closeness at the time of the interview (when the adult child was 19 years or older), and not at the time of the parents' separation. Tschann et al. (1990) analyzed 184 divorced families, and found that children had more emotional and behavioral problems when the relationship with their biological mother was poor at the time of divorce. However, since the first measurement of the outcome variable took place only at the time of divorce, the causal relationship between divorce, quality of parent-child relationship, and the well-being of the children could not be assessed. An advantage of our study is that we can analyze changes in a child's well-being and the quality of the parent-child relationship before and after parental separation. Additionally, the data used in the study by Tschann et al. (1990) are from 1980 to 1983, and thus refer to a time when divorce was not as common as it is today. Therefore, it is unclear whether the effects of parental separation on children's well-being have changed in more recent years.

Independent of family structure, research has confirmed that high-quality biological parent-child relationships are positively associated with child well-being (Li & Meier, 2017; Musick & Meier, 2010; Thomas et al., 2017). This is the case for both father-child and mother-child relationships, and for adolescents as well as for children (Li & Meier, 2017; Streit et al., 2020; Videon, 2005). Hence, the socioemotional adjustment and psychological well-being of both children and adolescents tend to be better when they experience warmth and acceptance from their parents.

3.3 Data and Method

3.3.1 Data and Sample

By utilizing wave 2 to wave 13 (2009/2010 – 2020/2021) of the German Family Panel pairfam, release 13.0 (Brüderl et al., 2021), we draw on rich, individual-level panel data for children between 7 and 15 years old and their resident parents. The main

participants, the so-called anchors, are usually one of the parents of these children. The anchors belong to three birth cohorts (born in 1971–73, 1981–83, and 1991–1993). They are randomly drawn from the German population registers, and interviewed annually to track multiple life phases. In the first wave, 12,402 anchors participated.

Moreover, parents, partners, and selected resident children are also surveyed. Resident children were surveyed from the second wave onwards, and their participation was conditional on a parent's consent. The coverage rate among children was around 60% in all waves Brüderl et al., 2021, p. 39 and the response rate of children whose respective anchor person had given consent was high with 76% Brüderl et al., 2021, p. 32 to 96% Brüderl et al., 2021, p. 21 in different survey waves. A detailed description of the study can be found in Huinink et al. (2011). In our analyses, we combine data from the child questionnaire and anchor data, which include the anchor's relationship history.

The unit of analysis in our study is the child. Because a considerable share of anchor respondents was childless, and because only a subset of children was surveyed, the child dataset contains information on 3,882 children who completed the questionnaire. Given the longitudinal character of our data, we keep in our sample only the children who participated in the survey at least twice. With our focus on parental separation, we restrict the sample to children whose parents were in a relationship with each other when they entered the survey (as this is the group at risk of experiencing the transition from a two biological-parent family to a single-parent family). In addition, we only keep in our sample those children whose anchor was the biological parent. Since repartnering of the resident parent (Kuhlemann & Krapf, 2022) and the overall number of family structure transitions is negatively associated with children's emotional symptoms (Fomby & Cherlin, 2007), we ensure with the restriction that the transition to a single-parent family is the first family transition the child experiences. Moreover, we only keep children in the sample who have their primary residence after separation at the anchor's place. Thus, we can be sure that the child refers to the resident parent when asked about the quality of the relationship. We drop children who have any missing values on the variables of interest. In general, the number of missing values on each variable is very small in our sample, i.e., not more than 5% of respondents have missing information on a single variable. With such a small share, the potential impact of the missing data on

the results is negligible (Jakobsen et al., 2017).

The sample restrictions lead to our analytical sample, which includes 2,057 children, aged 7–15, who provide us with 9,141 valid person-years. Of these children, 99 experienced a transition from living in a two-biological-parent family to living in a single-parent family. The remaining 1,958 children in our analytic sample continued to live with both of their biological parents. Although they did not experience a change in our treatment variable, they are included in the sample in order to obtain more reliable estimates for the age and period effects (and the other control variables) (Brüderl, 2010). Of the children who were living in a single-parent family after their parents separated, 80.81% were residing with their biological mother, while only 19.19% were living with their biological father. A sensitivity analysis showed that the results were similar for a sample that included only biological mothers and their children. Therefore, we have chosen to keep single-father families in the sample (results are provided upon request). In order to investigate a uniform time frame for all children who experience parental union dissolution, we focus on the short-term effects of separation (i.e., we compare the level of child well-being reported in the interview years before the parents' separation, and in the interview in the year after the separation).We limit our sample to one year after separation because it is possible that children's well-being adjusts to the new family structure. Thus, by restricting the time frame, we ensure that our effect is not diluted by differences in the post-separation period.

3.3.2 Measures

In the following, we discuss the measurement of variables in our analyses. All variables in our models are time-varying, and were measured in waves 2 to 13.

Child Well-Being. We use two measures of child well-being as our outcome variables: emotional symptoms and behavioral problems. The respective item batteries are part of the established and standardized Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997) that is partly integrated into pairfam. Behavioral problems are measured by the children's responses to questions about whether they *usually do what adults request*; *take things that do not belong to them*; *can make other people do what they*

want; *often lose their temper*; or *cheat*. Emotional problems are measured by the children's answers to questions about whether they *easily lose self-confidence*; *experience a lot of headaches, stomach aches, or sickness*; *have a lot of fears*; *are often unhappy*; or *worry a lot*. The answering categories are based on a three-point scoring system: 0 = *not true*, 1 = *somewhat true*, 2 = *very true*. For the two scales, we calculate the average from five items, (i.e., each scale ranges between zero and two, with higher values indicating greater problems). Regarding the ordinal nature of items with only three response options, we calculate Ordinal Alpha to analyze the reliability of our outcome variables. Ordinal Alpha is conceptually equivalent to Cronbach's Alpha but provides a more accurate estimate of reliability for binary and ordinal response scales (Zumbo et al., 2007). For emotional problems, the Ordinal Alpha is $\alpha = .74$, and for behavioral problems, it is $\alpha = .69$. In contrast, Cronbach's Alpha for our two outcome variables is lower ($\alpha = .65$ for emotional problems; $\alpha = .50$ for behavioral problems). Previous German studies have also reported low Cronbach's Alpha for children's self-reports of their emotional and behavioral problems (Becker et al., 2018; Lohbeck et al., 2015). However, a simulation study has shown that Cronbach's Alpha tends to underestimate reliability in ordinal variables, which seems to explain the lower values observed in our case (Zumbo et al., 2007). While Ordinal Alpha for emotional problems takes a value above .7, which is widely considered an acceptable level of reliability, Ordinal Alpha for behavioral problems is just below the threshold. One reason for the low alpha might be a restricted theoretical reliability. The behavioral problems scale contains items that refer (a) to behaviors targeted more towards authority figures (e.g., the item *I usually do as I am told*) and (b) to behaviors that are targeted more toward other children (e.g., the item *I take things that are not mine*). Although both aspects are part of the construct of behavioral problems, their correlation is small (Spearman's $r = .12$). This might account for the comparatively lower level of the reliability measure. Other indicators belonging to the SDQ scale are not regularly asked in pairfam.

Separation Indicator Our key independent variable is the parents' separation. From the relationship histories of the biological parents, we extract the information about their relationship status. We create a dummy variable, which takes a value of zero if the biological parents were still in a relationship, and a value of one if the biological parents had separated since the last interview. We focus not only on the marital partnerships,

but also on the non-marital partnerships of parents.

Parent-Child Relationship Quality To test our second hypothesis, we interact the family relationship variable with the separation indicator. To measure parent-child relationship quality, we use two concepts: perceived conflict behavior, and intimate disclosure. Both measures are based on the children's reports. Each variable is composed of two items. Conflict behavior is measured by the children's responses to questions about (a) *how often the resident parent and the child are angry with each other*; and (b) *how often they disagree and quarrel*. The response options range from (1) *never* to (5) *always*. The individual mean of the answers to these two items is our measure of conflict levels, and ranges from one to five. Intimate disclosure is measured by the children's answers to questions about (a) *how frequently the child shares his/her secrets and private feelings*; and (b) *how often the child tells the resident parent what is bothering him/her*. Again, we use the mean of the two items for our intimate disclosure measure. The question battery is based on the Network of Relationships Inventories (NRI), a tool used to measure children's perceptions of their personal relationships (Furman & Buhrmester, 1985). Cronbach's alphas for the two relationship dimensions range between $\alpha = .71$ for conflict behavior and $\alpha = .79$ for intimate disclosure. Since each indicator variable in itself measures a reliable relationship dimension, we decided to analyze the effect of the relationship indicators separately instead of calculating a summary score.

Control Variables In the multiple regression models, we control for the possible confounding effects of a number of factors. A confounder is a variable that influences both our outcome variable, child well-being, and our key independent variable, parental separation. An approach for deciding whether or not variables count as confounders is based on theoretical considerations (Rohrer, 2018). In the following, we elaborate on our inclusion of control variables based on the findings of prior research.

One possible confounder is the economic situation of the family. Prior research has shown that couples with fewer economic resources are more likely to separate (Amato & Hohmann-Marriott, 2007). At the same time, parents' economic situation also influences child well-being (Duncan et al., 2015). We measure the economic situation of each family based on children's self-rated economic deprivation. It consists of three

questionnaire items: (a) *we do have enough money for everything we need*; (b) *we often have to do without because of financial constraints*; and (c) *in my family, money is usually tight* (Cronbach's α = .81). The response scale ranges from (1) *completely wrong* to (5) *ompletely true*. From these three items we calculated an average that ranges from one to five, with higher values indicating higher levels of family economic deprivation from the child's perspective. We refer to children's evaluation because we are interested in how the parents' financial situation is perceived by the child. Moreover, we control for depressive symptoms of the resident parent. Individuals with lower levels of mental health have a higher probability of separation (Breslau et al., 2011). Simultaneously, it has been shown that maternal depressive symptoms are negatively related to children's well-being (Luoma et al., 2001). In pairfam, the anchor persons are asked whether they are *happy, calm, and relaxed*; whether they *feel good and secure*; and whether they *enjoy life* (Cronbach's α = .90). From this information, we create an index variable based on the mean of the self-rated answers, ranging from one to four. In order to control for possible age effects, we include the children's and the resident parents' ages in the models.

In order to test whether the control variables contribute to the quality of the model, we calculate the within R2 in a fixed effects regression (Hansen, 2022). Therefore, we added our control variables to the null model step by step and show that the within R2 increases (see Appendix A).

3.3.3 Analytical Strategy

In order to estimate the effects of parental separation on child well-being, we use fixed-effects regressions. Fixed-effects models estimate the causal effects based on a comparison of changes within an individual before and after a so-called treatment event – in our case, a parental separation – has occurred. In our study, the 99 children who have experienced a parental separation provide us with the within-child variation needed to calculate a fixed-effects estimator. This approach allows us to analyze the differences in well-being before and after the parental separation within each child. The resulting within estimator controls for all (unobserved and observed) time-constant factors, and thus eliminates bias from temporally stable unobserved heterogeneity (Brüderl &

Ludwig, 2015). One example of such an often unobserved potential confounder is an individual's personality. People who are neurotic are more likely than people who are not neurotic to separate (Roberts et al., 2007) (i.e., they self-select into separation). At the same time, the children of parents who are neurotic have lower levels of well-being (Fan et al., 2020). The fixed-effects approach adjusts for the bias generated by omitting such time-constant unobserved variables, which makes causal claims more robust (McLanahan et al., 2013). This is an important contribution to the literature, given that most of the studies that have examined the effects of parental separation on children (especially in Germany) were based on cross-sectional data that ignored such unobserved heterogeneity.

To identify varying effects of separation on children depending on the parent-child relationship quality, we estimate a multiplicative interaction term of separation and the level of (a) intimate disclosure and (b) the level of conflicts between the child and the resident biological parent.[2] All analyses were estimated with Stata 17 (StataCorp, 2021).

3.4 Results

3.4.1 Descriptive Results

Table 3.1 summarizes our descriptive statistics. The descriptive results show that children's levels of well-being differed slightly depending on whether they were living in a single-parent or a two-biological-parent family. In line with the existing research, we find that children who experienced a parental separation had more emotional problems (M = .52) than children who were living with their two biological parents (M = .48). The difference is found to be larger for behavioral problems, with a mean of .4 among children in single-parent families and a mean of .30 among children in two-biological-parent families. Moreover, the relationship quality, based on measures of intimate disclosure and conflict, is shown to be lower for children living in a single-parent family. In addition, the economic deprivation in single-parent families (M = 2.01) is worse than in families with two biological parents (M = 1.58). Consistent with previous research, our descriptive results also show that anchor persons who are single parents show more frequently depressive symptoms (M = 1.96) than parents who live with their child's biological parent (M = 1.72).

Table 3.1: Descriptive statistics for variables used in the analysis.

Variable	Total				Single-parent family		Two-biological-parent family		Mean Difference	t (9139)	Cohen's d
	M	SD	Min	Max	M	SD	M	SD			
Emotional problems	0.48	.039	0	2	0.52	0.36	0.48	0.39	-0.03	-0.84	-0.08
Behavioral problems	0.30	0.27	0	2	0.40	0.30	0.30	0.27	-0.09***	-3.44	-0.35
Intimate disclosure	3.43	0.95	1	5	3.31	0.97	3.43	0.95	0.12	1.2	0.12
Conflicts	2.11	0.72	1	5	2.24	0.71	2.11	0.72	-0.12*	-1.71	-0.17
Child's age	11.05	2.11	7	15	11.79	1.85	11.04	2.11	-0.75***	-3.49	-0.35
Resident parent's age	41.12	4.26	26	50	39.88	4.66	41.14	4.25	1.26***	2.92	-0.30
Economic deprivation of family (child's perspective)	1.59	0.80	1	5	2.01	1.12	1.58	0.80	-0.43***	-5.29	-0.53
Resident parent's depressive symptoms	1.73	0.48	1	4	1.96	0.53	1.72	0.48	-0.23***	-4.81	-0.49
Number of observations	9141				99		9042				
in %	100				1.08		98.92				
Number of children	2057				99		1958				
in %	100				4.81		95.19				
Number of males	1081				54		1027				
in %	100				5.0		95.00				
Number of females	977				45		932				
in %	100				4.61		95.39				

Note: Mean differences refer to the differences between children living in single-parent families and children livingin two-biological-parent families. *p < .1 **p < .05 ***p < .01; p-values refer to t-test. Gender was only collected binary. *Source:* pairfam release 13.0 waves 2-13. Authors' own calculations.

Table 3.2: Results of the multiple regression analyses.

	Hypothesis 1		Hypothesis 2			
	(1)	(2)	(3)	(4)	(5)	(6)
	Emotional Problems	Behavioral Problems	Emotional Problems	Behavioral Problems	Emotional Problems	Behavioral Problems
Parental separation	0.05***	0.10	0.14	-0.28**	0.31***	0.08
(ref.: no parental separation)	(0.17)	(0.00)	(0.31)	(0.02)	(0.00)	(0.30)
Intimate disclosure of child			-0.01		-0.03***	
towards the anchor			(0.18)		(0.00)	
Parental separation x intimate disclosure			-0.03		-0.06**	
			(.46)		(0.03)	
Conflicts in the parent-child relationship				0.07***		0.06***
				(0.01)		(0.00)
Parental separation x Conflicts				0.14***		0.01
				(0.01)		(0.88)
Child's age	-0.02**	-0.02***	-0.03**	-0.02**	-0.02***	-0.02***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.00)	(0.01)
Resident parent's age	0.01	0.01	0.01	0.01	0.01	0.003
	(0.45)	(0.46)	(0.46)	(0.67)	(0.47)	(0.70)
Economic deprivation of family	0.05***	0.03***	0.04***	0.03***	0.03***	0.03***
(child's perspective)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Resident parent's depressive symptoms	0.0001	0.0001	-0.0001	-0.002	-0.001	-0.002
	(0.10)	(0.10)	(0.99)	(0.90)	(0.92)	(0.83)
Constant	0.36	0.25	0.40	0.35	0.38*	0.24
	(0.27)	(0.27)	(0.22)	(0.27)	(0.09)	(0.29)
Observations	9141	9141	9141	9141	9141	9141
Within R-squared	0.024	0.029	0.025	0.045	0.038	0.055 height

Note: Results of fixed-effects regressions with main effect (model (1) and model (2)) and interaction effect of parent-child relationship quality (measured in intimate disclosure and conflicts) and parental separation on children's well-being (model (3) – model (6)).
p-values are in parentheses. Estimates are unstandardized *B*-coefficients. *Source:* pairfam release 13.0 waves 2-13. Authors' own calculations.

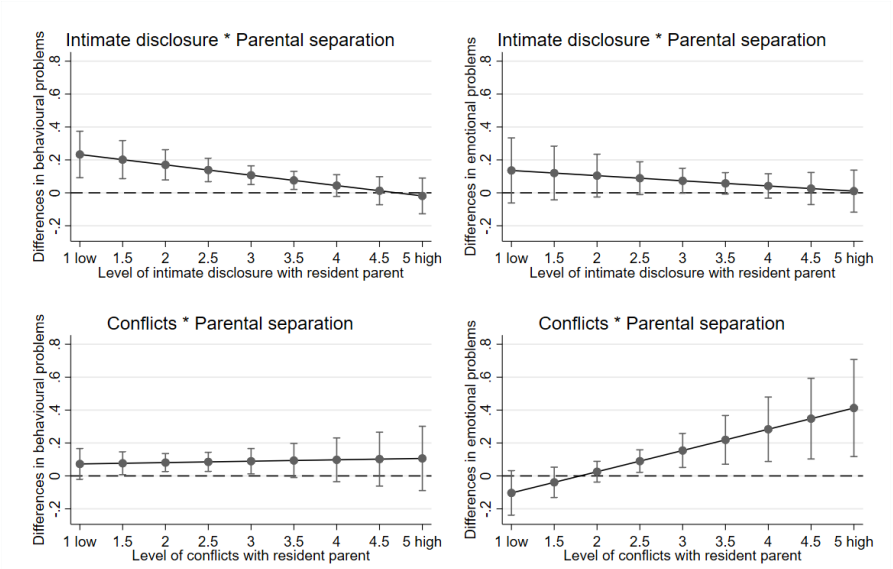
3.4.2 Results of the Multiple Regression Analyses

In line with the results of existing research and with hypothesis 1, models 1 and 2 in Table 3.2 shows that experiencing a parental separation had a small negative effect on children's well-being. On average, the children in our sample experienced more emotional and behavioral problems after their biological parents separated than they did before the separation. After the separation, the children's emotional problems increased, on average, by B = .05, but this effect was not statistically significant. By contrast, the increase in the children's behavioral problems was B = .10, and was statistically significant, at p = .001. With respect to our control variables, especially the perceived economic deprivation of the family from the child's point of view and the child's age, were significantly associated with the child's emotional and behavioral problems. Regarding the family's economic situation, we find a significant positive effect: an increase in the perceived economic deprivation of the family was associated with an increase in the child's emotional and behavioral problems. Children's age is shown to be negatively related to our outcome variables. A one-year increase in the child's age was associated with a reduction in his/her emotional problems and behavioral problems (B = -.02). Similar results are obtained in a model without any control variables, indicating that overcontrol bias is not a problem in our study (Appendix A).

In order to identify the potentially buffering effect of high parent-child relationship quality (hypothesis 2), we estimate an interaction between parental separation and our two measures of relationship quality (models 3 – 6 in Table 3.2). By adding the interaction effect, the within R^2 increases indicating an improved model fit. Theoretically, the interaction provides insights into whether the negative effects of a parental separation on children's well-being varied depending on the quality of the relationship between the resident parent and the child. Figure 3.2 illustrates the interaction effects in conditional effect plots. The marginal effects were estimated while keeping effects of all other variables constant at their sample mean. The corresponding regression table for Figure 3.2 can be found in the supplementary material (Appendix B; Table 4–5). The plots show the effects of the separation indicator conditional on the values of the different measures of relationship quality. Thus, we can directly compare the difference in well-being of children who live with their two biological parents and children who expe-

rienced the transition to a single parent family for different levels of relationship quality. The dashed horizontal line refers to the well-being of children in two-biological-parent families (reference category). The solid line shows the children's emotional and behavioral problems after parents' separation depending on the relationship quality level.

Figure 3.2: Fixed-effects regression with interaction effect of parent-child relationship quality (measured in intimate disclosure and conflicts) and parental separation on children's well-being.



Source: Pairfam Release 13.0; waves 2-13. Authors' own calculations.
Note: Conditional effect plots with 95% confidence intervals.

The upper left panel shows that a child who has experienced the transition to a single-parent family and who has a very low level of intimate disclosure has increased behavioral problems by .24 compared to the child who lives with two biological parents and also has an intimate disclosure level of 1. This difference in behavioral symptoms disappears if the level of intimate disclosure between parents and children is high (intimate disclosure = 4 or higher). Hence, these finding indicates that an intimate parent-child relationship can buffer the negative effects of a parental separation on children's behavioral problems and supports our second hypothesis. However, the pattern of the interaction of conflicts and separation on behavioral problems (illustrated in the lower

left panel of Figure 3.2) does not support hypothesis 2. Here, the level of behavioral problems is increased for all children after separation compared to before separation, regardless of the level of conflicts.

With regard to emotional problems, we find that experiencing a separation had a significantly stronger effect if the level of conflict between the parent and the child was high, while experiencing a separation was associated with slightly fewer emotional problems than before the separation if the level of conflict was very low (cf. lower right-hand panel in Figure 3.2). These findings are in line with our hypothesis 2. The pattern of the moderating effect of intimate disclosure is similar (although less pronounced) for emotional problems. An intimate parent-child relationship can buffer the negative consequences of a parental separation on children's emotional problems. However, the interaction remains statistically insignificant (cf. upper right-hand panel in Figure 3.2).

3.5 Discussion

Research has shown that experiencing a parental separation is negatively associated with children's well-being. While many studies took a deficit perspective, in our paper we investigated factors that support children to adapt to family changes. Prior research has focused mainly on the socio-economic situation of families as a moderator of parental separation (Brand et al., 2019; Grätz, 2015; Härkönen et al., 2017). We extend on this finding and argue that also the parent-child relationship quality might be a source of heterogeneity in separation effects on children. Having a good relationship with the resident parent can reduce the negative outcomes for children following the separation of their biological parents. We focused on two parent-child relationship indicators: intimate disclosure and conflict. In the empirical analyses, we used fixed-effects regressions to analyze the changes in a child's well-being in the years before and in the year after separation. In doing so, we focused on the short-term consequences of parental separation. As measures for children's well-being, we used emotional symptoms and behavioral problems.

The findings of our regression analyses were mixed. First, with regard to the main effects, we found a significant increase in children's behavioral problems after their par-

ents' separation. However, the increase was not significant for emotional symptoms. In the second part of our analyses, in which we analyzed children with low and high relationship quality in separate groups, we found partial support for our heterogeneous effects hypothesis. Children who had a high level of conflict with their resident parent experienced an increase in their emotional problems after their parents broke up. In line with this finding, we observed that children who had a low level of intimate disclosure with their resident parent had more behavioral problems after than before the separation. By contrast, we did not find statistically significant heterogeneous effects of parental separation on children's emotional problems depending on their level of intimate disclosure with the resident parent. Here, the effects were small and insignificant for children regardless of whether they had a low or a high level of intimate disclosure. For children's behavioral problems, the effects of parental separation were similar for both the low and the high conflict group. In both groups, behavioral problems increased after the separation.

These findings might indicate that different indicators of relationship quality are relevant for the two well-being dimensions analyzed in our study.With regard to conflicts and emotional symptoms, the literature shows that conflictual relationships limit children's ability to manage emotions, which, in turn, increases the likelihood that children will develop emotional problems (Kiel & Kalomiris, 2015; Lougheed et al., 2022). By contrast, the effect of the level of intimate disclosure in the parent-child relationship might be more relevant for children's behavioral problems. In our study, intimate disclosure was defined as the child having frequent contact with the resident parent, and being able to share his/her private feelings and thoughts. Prior research has shown that children with behavioral problems have fewer conversations about their emotional experiences with their mother than children without behavioral problems (Katz & Windecker-Nelson, 2004). These honest conversations can improve both the parent's and the child's understanding of the new family situation, and in turn, explain why children who had a low level of intimate disclosure with their resident parent had more behavioral problems after than before the separation.

Areas of action for future research can be derived from our limitations. Our first limitation concerns reversed causality. Simple fixed-effects models do not necessarily

eliminate the problem of reverse causality (Collischon & Eberl, 2020). Whether parental separation affects child well-being or whether child well-being influences the likelihood of parental separation remains unclear. For example, children's behavior or characteristics (e.g., emotional problems) could affect their parents' decision to separate. However, Amato (2014) discussed different methodological approaches in their study, and concluded that given the impossibility of conducting true experiments, child fixed effects models are among the best methods for estimating the causal effects of divorce on children. Second, while a fixed-effect model solves the omitted variable problem with respect to time-constant variables, it does not control for unobserved time-varying variables. Two potential confounders that we could not control for were interparental relationship quality after separation and the quality of the children's relationship with the non-resident parent. As both factors may influence the children's well-being and their relationship with the resident parent, they could confound our results. Unfortunately, the variables were collected as part of the pairfam question program at irregular intervals only; thus, we were unable to control for them in our analyses. A third weakness of our study is the small number of separation events. Parental separation is rare in our longitudinal data and since the number of children surveyed in pairfam was rather small, the statistical power of our analyses was limited. Moreover, due to the limited size of our sample, we were unable to analyze how the children adjusted to their parents' separation over time. It is, for example, conceivable that the children adjusted to their new family situation, and that their well-being recovered from the shock of the parental separation. Future research should therefore analyze adjustment effects using a growth curve model. The extent of the children's adaptation might also vary over different levels of parent-child relationship quality. In terms of heterogeneous effects analysis, there are many other exciting further aspects. For example, future research could look at heterogeneous effects in relation to sexual orientation and sexual identity or race and ethnicity. In our sample, however, we do not have enough information to analyze these potential moderators. Given the increasing relevance of studying children living in various family structures, we need larger longitudinal datasets that include information on children. This would enable social scientists to assess children's well-being in subcategories (i.e., in joint physical custody families or in residential custody single-mother or single-father families; or according to how much time the children spend with their mother or father).

The results of this study contribute to the literature in several ways. Most importantly, our findings support the claim that not all children respond identically to their parents' separation. This was found in a fixed-effects model that indicated the robustness of the effects after time-constant factors were taken into account. Such analyses have rarely been done using German data. Thus, our results underline the importance of taking heterogeneous effects into account in future research and contribute to the identification of indicators that facilitate adjustment to parental separation. Analyzing the variability in children's responses after the separation of their parents provides us with a better picture of the consequences of parental separation, and of children's resilience to stress. Thereby, our study emphasizes the importance of recognizing and valuing the diversity of families and working to provide inclusive and supportive services to all families, regardless of their structural differences (Russell et al., 2022). These findings are relevant not only for researchers in the field, but also for policymakers and institutions seeking to reduce social inequality, and to provide the best possible support for children after parental separation.

Notes

1. The association between parental separation, parent-child relationship quality, and children's well-being is complex. While our hypothesis 2 focuses on the moderating effect of parent-child relationship quality, it might also be a mediator (Fauber et al., 1990). Reduced parenting skills around the time of separation might cause the quality of the parent-child relationship to suffer, and may thus adversely affect the child's well-being. To disentangle the role of parent-child relationship as a mediator or moderator, we conduct separate analyses for children based on their level of relationship quality before the separation (Appendix C) This allows us to identify variations in the effect of parental separation in different groups and explicitly ignores changes in the relationship quality in the aftermath of the separation (i.e., mediating effects). The results are in line with our main results presented in Figure 3.1, where we modelled moderation with an interaction term. Clearly, the quality of the parent-child relationship might diminish before the separation. Unfortunately, we do not have more detailed information about

the development of the relationship quality over time.

2. For our fixed effects regression model with our main variables of interest X_{it} and D_{it} we estimate the following equation:

$$Y_{it} = \beta_1 \cdot X_{it} + \beta_2 \cdot D_{it} + \beta_3 \cdot X_{it} \cdot D_{it} + \beta_4 \cdot \mathbf{Z_{it}} + \alpha_i + \mu_{it},$$

where:
Y_{it} is our outcome variable, children's well-being,
X_{it} is our variable measuring parent-child relationship quality,
D_{it} is a dummy variable indicating whether children have experienced a parental separation or not,
Z_{it} is a vector of our time-varying control variables,
α_i our fixed effect for child i and μ_{it} our error term.

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Appendix

Appendix A

Table 3.3: Null model and stepwise addition of the control variables.

	Emotional problems				Behavioral problems			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parental separation	0.005	0.05	0.05	0.05	0.06**	0.1***	0.1***	0.1***
(ref.: no parental separation)	(0.89)	(0.14)	(0.14)	(0.17)	(0.03)	(0.00)	(0.00)	(0.00)
Child's age		-0.03**	-0.03**	-0.02**		-0.02***	-0.02***	-0.02***
		(0.02)	(0.02)	(0.02)		(0.01)	(0.01)	(0.01)
Resident parent's age		0.01	0.01	0.01		0.004	0.004	0.01
		(0.58)	(0.58)	(0.45)		(0.57)	(0.57)	(0.46)
Resident's parent depressive symptoms			0.004	0.0001			0.002	-0.0001
			(0.78)	(0.996)			(0.79)	(0.995)
Economic deprivation of family				0.05***				0.03***
(child's perspective)				(0.00)				(0.00)
Constant	0.48	0.52	0.51	0.36	0.30***	0.35	0.35	0.25
	(0.00)	(0.11)	(0.11)	(0.27)	(0.00)	(0.11)	(0.12)	(0.27)
Observations	9141	9141	9141	9141	9141	9141	9141	9141
R-squared	0.00	0.017	0.017	0.024	0.001	0.023	0.023	0.029
Within R-squared	-0.0001	0.0165	0.0164	0.024	0.001	0.023	0.023	0.029 height

p-values are in parentheses

*** p<.01, ** p<.05, * p<.1

Source: pairfam release 13.0 waves 2-13. Authors' own calculations.

Appendix B

Table 3.4: Marginal effects: Children's well-being (emotional and behavioral problems) and parental separation depending on the level of intimate disclosure.

Intimate disclosure Parental separation (ref: no parental separation)						
	at	dy/dx	Std. Error	z	P>z	[95% CI]
Emotional problems	1	0.11	0.10	1.11	0.27	-0.09 to 0.32
	2	0.01	0.09	1.17	0.24	-0.07 to 0.27
	3	0.09	0.07	1.26	0.21	-0.05 to 0.22
	4	0.07	0.05	1.37	0.17	-0.03 to 0.17
	5	0.06	0.04	1.45	0.15	-0.02 to 0.14
	6	0.04	0.03	1.28	0.20	-0.02 to 0.11
	7	0.03	0.04	0.77	0.44	-0.05 to 0.10
	8	0.02	0.05	0.31	0.76	-0.08 to 0.11
	9	0.00	0.07	0.02	0.98	-0.13 to 0.13
Behavioral problems	1	0.25	0.07	3.38	.00	0.10 to 0.39
	2	0.21	0.06	3.58	.00	0.10 to 0.33
	3	0.18	0.05	3.83	.00	0.10 to 0.27
	4	0.15	0.04	4.07	.00	0.08 to 0.22
	5	0.12	0.03	3.99	.00	0.06 to 0.16
	6	0.09	0.03	3.05	.00	0.03 to 0.14
	7	0.06	0.03	1.61	.11	-0.01 to 0.12
	8	0.02	0.04	0.52	.60	-0.06 to 0.11
	9	-0.01	0.06	-0.16	.87	-0.12 to 0.10

Source: pairfam release 13.0 waves 2-13. Authors' own calculations.

Table 3.5: Marginal effects: Children's well-being (emotional and behavioral problems) and parental separation depending on the level of conflicts.

Conflicts Parental separation (ref: no parental separation)						
	at	dy/dx	Std. Error	z	P>z	[95% CI]
Emotional problems	1	-0.140	0.069	-2.03	0.042	-0.276 to -0.005
	2	-0.058	0.047	-1.44	0.149	-0.160 to 0.024
	3	0.004	0.032	0.14	0.891	-0.059 to 0.068
	4	0.077	0.036	2.16	0.031	0.007 to 0.146
	5	0.149	0.053	2.79	0.005	0.044 to 0.254
	6	0.221	0.076	2.89	0.004	0.071 to 0.371
	7	0.294	0.101	2.90	0.004	0.096 to 0.492
	8	0.366	0.126	2.90	0.004	0.118 to 0.614
	9	0.438	0.152	2.88	0.004	0.140 to 0.736
Behavioral problems	1	0.09	0.05	1.78	0.08	-0.01 to 0.18
	2	0.09	0.04	2.47	0.01	0.02 to 0.16
	3	0.09	0.03	3.23	0.00	0.04 to 0.15
	4	0.09	0.03	3.18	0.00	0.04 to 0.15
	5	0.10	0.04	2.48	0.01	0.02 to 0.17
	6	0.10	0.05	1.90	0.06	-0.00 to 0.20
	7	0.10	0.07	1.51	0.13	-0.03 to 0.24
	8	0.10	0.08	1.26	0.21	-0.06 to 0.27
	9	0.11	0.10	1.08	0.28	-0.09 to 0.30

Source: pairfam release 13.0 waves 2-13. Authors' own calculations.

Appendix C

Table 3.6: Fixed-effects regression model results.

	Emotional Problems				Behavioral Problems			
	Intimate disclosure		Conflict		Intimate disclosure		Conflict	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	high	low	high	low	high	low	high	low
Parental separation	0.05	0.07	-0.04	0.12*	0.03	0.16***	0.14***	0.1*
(ref.: no parental separation)	(0.23)	(0.2)	(0.38)	(0.05)	(0.47)	(0.00)	(0.00)	(0.08)
Child's age	-0.02	-0.02	-0.02*	-0.02	-0.01	-0.03**	-0.01	-0.04**
	(0.15)	(0.22)	(0.10)	(0.43)	(0.29)	(0.03)	(0.26)	(0.02)
Resident parent's age	0.002	0.01	0.001	0.002	-0.01	0.01	-0.003	0.02
	(0.89)	(0.5)	(0.94)	(0.92)	(0.60)	(0.30)	(0.73)	(0.20)
Economic deprivation of family	0.04***	0.05***	0.05***	0.05***	0.02***	0.03***	0.03***	-0.03**
(child's perspective)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
Resident parent's depressive symptoms	-0.02	0.003	0.001	-0.004	-0.01	0.01	-0.01	-0.01
	(0.43)	(0.90)	(0.97)	(0.97)	(0.48)	(0.68)	(0.49)	(0.46)
Constant	0.59	0.17	0.54	0.60	0.57*	0.07	0.45*	-0.01
	(0.19)	(0.75)	(0.15)	(0.34)	(0.05)	(0.87)	(0.09)	(0.98)
Observations	5329	3812	5717	3424	5329	3812	5717	3424
Adj. R-squared	0.03	0.02	0.04	0.02	0.03	0.03	0.03	0.03

Source: pairfam release 13.0 waves 2-13. Authors' own calculations

Regression coefficients. Hypothesis 2. Outcome variables: children's emotional and behavioral problems depending on parent-child relationship quality.

4 Do Kids See it Coming? Analyzing Children's School Performance in the Years Before Parental Separation in Norway

Pauline Kleinschlömer

Abstract

The study examines whether children's school performance already declines in the years prior to parental separation, adopting a process-oriented approach. In addition, the study explores heterogeneous effects based on children's socioeconomic background and gender. Existing research on the effect of family transitions on children typically compares outcomes before and after parental separation. However, this approach overlooks that parental separation is often preceded by a longer-term process of family decline. Therefore, the adverse impact on children's educational outcomes may occur even prior to the formal separation, resulting in social disparities in their educational development at an earlier stage. Utilizing Norwegian register data spanning the years 2007 to 2017, this study employs fixed effects regression to analyze math and reading scores of 185,721 children aged 9 to 15 years, with 6,593 had experiencing parental separation. Children's school performance show a slight decline even before their parents separate, with boys primarily driving this pattern. No clear pattern evolved for heterogeneities by children's socioeconomic background. This study underscores the need to regard parental separation as a gradual process rather than a discrete event, highlighting the early emergence of separation effects on children's educational outcomes and the importance of considering heterogeneous effects.

Keywords

parental separation, math scores, reading scores, pre-separation effects, register data

4.1 Introduction

The majority of studies in the literature suggest that parental separation is associated with negative consequences for children's development (Amato, 2000; McLanahan et al., 2013; R. K. Raley & Sweeney, 2020). This affects multiple dimensions of child well-being. In addition to the negative effect on children's behavioral and emotional problems (Amato, 2014; Kleinschlömer & Krapf, 2023) and health indicators (Goisis et al., 2019; Kleinschlömer et al., 2024), parental separation has a negative consequence on children's educational achievements. There is evidence from several countries that children and adolescents with divorced or separated parents perform less well in school, on average, than those who grow up with non-divorced parents (Amato, 2014; Bernardi & Radl, 2014; R. K. Raley & Sweeney, 2020). Although the effects of parental separation on children's educational outcomes are generally modest, further investigation is warranted. Poor educational outcomes may initiate processes that lead to other kinds of disadvantages with regard to physical and mental well-being (Dalgard et al., 2007; Krokstad et al., 2002), relationship stability (Lyngstad, 2004), and economic well-being later in adulthood (Amato & Keith, 1991). Therefore, it is important to improve our understanding of children's reactions to parental separation.

Previous studies have typically treated separation as a discrete event, comparing educational outcomes before and after parental separation. However, this conceptualization disregards the fact that parental separation frequently results from an ongoing progression of family deterioration within the dissolution process. During the time leading up to a divorce, family routines undergo changes, parent-child interactions may diminish, and family conflict may intensify. This may, in turn, negatively affect children's school performance (Aughinbaugh et al., 2005). Consequently, the negative effects on children's educational outcomes may unfold even before the actual separation, placing them at risk of developmental setbacks (Amato, 2010). Although scholars agree that marriages that end in divorce are plagued by dysfunction and conflict even before the formal separation process (Cao et al., 2022), this is rarely explicitly tested. I aim to fill this gap by adopting a process-oriented approach, as proposed by Amato (2010) and Kim (2011).

I will address the following research questions: Is children's school performance already deteriorating in the period before parental separation? What are the differences in the effects on children's school performance before separation based on the socioeconomic status and gender of the children? I use Norwegian register data to analyze children's math and reading scores in grades 5, 8, and 9. Although children's abilities in math and reading are interrelated (Jindra et al., 2022; Korpipää et al., 2017), each subject has its own individual developmental trajectory (Little et al., 2021). Therefore, it is important to analyze the effects of parental separation on math and reading scores separately. My definition of separation is based on the event on which the departure of a parent is recorded in the register data. The rationale behind this distinction is that when a parent moves, the child loses the additional benefits that an additional parent could potentially provide. These include financial resources as well as emotional and time-related resources (Manning & Lamb, 2003; Sweeney, 2010). For my analyses, I employ fixed-effects regression models that allow me to estimate the changes in children's school performance up to four years before separation until the year of parental separation. Using this method, I can examine whether children's math and reading scores already deteriorate in the years before parental separation, thus adopting a process-oriented approach. To further explore heterogeneous effects, I conduct separate analyses depending on children's gender and parental socio-economic background.

This paper contributes to the literature in several ways. Firstly, the modelling strategy employed in this study differs from that of numerous previous studies. Rather than treating parental separation as a discrete event by comparing children's average well-being before and after the event (e.g., the timing of the father's physical absence (McLanahan et al., 2013)), I conceptualize parental separation in a longer time frame. This approach incorporates the decline in family dynamics that often precedes the actual separation, including increased interparental conflicts that lead to reduced intimate connections between parents and children (Sun, 2001) and a stressful environment for children (Jekielek, 1998). Research indicates that these conflicts can result in psychological maladjustment issues (Martin et al., 2017; Sherrill et al., 2017), suggesting that the effects of separation may unfold before the formal separation occurs (Aughinbaugh et al., 2005). A simple comparison of children's educational outcomes before and after parental separation may not fully capture the nuances of the event. Such a comparison

of children's outcomes based on averages hides time-specific deviations from the mean. Consequently, I compare children's school outcomes in the individual years preceding parental separation with the year of parental separation separately, rather than averaging over all the pre-separation years. This results in a more detailed analysis of the effect of parental separation on children's school outcomes. Examining not only the impact on children's educational outcomes after separation, but specifically the impact prior to separation is crucial for a holistic understanding of children's experiences. It enables a more comprehensive approach to support children not just during the separation itself, but also beforehand, potentially lessening the negative effects of separation and ensuring more effective interventions tailored to children's specific needs. Guidance during this period of familial uncertainty is particularly important, as middle childhood is a critical period for identity formation (Maccoby, 1984). It requires a stable foundation to explore and establish one's values and beliefs, while also navigating the desires for independence while ensuring that children make informed and responsible decisions. Therefore, understanding how family instability affects the school outcomes of children is essential for providing support during this critical period of identity formation. Secondly, while previous research on the association between pre-divorce effects and children's school performance has been constrained by limited sample sizes (Aughinbaugh et al., 2005; Kim, 2011), I present new findings using comprehensive register data that are both representative and longitudinally informative. Third, this study recognizes that not all children respond uniformly to parental separation by analyzing heterogeneous effects based on children's socio-economic background and gender. Lastly, in contrast to most previous studies on pre-separation effects, my definition of parental separation includes not only marital but also non-marital cohabitation. The prevalence of non-marital cohabitation is rising (Sassler & Lichter, 2020; Zahl-Olsen et al., 2023). Considering that, on average, this form of partnership carries a higher break-up risk (Wiik et al., 2009), it can be argued that children living with cohabiting parents face an elevated risk of family instability compared to children living with married parents (Manning, 2015). Therefore, it is important to incorporate current social changes into the research design.

4.2 Theoretical Background

The negative consequences of parental separation on children's school performance are evident across various nations (McLanahan et al., 2013). Hence, parental separation also has a negative effect on children's school performance in Norway, the country from which I obtained the data for this study. This is demonstrated by lower school grades (Nilsen et al., 2020), reduced educational attainment (Steele et al., 2009), diminished educational ambitions (Zeratsion et al., 2015), and an elevated risk of dropping out of school (Karhina et al., 2023) for children who have experienced parental separation. In my study, I aim to move beyond this perspective and analyze whether children's school performance deteriorates in the period leading up to parental separation.

Such negative pre-separation effects can be explained using two theoretical frameworks: (1) the stress perspective and (2) the resource perspective. The stress perspective highlights that the dissolution process is accompanied by a period of continuous family decline even before the formal separation takes place. This decline is characterized by reduced intimate connections between parents and between parents and children, diminished parental commitment to children's education, decline in parent-child communication and fewer economic and human resources (Astone & McLanahan, 1991; Sun, 2001). Ongoing conflicts and tension between parents contribute to a stressful environment for children (Jekielek, 1998). Further, interparental conflicts can have spill-over effects, leading to increased parent-child conflicts and psychological adjustment issues in children (Martin et al., 2017; Sherrill et al., 2017). Resource theories primarily focus on the household resources available to support children (Manning & Lamb, 2003; Sweeney, 2010), which may cover both emotional and financial aspects. Based on the resource perspective, research has found that many women with children increase their labor supply when marital conflict and the risk of divorce increase (Genadek et al., 2007; Özcan & Breen, 2012). However, due to ongoing conflict and reduced parenting quality, parents at risk of separation may not be able to transfer these increased resources to the same extent as parents without interparental conflict. As a result, parents who are on the verge of a separation may not be able to provide the same level of support to their children as they would otherwise (Amato, 2000, 2010). This, in turn, may adversely affect their school performance even before their parents formally separate.

Consequently, numerous mechanisms may account for a decline, including increased stress, diminished emotional resources, or decreased parenting practices. Nevertheless, while my study does not delve into testing each of these mechanisms, it is important to note that all of these theoretical mechanisms consistently predict a decline in children's school performance in the years leading up to separation. Thus, it is crucial to consider the pre-separation period when assessing children's well-being in the context of parental separation. This leads to the hypothesis: Children's school performance deteriorates already before their parents separate *(hypothesis 1)*.

Only a few studies have examined children's well-being in the period before parental separation, exploring a range of outcomes (Aughinbaugh et al., 2005; Goisis et al., 2019; Kim, 2011; Strohschein, 2005; Tullius et al., 2022). These studies found mixed results. While some found pre-separation effects on children's well-being (Aughinbaugh et al., 2005; Strohschein, 2005), others found no effects (Aughinbaugh et al., 2005; Goisis et al., 2019; Kim, 2011; Tullius et al., 2022). The differences in the age groups of children studied, variations in methodological approaches, different institutional settings or the variety of outcome variables might account for these conflicting findings.

There are two studies, analyzing children's math and reading scores in the pre-divorce period (Aughinbaugh et al., 2005; Kim, 2011). Kim (2011) utilized a matching approach combined with a growth curve model to analyze child development across the pre-divorce, in-divorce, and post-divorce periods. The results showed a significant detrimental effect on children's math test scores during the in-divorce and post-divorce period, but not before divorce. However, the pre-divorce period only covered a one-year window, which may be too short to capture pre-divorce effects. Aughinbaugh et al. (2005) extended the time period and analyzed, among other outcome variables, children's math and reading scores up to five years before the divorce and six years after the divorce. The fixed-effects regressions showed that children's school performance is not significantly affected by changes in their parents' marital status, both before and after the divorce. However, Aughinbaugh et al. (2005) and Kim (2011) relied on a relatively small number of children who had experienced parental divorce in both studies. In contrast, I can analyze pre-separation effects using a large population-based sample with over n = 3000 observations of children in each year before the transition to a single-

parent family (see Table 4.1). Further, Aughinbaugh et al. (2005) focused specifically on married couples, as they did not include cohabiting couples in their analyses. Since non-marital cohabitation is increasing in most countries worldwide, including Norway, and marital cohabitation is decreasing (Sassler & Lichter, 2020; Zahl-Olsen et al., 2023), the inclusion of cohabiting couples to the present study enhances the inclusiveness and generalizability of the research findings and better reflects the current union patterns.

All studies of pre-divorce effects have treated separated children as homogeneous. However, the impact of parental separation on children's school performance is complex and influenced by multiple factors, including family characteristics like parental education and disposable income (Karhina et al., 2023; Nilsen et al., 2020). I argue that not all children anticipate parental separation in the same way and want to examine whether there are heterogeneous effects. Protective factors can mitigate the negative effects of parental separation on children's well-being. The presence or absence of such "shock absorbers" (Amato, 2000, p. 1272) can lead to heterogeneous effects in anticipation of separation on children's well-being. One moderator in this regard is family's socioeconomic background. Parents who have more resources before divorce may be better able to provide a safe and stable environment for their children (Bernardi, 2014). In addition to financial capital, which serves educational purposes by subsidizing educational goods (e.g. books) and services (e.g. tutoring, private classes, and college tuition), parents' own human capital (Becker, 1962) enables parents to offer academic help and career guidance to their children, which may lower divorce-related stress. This may positively affect children's school performance. Following this line of argumentation, I argue that children with more socioeconomic resources prior to parental separation will experience fewer negative school outcomes in the years before separation than children with low socioeconomic resources *(hypothesis 2a)*. However, based on the more to lose hypothesis (Breen & Goldthorpe, 1997), it is also reasonable that as parental conflict limit the time parents can spend with their children (Astone & McLanahan, 1991; Özcan & Breen, 2012), parents from higher socioeconomic backgrounds have fewer opportunities to transmit advantages to their children. However, the children with a higher socioeconomic background were used to these resources and now notice a clear difference. This argumentation leads to the contradicting hypothesis that children with more socioeconomic resources prior to parental separation experience more negative school

outcomes in the years before parental separation than children with low socioeconomic resources *(hypothesis 2b)*.

Heterogeneous effects are also possible regarding the gender of the children. Sons and daughters may be affected differently as a result of different types of attachment to their parents (Buist et al., 2002), different roles in the family (S. Raley & Bianchi, 2006), and being socialized into responding differently to problems (Leaper & Friedman, 2007). In addition, research has shown that boys and girls have different coping strategies for school-related stress (Wilhsson et al., 2017). With regard to family instability, prior research has revealed a tendency that the relationship between marital conflict and child maladjustment is stronger for boys than girls (Davies & Lindsay, 2001). Therefore, I argue that boys' show more negative school outcomes in the years before parental separation than girls *(hypothesis 3)*.

4.3 The Norwegian Context

As in many other Western societies, Norway has experienced a notable increase in the number of divorces and separations over recent decades. Although the crude divorce rate in Norway has declined in recent years, it has more than doubled since the 1960s, with 1.6 divorces per 1,000 individuals reported in 2022 (Eurostat, 2024). In Norway, approximately half of all births occur in cohabiting unions (Andersson et al., 2017). Despite Scandinavian countries often being considered as countries where cohabitation and marriage are largely equally institutionalized, research indicates that the quality of relationships is lower and breakup intentions are more common among cohabiting couples compared to married ones (Wiik et al., 2009). This condition elevates the risk of family instability for children of cohabiting parents, correlating negatively with their overall well-being (Manning, 2015). This pattern underlines the importance of including cohabiting couples in my study.

Overall, 24% of the children living in Norway experience parental separation by age 15 (Andersson et al., 2017). Although Norway's welfare policies provide a social safety net for single-parent families, the poverty rate among single-parent families is considerably higher among single-mothers (34%) than among coupled parents (5%) (Härkönen,

2018).

In Norway, children have the right and obligation to receive 10 years of tuition-free education, usually from the age of 6 to 16 (OECD, 2023). After completing grade 10, students usually apply for different academic and vocational tracks. Academic tracks last three years and qualify students for university studies (Falch et al., 2013).

4.4 Data and Methods

4.4.1 Data and Sample

To answer the research questions, I rely on Norwegian Population Register data, which include all persons who have ever lived in Norway after 1964. The data are provided by Statistics Norway. The data allow linking individuals to their spouses, co-habiting partners, and children. In addition, the Norwegian Population Register includes information on income, school grades, and highest educational level. This combination makes the dataset suitable for answering the research question of whether a decline in school achievement is evident prior to parental separation and to what extent this decline differs with respect to socioeconomic background and gender of the children. The data in our sample covers the time period from 2007 to 2017. We ignore data from the time before 2007 because information on children's national grades in grade 5, 8 and 9 have only been available since 2007. In addition, the scientific use file of the register data are available until 2017.

I imposed several restrictions on the register data to ensure that my final sample meets the theoretical and methodological requirements for the following analysis. In a first step, I identified children and their parents, leading to an original sample of N = 1,440,212 children and n = 12,625,474 observations. Next, I limit my sample to the years since 2007 and start the analysis from the year of fifth grade for all children, and the final year of observation for children in my sample is ninth grade. This results in a reduction of the sample size by n=10,708,668 person-years. In addition, I ensure, that all children have registry entries in at least two of the three school years (grades 5, 8 and 9), and have no missing values on the other variables of interest. This leads to a reduction of the sample size by n = 628,319 person-years. For my analytical strategy,

I need at least one measurement of the outcome variables before parental separation. Since the outcome variable is measured for the first time in grade 5, I drop children who have already experienced a parental separation before grade 5. This reduces the sample by n = 313,674 person years. To avoid selectivity, I drop children who will ever live in a stepfamily (reduction of n = 11,340 person-years) and children who experienced more than one family transition within the years in between grade 5 and grade 9 (e.g., children whose biological parents have repartnered after separation) (reduction of n = 1,165 person-years). I also deleted children whose parents have deceased. This leads to a reduction of n = 1,240 person years.

Running a fixed-effects regression requires the measurement of the outcome variable at a minimum of two points in time. However, the outcome variable is absent in grades 6 and 7. Therefore, children who experienced parental separation two years before the measurement of the outcome variable were excluded from the analysis. This exclusion criterion applies to cases where parental separation occurred in grade 8, but the outcome variable was not measured in grade 6. Likewise, the same exclusion criterion applies to cases where children experienced parental separation in grade 9, but the outcome variable was not measured two years earlier in grade 7 (see Appendix A for a graphical overview of the exclusion criteria). Thereby, I listwise delete observations in grade 6 and 7 as my outcome variable is not measured in these grades. This leads to a final sample of 185,721 children and 557,163 observations (person-years). Of these, N = 6,593 children lived with their biological parents in the 5th grade and experienced their separation in the 9th grade at the latest, resulting in n=16,610 person-years. 179,128 children continuously reside with their two biological parents within the observation period. Despite not experiencing parental separation, these children are included in the sample to obtain more reliable estimates for the age and period effects (and the other control variables) in the fixed effects estimation (Brüderl, 2010). The sample size in the years before parental separation is demonstrated in Table 4.1.

4.4.2 Measures

In the following, I describe the operationalization of the variables used in the analysis. All variables are time-varying and were measured in grade 5, 8 and 9.

Table 4.1: Overview of the observations in the years up to the separation by grade

	Grade			
Years to separation	Grade 5	Grade 8	Grade 9	Total
4 years to separation	3,424	0	0	3,424
3 years to separation	3,169	0	0	3,169
1 year to separation	0	3,424	0	3,424
Year of separation	0	3,169	3,424	6,593
Total	6,593	6,593	3,424	16,610

Note: Only children who experience parental separation are included in this table.
Source: Norwegian register data. Author's own calculations.

School Performance: I take the national test scores in math and reading as my outcome variables. Since 2007, these mandatory tests are conducted in Grades 5, 8, and 9 by the Norwegian Directorate for Education and Training and aim to monitor the learning outcomes of students in the Norwegian school system. In order to ensure comparability across years, a variable indicating percentile ranks for maths and reading scores, respectively, was generated for each school year, ranging from 0 to 100. A percentile rank of 50 represents the median grade of the respective school year. Values below 50 indicate a grade that is worse than the median, while values above 50 indicate a grade that is better than the median.

Years to parental separation: In order to generate the key explanatory variable, it is first necessary to identify the year of parental separation. This is achieved by relying on register information on parents' marital status and cohabitation status. Separation is defined as the event in which one of the parents has moved out of the family household or the spouses have filed for divorce. Second, to reflect the process-oriented approach in my analysis, I created a count variable representing the years until parental separation. The variable ranges from 0 to 4, with 0 being the year of parental separation. In this paper, my aim is to compare the years before parental separation with the year of separation. Therefore, a school grade for the year of parental separation is available for all children. However, this means that the effect for 2 years prior to separation cannot be calculated due to the lack of values for the outcome variable in grades 6 and 7 and the need for two measures for a fixed effects regression.

Control variable: I controlled for time-varying confounders including parental income as an indicator for children's financial resources. Children from low income families in Norway have lower school grades (Elstad & Bakken, 2015). At the same time, parents with a lower socio-economic background are more likely to separate (Amato, 2010; Lyngstad, 2004). In the register data parental income is generated by adding up maternal and paternal income. The income includes salaries, pensions, and estimated income from business activities. I generated a percentile ranked variable within a year, ranging from 0 to 100 to capture inflation. In addition, the calendar year is included as a dummy variable in order to control for any potential trends (for space reasons, the variable is not included in the regression tables).

Moderator: In order to identify the role of children's socioeconomic background in the association between parental separation and children's well-being, I conduct separate analyses based on the educational background of the parent. Education is measured in the register data using the Norwegian Standard Classification of Education (NUS2000). To operationalize parents' highest educational background, I used the highest NUS2000 score, depending on whether the mother or the father has the highest score. To enable international comparability, I converted the NUS2000 score into the International Standard Classification of Education (ISCED2011 values) (Barrabés & Kjølstad Østli, 2017). From this, I generated three groups with different educational levels: Families where none of the parents has a higher educational level than ISCED5 (lower secondary education), families where at least one parent has a bachelor's degree (ISCED6), but no higher degree, and where at least one parent has at least a master's degree (ISCED7).

4.4.3 Analytical Strategy

To analyze changes in children's school performance before parental separation, I employ fixed-effects regression models. This approach estimates the change in math and reading scores within a child for each year preceding parental separation and the year of separation. Hence, only children who experience a change in their treatment variable - those children encountering parental separation between grade 5 and 9 (n = 6,593) – contribute to the within-variation and contribute to the fixed-effects estimate. The resulting within estimator accounts for both unobserved and observed time-constant

factors, effectively controlling for bias originating from temporally stable unobserved heterogeneity (Brüderl & Ludwig, 2015). One example for a potential time-constant confounder is children's gender. Parents are more likely to separate when having a daughter (Kabátek & Ribar, 2021). At the same time, girls have on average better school grades than boys (Voyer & Voyer, 2014). The fixed-effects method is thus robust to bias originating from time-invariant, (un)observed variables and increases the robustness of causal claims (Wooldridge, 2010). To assess the heterogeneous effects, I conduct separate analyses depending on the socio-economic background of the parents and the gender of the children.

4.5 Results

4.5.1 Descriptive Results

Table 4.2 summarizes the descriptive statistics of the sample. The descriptive results show that parents of children living in a two-biological parent family have a slightly higher education than children living in a single-parent family. In two-biological parent families, 18.06% of parents have higher education, while in single-parent families, this share is only 14.56%. This goes along with higher parental income in two-biological parent families (mean rank = 50.03) than in single-parent families (mean rank = 48.24). The descriptive results also show that children have lower math scores (mean rank = 44.291) and reading scores (mean rank = 45.66) when living in a single-parent family than when living in a two-biological parent family (mean rank for math scores = 50. 10; mean rand for reading scores = 50.08).

4.5.2 Results of the Multiple Regression Analyses

The results of the fixed-effects regression model, which analyzed the effects of the children's school performance up to four years before parental separation for the full sample, are presented in Figure 4.1. The corresponding regression table for Figure 4.1 can be found in the supplementary material (Appendix B, Table 3). Due to the large sample size, I take $\alpha = 0.01 = 0.01$ as the significance level for all my analyzes. The dashed horizontal line ($\beta = 0$) in all figures refers to the school performace in the year of parental separation (reference category). Figure 4.1 shows that four years be-

Table 4.2: Descriptive statistics

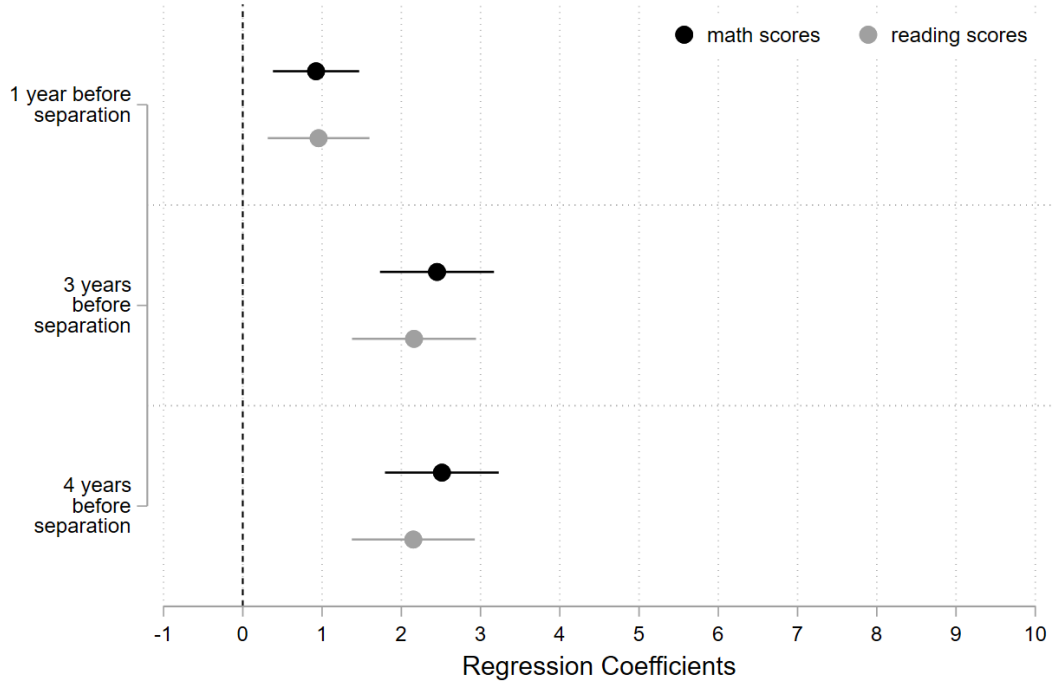
Variable	Total sample				Two-biological parent family		Single-parent family	
	Mean/ %	SD	Min	Max	Mean/ %	SD	Mean/ %	SD
Math Scores	50	28.86	0	100	50.10	28.85	44.29	28.49
Reading Scores	50	28.84	0	100	50.08	28.83	45.66	28.91
Parental Income	50	28.87	0	100	50.03	28.87	48.24	28.86
Parental highest educational background								
Low	37.84				37.75		42.80	
Medium	44.16	0.72	1	3	44.19	0.72	42.64	0.70
High	18.00				18.06		14.56	
Number of obs.	557,163				547,401		9765	
in %	100				98.25		1.75	
Number of children	185,721				179,198		6,593	
in %	100				96.45		3.55	
Number Males	94,033				90,754		3,279	
in %	100				96.51		3.49	
Number Females	91,688				88,374		3,314	
in %	100				96.39		3.61	

Note: The two-biological parent family column represents descriptive statistics for children before the change in a single-parent family and for children who stayed in a two-biological parent family throughout the observation period. The single-parent column represents descriptive statistics for the year of separation.
Source: Norwegian register data. Author's own calculations.

fore parental separation children have on average $\beta = 2.51$ better results in math and $\beta = 2.15$ better results in reading than in the year of separation. The effect size remains similar three years before separation, with children showing $\beta = 2.45$ better math and $\beta = 2.16$ better reading scores than in the year of separation. However, one year before separation, the effect size shrinks. Children's math scores are $\beta = 0.92$ better than in the year of parental separation and children's reading scores are $\beta = 0.96$ better. There is no statistically significant difference in children's school performance three years before parental separation compared to four years before separation. However, there is a statistically significant difference in math and reading scores between three and four years before separation compared to one year before separation. Thus, the data support hypothesis 1 that children's school performance declines prior to their parents' separation. Despite this, the effect size is small in magnitude, with the regression coefficients ranging around $\beta = 2.0$ on a scale of the outcome variable from 0 to 100.

For hypothesis 2 and hypothesis 3, I am interested in heterogeneous effects. Figure

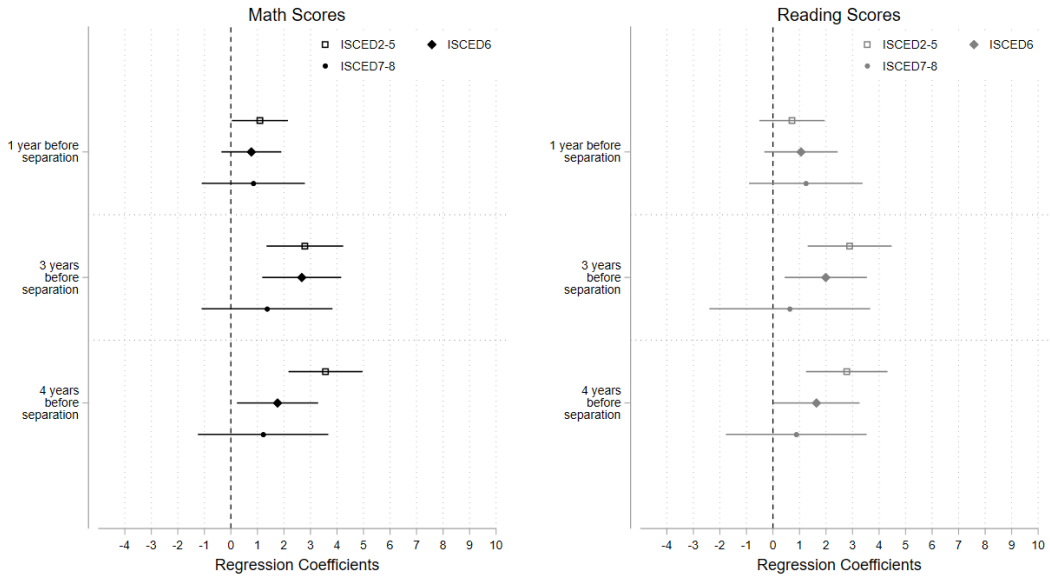
Figure 4.1: Fixed-effects regression model results. Regression coefficients. Outcome variable: Children's math and reading scores.



Note: The dashed horizontal line represents children's school performance in the year of parental separation (reference category). The scale for children's math and reading scores ranges from 0 to 100. The regression coefficient for two years before parental separation cannot be analyzed because the outcome variable is only measured in grades 5, 8 and 9. To run a fixed-effects regression, at least two measurements of the outcome variable are required. Due to the data structure, it is not possible to model a two-year period prior to parental separation with two measurements.
Source: Norwegian register data. Author's own calculations.

4.2 shows the results for hypotheses 2a and 2b, where I highlight the heterogeneous effects based on the children's socioeconomic background. The left figure shows the children's results in math and the right figure shows the children's results in reading. The corresponding regression table can be found in Appendix C (Table 4-9). The figure shows that children with high socio-economic resources do not have significantly better results in math or reading before their parents separate than in the year of separation. There appears to be no change in their school performance in the years before parental

Figure 4.2: Fixed-effects regression model results depending on children's socioeconomic background. Regression coefficients. Outcome variable: Children's math and reading scores.

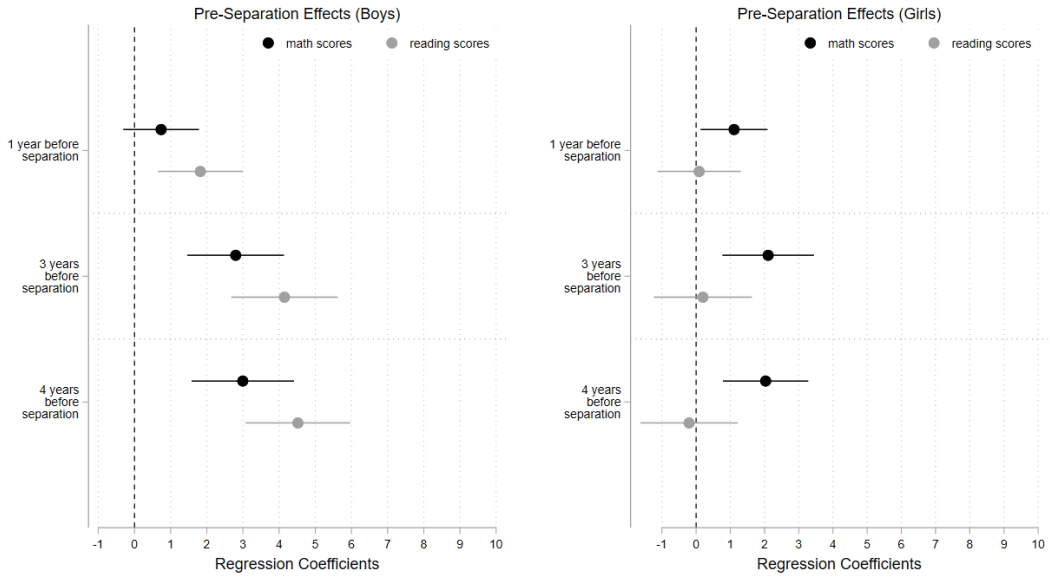


Note: The dashed horizontal line represents children's school performance in the year of parental separation (reference category). The scale for children's math and reading scores ranges from 0 to 100.
Source: Norwegian register data. Author's own calculations.

separation. However, there are significant differences in the school performance of children with a medium or low socio-economic background in the years before formal separation and in the year of separation. These children have significantly better math and reading scores three to four years before parental separation than in the year of separation. One year before separation, the difference turns insignificant, indicating that children with a lower socio-economic background show stronger pre-separation effects than children with a high socio-economic background. Thus, the data confirm hypothesis 2a. However, the effect sizes, and thus the difference between children with high socio-economic background and a low socio-economic background is small.

Figure 4.3 focuses on the gender differences in children's pre-separation effects (see Appendix D, Table 10 - 13, for the corresponding regression table). In line with hy-

Figure 4.3: Fixed-effects regression model results depending on children's gender. Regression coefficients. Outcome variable: Children's math and reading scores.



Note: The dashed horizontal line represents children's school performance in the year of parental separation (reference category). The scale for children's math and reading scores ranges from 0 to 100.
Source: Norwegian register data. Author's own calculations.

pothesis 3, boys show greater differences in their reading scores in the years before separation and the year of separation than girls. Boys have $\beta = 4.52$ better reading scores four years before parental separation than in the year of separation. The effect is statistically significant at $\alpha = 0.01$. In contrast, girls' reading scores do not show statistically significant differences in the years before separation compared to the year of separation. Their reading scores do not seem to be affected by parental separation. Pre-separation effects on children's math scores are similar for both boys and girls.

4.5.3 Additional Analyses

To rule out the possibility that the observed pattern is a general pattern in the data and not due to parental separation, I conducted an additional sensitivity analysis comparing the trend in math and reading scores for children who experience parental separation and

for children who continuously live in a two-biological parent family. Since the variable "years before separation" is not set for children who live continuously in a family with two biological parents (because they do not experience parental separation), I randomly assigned a number between zero and four to this group. The results show that while the school performance of children in single-parent families deteriorates with each year that the separation of the parents' approaches, the school performance of children in two-parent families remains stable (see Appendix E). This indicates that the observed pre-separation effects in the fixed effects analyses are not a general effect, but can be attributed to the separation of the parents.

4.6 Discussion

Parental separation and its consequences for children's well-being have long been studied by many researchers (R. K. Raley & Sweeney, 2020). However, most studies have treated parental separation as a discrete event and compared children's outcomes before and after parental separation. In the present study, I argue that parental separation is a process of continuous family decline rather than a discrete event. As conflict between parents increases prior to parental separation and is associated with a decline in parental parenting quality (Martin et al., 2017; Sun, 2001), I argue that children's well-being deteriorates in the years prior to formal separation. In doing so, I rely on Norwegian register data (2007 - 2017) and use children's math and reading performance in grades 5, 8, and 9. To account for the possible correlation between children's school performance and unobserved factors related to parental separation, such as gender or other time-invariant characteristics, I estimate fixed-effects models. This is a major advantage, as Kim (2011) in particular mentions in his limitations the concern that unobserved confounders could have significantly influenced his results.

I find small pre-separation effects in the years prior to parental separation. Four years before parental separation children have significantly better reading scores ($\beta = 2.15$) and math scores ($\beta = 2.51$) than in the year of separation or one year before separation. However, keeping in mind that the outcome variable ranges from zero to 100, the effect size is quite small with 45.05 to 45.88 average points among children whose parents separated. Nevertheless, the results indicate that children's school performance already

deteriorates in the years before parental separation. Hence, guidance during the period of familial uncertainty is particularly important, as middle childhood is a critical period for identity formation (Maccoby, 1984). An analysis of the heterogeneous effects shows that children with a lower socioeconomic background have stronger effects before separation than children with a high socioeconomic background. However, the difference between children living in a family with a high socioeconomic background and children living in a family with a low socioeconomic background is small. In addition, the results show that boys exhibit stronger pre-separation effects on their reading scores compared to girls.

Some limitations of my findings should be borne in mind. My results help to understand *whether* and *how much* separation affects children's school performance but does not answer the question of why. Identifying the specific mechanisms that drive pre-separation effects on children's math and reading scores is beyond the scope of my analysis. There are many potential mechanisms associated with parental separation and children's declining school performance in the period before the formal separation (e.g. parental conflict, decreased parenting practices declined parent-child relationship quality (Sun, 2001)). The register data provide no variables to test these mechanisms. However, I can rule out the possibility that a reduction in financial resources is the mechanism at play. Financial resources are often used as a mechanism to explain the negative consequences for children of parental separation (Manning & Lamb, 2003; Sweeney, 2010). The moving out of one parent reduces the household income available for the child, putting single-parent families at an increased risk of falling below the at-risk-of-poverty threshold (Mortelmans, 2020), which may in turn also negatively affect children's school performances. However, since I look at the period before parental separation, defined as the event when one parent moves out, the decline in financial resources cannot be used as an explaining mechanism for pre-separation effects. Future research should examine potential pathways that can explain children's reduced school performance before parental separation. This might enhance our understanding of pre-separation effects and allow for a more comprehensive understanding of the factors at play, potentially enabling more targeted and effective interventions to support children during and after the separation process. Secondly, the pre-separation effect hypothesis relies on two assumptions: interparental conflicts and its negative effect on children's

development. In this regard, some research raises the possibility of reverse causation of child effects on interparental conflict (Cui et al., 2007; Jenkins et al., 2005). However, the literature also supports the direction that interparental conflict puts children at risk for developmental setbacks, (Hetherington, 1979; Peterson & Zill, 1986) and concludes that the relationship "is nevertheless a real and important one" (Emery, 1982, p. 312). In this sense, I must acknowledge that not every high conflict marriage ends in divorce (Hanson, 1999) and not every divorce is preceded by a period of marital discord (Amato & Fowler, 2002). Hanson (1999) shows that 75 percent of high conflict marriages do not end in divorce, suggesting that children l also experience parental marital discord. However, even without knowing the exact mechanism, my study confirms that there are significant pre-separation effects. Further, the data does not include information on the children's school performance in grades 6 and 7. Therefore, it is not possible to compute the point estimate for two years prior to parental separation, as at least two measures of the outcome variable are required to run a fixed-effects regression. Including grades 6 and 7 would have provided a more comprehensive picture of the children's pre-separation effects. Future research should include a longer time frame to take a life-course perspective on pre-separation effects on children. A broader time window would allow researchers to identify the onset of pre-separation effects. Finally, the organization of the Norwegian school system may bias the results. The transition to lower secondary school takes place in grade 8, when the children are around 13 years old. This could lead to increased stress. However, research has shown that the timing of parental separation has only a marginal effect on children's academic performance (Sigle-Rushton et al., 2014). So I assume that the same is the case for pre-separation effects.

Despite these limitations, the results emphasize the importance of modelling parental separation over a longer period of time. This is a crucial first step towards comprehending pre-separation trajectories within a life course framework. A simple before-after comparison of the average well-being of children in the years before parental separation with the average well-being of children in the years after parental separation hides heterogeneous effects in children's school performance in the years before parental separation. A key strength of the analysis is the use of a large population-based sample that allows me to analyze within effects as well as heterogeneous effects. To my knowledge, no study has examined the pre-effects of parental separation on children's school out-

comes using longitudinal and representative data from outside the U.S. context, making my study an important contribution to the current literature. Despite research showing the negative associations between parental divorce and various outcomes are generally very similar in Norway and the United States (Breivik & Olweus, 2006), my findings are inconsistent with previous research Aughinbaugh et al. (2005) and Kim Kim (2011), who found no significant pre-separation effect.

As educational inequalities are important policy concerns in most advanced economies, it is important to understand factors leading to structural differences in children's educational success. In this regard, analyzing the pre-separation phase helps in designing more targeted interventions. The enhancement of understanding children's consequences of parental separation allows for the development of support systems that address specific challenges children might be facing. Early intervention strategies can focus on providing resources, counseling, or support networks to assist children who are already experiencing difficulties due to family stressors.

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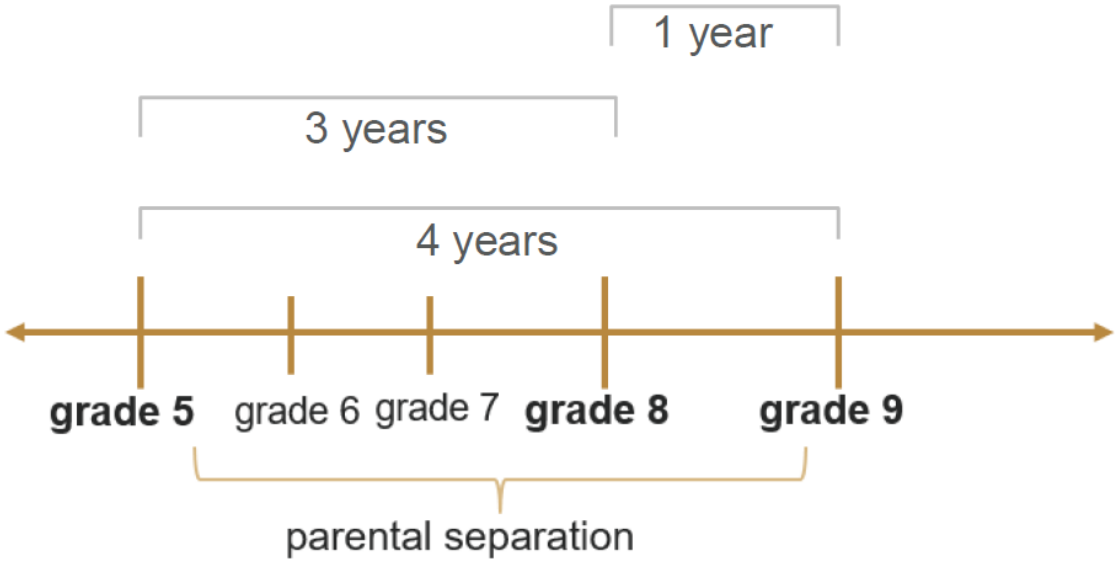
Appendix

Appendix A

Figure 4.4: Graphical overview of the data structure.



Appendix B

Table 4.3: Fixed-effects regression coefficients for hypothesis 1.
Outcome variables: math and reading scores (ranging from 0 to 100)

	(2) Math Scores	(3) Reading Scores
Years before parental separation		
(Ref.: Year of parental separation)		
1 year before parental separation	0.92***	0.96**
	(0.001)	(0.004)
3 years before parental separation	2.45	2.16
	(0.00)	(0.00)
4 years before parental separation	2.51***	2.15***
	(0.00)	(0.00)
Parental income	-0.01	0.0001
(percentile rank)	(0.55)	(0.99)
Constant	44.72***	45.70***
	(0.00)	(0.00)
Observations	16,610	16,610
Adj. R2	0.01	0.01

p-values are in parentheses *** p<.001, ** p<.01, * p<.05
Source: Norwegian register data. Author's own calculations.

Appendix C

Table 4.4: Fixed-effects regression coefficients for hypothesis 2. Outcome variables: math and reading scores (ranging from 0 to 100) depending on children's socioeconomic background.

	(4)	(5)	(6)	(7)	(8)	(9)
	Math Scores			Reading Scores		
	low education	medium education	high education	low education	medium education	high education
Years before parental separation (Ref.: Year of parental separation)						
1 year before parental separation	1.09**	0.77	0.84	0.72	1.06*	1.24
	(0.01)	(0.08)	(0.26)	(0.13)	(0.05)	(0.14)
3 years before parental separation	2.79***	2.67***	1.36	2.89***	1.99***	0.63
	(0.00)	(0.00)	(0.15)	(0.00)	(0.00)	(0.59)
4 years before parental separation	3.57***	1.76**	1.22	2.78***	1.64**	0.88
	(0.00)	(0.01)	(0.20)	(0.00)	(0.00)	(0.39)
Parental income	-0.02	0.002	0.01	0.03	-0.03	-0.02
(percentile rank)	(0.35)	(0.93)	(0.82)	(0.17)	(0.18)	(0.61)
Constant	37.1***	47.96***	57.83***	37.04***	50.40***	61.80***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	7,315	6,983	2,312	7,315	6,983	2,312
Adj. R2	0.02	0.01	0.01	0.01	0.01	0.01

p-values are in parentheses *** p<.001, ** p<.01, * p<.05

Source: Norwegian register data. Author's own calculations.

Appendix D

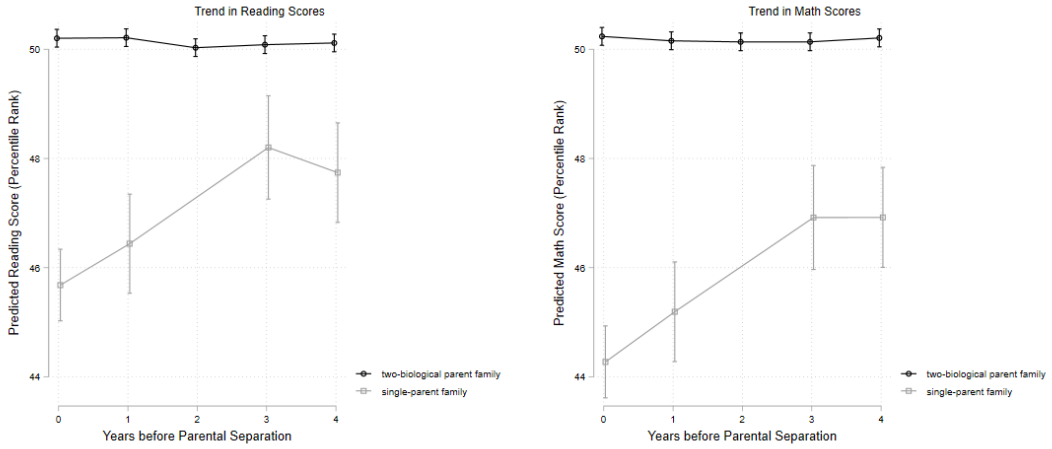
Table 4.5: Fixed-effects regression coefficients for hypothesis 2. Outcome variables: math and reading scores (ranging from 0 to 100) depending on children's gender.

	(10)	(11)	(12)	(13)
	Math Scores		Reading Scores	
	Boys	Girls	Boys	Girls
Years before parental separation				
(Ref.: Year of parental separation)				
1 year before parental separation	0.74	1.11**	1.82***	0.09
	(0.07)	(0.01)	(0.00)	(0.85)
3 years before parental separation	2.80***	2.11***	4.15***	0.20
	(0.00)	(0.00)	(0.00)	(0.72)
4 years before parental separation	2.99***	2.03***	4.52***	-0.21
	(0.00)	(0.00)	(0.00)	(0.71)
Parental income	-0.01	-0.01	-0.02	0.02
(percentile rank)	(0.70)	(0.64)	(0.39)	(0.38)
Constant	46.76***	42.70***	42.21***	49.21***
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	8,264	8,346	8,264	8,346
Adj. R2	0.02	0.01	0.03	0.01

p-values are in parentheses *** p<.001, ** p<.01, * p<.05
Source: Norwegian register data. Author's own calculations.

Appendix E

Figure 4.5: Trend of children's math and reading scores.



Source: Norwegian register data. Author's own calculations.

5 Adaptation, Cumulative Disadvantage or Selection? Children's Age at Stepfamily Formation and School Achievement

Sandra Krapf, Pauline Kleinschlömer and Jonathan Wörn

Abstract

This study aims to investigate the impact of the timing of stepfamily formation on children's educational achievement, focusing on age-specific effects. While prior research has extensively investigated the effects of single-parent families on children, comparatively less attention has been devoted to understanding the experiences of stepchildren. If children raised in stepfamilies face disadvantages, the growing prevalence of such family structures underscores the importance of addressing potential social inequalities stemming from family composition. Using a large Norwegian register dataset, we employ family fixed effects analysis to compare the educational achievement of sibling experiencing stepfamily formation at different ages. In this first analysis, we find that children experiencing stepfamily formation between ages 12 and 14 exhibit slightly lower academic achievement than those experiencing it at age 16. In a second analysis, we assess the selection into stepfamilies by comparing them to children in two-biological parent families using an OLS regression analysis. Children in stable two-parent families have significantly higher academic achievement than those in stepfamilies even among children who experienced stepfamily formation after educational achievement was assessed, indicating that selection plays an important role in family dynamics. We contribute to the literature by elucidating age-specific effects of stepfamily formation on educational outcomes and highlighting the complex interplay between selection processes and causal effects.

Keywords

Stepfamily Formation, School Achievement, Adaption, Cumulative Disadvantage, Selection

5.1 Introduction

Family life and arrangements in Western societies have undergone significant transformations in recent decades, with parental separation becoming increasingly prevalent. Numerous studies suggest that children raised outside of a two-biological-parent family face disadvantages in terms of psycho-social wellbeing, educational success and health outcomes (P. Amato & James, 2010; P. R. Amato, 2000; Härkönen et al., 2017; McLanahan et al., 2013; Raley & Sweeney, 2020). Following parental separation, some children undergo the formation of stepfamilies. While research typically focuses on the outcomes of children in single-parent families, there has been paid less attention to the group of stepchildren. As stepfamily formation affects family roles and resources, examining its impact on children can enhance our comprehension of post-separation family dynamics. This is pertinent given the non-negligible number of stepfamilies in many European countries and the United States (Andersson et al., 2017; Steinbach et al., 2016), along with indications of their rising prevalence in certain regions over time (Kleinschlömer & Krapf, 2023).

The aim of this study is to conduct a comprehensive analysis of the consequences of children's age at stepfamily formation on their educational achievement at age 16 measured via the Grade Point Average (GPA). Academic achievement is a crucial determinant of life prospects, as final school grades have been linked to later-life success, including university performance, occupational prestige, income, and well-being (**star**).

The findings from prior studies examining the effects of stepfamilies on children's educational outcomes are mixed. While some conclude that there are no differences between children in stepfamilies and those in single-parent families (Mariani et al., 2017; Usevitch & Dufur, 2021), others show that children in stepfamilies fare worse with regards to educational outcomes (Fomby et al., 2021; Kalmijn, 2015). One reason for these inconclusive findings might be that the studies overlook variations in stepfamily effects over the age of children at the time of stepfamily formation. Results from a siblings analysis of parental separation show evidence consistent with a "crisis" model where disruption at age 14 appears to be detrimental for final school grades at age 16 while younger children performed better (Sigle-Rushton et al., 2014). The present pa-

per builds upon that study by focusing on the age at stepfamily formation. The age at which stepfamily formation occurs may influence children's experiences in different ways. Firstly, children who experience stepfamily formation at a younger age may have more time to adapt to the new family structure across their life-course and thus stepfamily effects are smaller than among older children. Conversely, younger children might struggle to recover from setbacks, implying that an earlier experience of stepfamily formation could have a more pronounced negative impact on academic achievement. Understanding these age-specific effects enables the development of tailored interventions. For instance, if it becomes apparent that children in certain age groups encounter difficulties with stepfamily formation, this information could inform school social work initiatives. Such targeted measures can better address the diverse needs of children at different life stages, ultimately promoting equal opportunities for children.

Our analyses capitalize on large administrative registers based on the full population of Norway, which include a substantial number of transitions into stepfamilies, thus allowing for data intensive statistical analyses. In a first step, we present the findings of a family fixed effects analysis. This approach controls for all observed and unobserved family-constant characteristics (e.g., parental educational aspirations and parent's own educational level) and observed child characteristics (e.g., children's gender, birth order) to arrive at a more causal estimate of the role of age at stepfamily formation. In the model, we identify differences in the GPA at age 16 of biological siblings in the same household who spent different amounts of time in a stepfamily due to their varying ages at the transition into a stepfamily. While this first analysis singles in on stepfamilies, our second analysis compares the GPA-levels of children in stepfamilies to those in stable two-biological and stable single-parent families. By including both children that experienced stepfamily formation before and after their GPA was assessed, GPA differences between children who (at the time of GPA assessment) already have and those who not yet have experienced a stepfamily formation can be compared to GPA-differences between family forms. This informs us about selection into different family types based on family characteristics associated with educational achievement.

5.2 Theoretical Background

A stepfamily forms when the resident parent of a child starts to co-reside with a (marital or non-marital) partner who is not the biological parent of the child. The transition into a stepfamily can be viewed as a partnership event, but the concept of linked lives from life course theory (Elder et al., 2003) suggests that parental repartnering not only impacts the lives of parents but also presents novel challenges and prospects for children. The challenges stem from the inherent stress of stepfamily formation, disrupting established household dynamics and necessitating an adaptation and re-establishment of roles for each family member (Ganong & Coleman, 2017; King et al., 2015). Such stress has been linked to adverse effects on cognitive processes (Lupien et al., 2009), thus stepfamily formation might increase the risk of adverse educational outcomes for children as long as this stress endures. On the other hand, opportunities arise from the infusion of resources into the household upon the introduction of a stepparent. Research indicates a lower prevalence of economically disadvantaged children in stepfamilies compared to single-parent households (Heintz-Martin & Langmeyer, 2020). An improved income situation can ease previously tense circumstances, and parents with less financial stress tend to have better parenting abilities (Conger et al., 2010). This can contribute to better educational achievement by fostering a supportive home environment conducive to learning and encouraging positive academic behaviors. Thus, the potential increase in household resources may mitigate the disruptive effect of stepfamily formation.

Empirically, it seems to be an established finding that stepchildren have worse educational outcomes than children growing up in two biological parent families (Biblarz & Raftery, 1999; Gennetian, 2005; Manning & Lamb, 2003). However, the results of prior studies that compare educational outcomes of stepchildren in single parent families are mixed. Several studies highlight the absence of negative effects of growing up in a stepfamily compared to single parent families (Helgertz & Tegunimataka, 2024; Mariani et al., 2017; Song & Glick, 2012; Usevitch & Dufur, 2021). Others conclude that children in single parent families have better educational outcomes than in stepfamilies (Biblarz & Raftery, 1999; Björklund et al., 2007; Fomby & Cherlin, 2007; Jonsson & Gähler, 1997; Kalmijn, 2015). Some studies even show a positive effect of stepfamilies

on children's educational achievement (Magnuson & Berger, 2009; Wagmiller et al., 2010).

One possible reason for these inconclusive findings might be heterogeneous effects over children's age that were not taken into account in many prior studies. Life course theory emphasizes that family transitions can yield diverse effects on children, contingent upon the timing of such transitions (Stritzel & Crosnoe, 2023). Key considerations in this regard include the duration of exposure to a particular family structure and the developmental stage during which a child undergoes stepfamily formation. Yet, our dataset lacks the granularity to disentangle these distinct timing effects and our analyses rely on age at stepfamily formation to explore temporal effects.

Our theoretical considerations lead to two contrasting hypotheses. On the one hand, potential negative effects of stepfamily formation may diminish over time. Stepfamilies require a period of adjustment until new family roles and daily routines are (re-)established. Initial increases in stress levels are adapted because over time, conflicts within the stepfamily tend to decrease (Ganong et al., 2011), while closer bonds between stepparents and stepchildren develop (King et al., 2014). Given that children who undergo stepfamily formation at younger ages have more time to adapt to the new circumstances, this argumentation suggests that an earlier (vs. later) experience of stepfamily formation is associated with better academic achievement at age 16 *(adaptation hypothesis)*.

On the other hand, early stepfamily formation might be negative for children's educational success also in the long term. The life course perspective underscores the significance of developmental stages in children's experiences. Research has demonstrated that early childhood is formative for cognitive development (Tomalski & Johnson, 2010). Early disturbances in a child's developmental journey can trigger a process of accumulating disadvantages, as developmental paths often tend to follow a trajectory set early on (Pasqualini et al., 2018). Consequently, when young children face setbacks in their schooling, such as those stemming from the formation of a stepfamily, it becomes more challenging for them to bridge the gap compared to older counterparts. Following this argumentation, an earlier (vs. later) experience of stepfamily formation

is associated with worse academic achievement at age 16 *(cumulative disadvantage hypothesis)*.

Both the adaptation and the cumulative disadvantage hypotheses propose variations in stepfamily effects based on children's age. However, families transitioning into stepfamilies may inherently differ from stable two-biological-parent families, even prior to the stepfamily formation. This means that the association between children's age at stepfamily formation and educational outcomes could be (partially or entirely) spurious. Certain family characteristics that are present already before stepfamily formation might affect both whether (or at what age of the child) their parent initiates stepfamily formation, and the child's educational achievement. One such characteristic might be the need for emotional support of the resident parent. Dating and repartnering soon after the break-up can be a coping mechanism to satisfy their need for emotional support and connection. However, when parents find themselves overwhelmed by their own emotional needs, they may have a lower capacity to provide support for their children. This argument is supported by previous research showing that parents' emotional well-being is positively related to young children's cognitive outcomes (Kiernan & Mensah, 2009). From such a selection perspective, one might expect that children experiencing stepfamily formation show lower educational achievement compared to children with two constantly coupled biological parents, irrespective of how old they were at the time of stepfamily formation *(selection hypothesis)*. When comparing the educational achievement of children raised in stepfamilies to those in stable single-parent families, we anticipate that similar unobserved factors may influence parental selection into these family structures, resulting in similar age patterns.

Research explicitly analyzing the impact of age at stepfamily formation on children's education is limited. A recent cross-sectional study in Sweden based on register data found that children who had experienced parent's remarriage had slightly higher levels of school achievements at grade 9 than those who did not experience parent's remarriage (Helgertz & Tegunimataka, 2024). The positive effect diminished with children's increasing age at remarriage, i.e. the older the child at the remarriage, the smaller was the effect on school achievement. Although the effect sizes were small, and it remained unclear whether differences between age groups were statistically significant

(Helgertz & Tegunimataka, 2024), the patterns do neither align with the adaptation not with the cumulative disadvantage hypothesis. Another study, based on US survey data, examined children's yearly math and reading achievements following parental separation and mothers' remarriage in the age group 5-15 (Aughinbaugh et al., 2005). It has to be noted that the paper focuses on the time since a child is exposed to the new family form instead of analyzing age effects. Using child fixed effects models, the authors observed a negative effect of remarriage on reading achievement, persisting from one year prior to remarriage to five years post-remarriage. With regard to the time elapsed since remarriage, there was no clear pattern, e.g. in the second year after remarriage, the effect was smaller than in the first year but increased again in the third year (Aughinbaugh et al., 2005) – which can be interpreted as contradiction to the adaptation hypothesis. The study did not find an effect of marriage on math achievement.

In sum, the results of the two studies discussed here suggest a limited understanding of the relationship between age at stepfamily formation and school achievement.

5.3 The Norwegian Context

As in many other countries in the Global North, Norway has witnessed a significant increase in divorce and separation over the past few decades. Although the crude divorce rate in Norway has declined again in recent years, it has more than doubled between the 1960s and 2020s, and 1.6 divorces per 1,000 persons were reported in 2022 (Eurostat, 2024). While welfare state policies are generous in Norway (Baran et al., 2014), the poverty rate among single-mother households (34%) is considerably higher than among coupled parents (5%) (Härkönen, 2018). There has been a notable rise in the prevalence of joint physical custody arrangements, where children spend at least 30% of their time in each parent's home, increasing from less than 10% of post-separation families at the turn of the millennium to 25% in 2012 (Kitterød and Wiik 2017). Among children whose parents separate or divorce, 41% become part of a stepfamily within 6 years (Andersson et al., 2017).

Children in Norway have the right and obligation to 10 years of education, free of cost, typically starting the calendar year they turn 6 and ending the calendar year they

turn 16 (OECD, 2023). At the end of grade 10, adolescents typically apply to different academic and vocational tracks. The academic tracks last for three years and qualify for studies at universities. The vocational tracks consist of two years of school-based education plus two years of on the job training, or of three years of school-based training (Falch et al., 2013).

5.4 Data and Methods

5.4.1 Analytical Strategy

In this paper, we measure educational achievement using the grade point average (GPA) in grade 10, i.e. in the year children turn 16 years old. We utilize two methodological approaches to examine our hypotheses regarding the heterogeneous effects of stepfamily formation on educational achievement across child age. First, to analyze the causal effect (i.e. the adaptation and the cumulative disadvantage hypotheses), we estimate a family fixed-effects model. This model focuses on a sample of families with at least two children who experience the transition from a single parent family to a stepfamily at different ages. Family fixed-effects models are akin to individual fixed-effects models, except that they compare outcomes among siblings who have grown up in the same family rather than comparing the outcomes of the same individual before and after an event (Firebaugh et al., 2013). Thus, only differences between siblings within the same family contribute to the estimated coefficient, and both observed and unobserved time-invariant family characteristics (e.g., parental education or general parenting style) do not introduce bias into the results. Using family fixed effects models, we assume that the older sibling acts as a counterfactual for the younger child (Sigle-Rushton et al., 2014), implying that conditions within the single-parent family would have remained unchanged had stepfamily formation not taken place. Examples of these stable environmental and family-related circumstances include shared personal traits inherited from the parents, exposure to the same parenting style, or family cultural capital (Andersen & Hansen, 2012). The family fixed effects approach minimizes residual confounding by accounting for all these constant factors shared by the siblings. In our analyses, we compare children's educational achievement in grade 10, i.e. the outcome variable is measured at age 16. Siblings vary in the age at which they experienced stepfamily formation. If we observe an u-shape pattern it would support the adaptation hypotheses,

with the lowest GPA among those who experienced stepfamily formation around the time of GPA measurement. Conversely, a linear effect with the lowest GPA in siblings who experience stepfamily formation in young ages would align with the cumulative disadvantage hypothesis.

In a second step, we evaluate the selection hypothesis, which posits systematic differences between stable two biological parent families and those experiencing separation and repartnering in terms of factors relevant to children's educational success. These selection effects are overlooked when comparing siblings within post-separation families. We estimate an OLS regression model were we focus on two comparisons. First, we compare stepchildren who experienced stepfamily formation between 7 and 16, i.e. in the year of the GPA measurement or earlier, to a 'placebo group' (Adda et al., 2011; Bernardi & Boertien, 2016). The 'placebo group' comprises children who experienced stepfamily formation after educational achievement was measured. In our analysis, this includes children aged 17 to 20 years when the family structure transition occurred. If within this 'placebo group' educational achievement at age 16 is lower than for those in stable two biological parent families, it supports the assumption that educational outcomes are influenced by unobserved family characteristics. Such a pattern would imply that an association between stepfamily formation and educational achievement is partly or fully due to selection. This is particularly relevant considering that the anticipation of family transitions has a minor impact on educational outcomes, as discussed in chapter 4 of this dissertation. Conversely, if the GPA of children who experienced stepfamily formation after age 16 is equal to educational achievement to those in single parent/two biological parent families, the notion that unobserved family characteristics (or "selection criteria") drive the association between family structure and educational achievement appears less plausible. The second comparison that we focus on in the OLS-regression is between family types, in particular children who grow up in stable two-biological parent families and those who experience the transition to a stepfamily. In order to provide a comprehensive picture about family structures, we also present the GPA of children who grew up in stable single parent families.

5.4.2 Data and Variables

In our analyses, we rely on Norwegian Population Register data, which includes all persons who were registered in Norway after 1964. We exclude data from the time before 2005 because information on partners' cohabitation status has only been available since 2005. The scientific use file of the register and linked data are available until 2017. The data are provided by Statistics Norway, include family demographics, and allow linking individuals to their spouses, cohabiting partners, and children. In addition, we link children's Grade Point Average (GPA) in grade 10 from the Norwegian Education Database. This combination allows us to analyze whether the age at the time of stepfamily formation is associated with children's GPA in grade 10.

We extracted a sample including all children who were born between 1990 and 2001, and obtained their GPA between 2006 and 2017, based on availability of all required variables for these individuals. The oldest children in our analyses have experienced stepfamily formation at age 20, the youngest at age 7.

We imposed several restrictions to ensure that our final samples meet the theoretical and methodological requirements for our analyses. The initial sample comprises n=1,440,212 children. We exclude all children who do not live in a two-biological parent family in 2005 (n=307,918). Further, we delete children who have experienced more than one parental separation (defined as either end of cohabitation or divorce; n=28,657) as well as children who have experienced more than one stepfamily formation or transitioned from a two-biological parent family directly to a stepfamily before the GPA measurement in grade 10 (n=4,049). In addition, we exclude children who have experienced parental death (n=13,860) and children whose parents have children with more than one partner (n=23,238). Additionally, we exclude children with missing information on parents' educational attainment (n=207). Further, we exclude children who have not yet received a GPA (n=674,034) and exclude children who took the GPA twice (n= 140). 99 percent of the children receive the final GPA when they are 16; as age is a central variable in our analyses, we exclude children who have the GPA measure at a different age (n=3,203). In addition, we restrict our sample to children who were between 7 and 20 years in the analyzed calendar years (n = 6,464). We chose age 20 as

the upper age limit because many young adults in Norway, especially those pursuing tertiary education, leave their parental home around that age (Schwanitz et al., 2017). As a result, exposure to the parental household beyond this age is increasingly unlikely. Children in stable single parent families are kept because they provide the control group for estimating the common effect of birth order (Brüderl, 2010; Brüderl & Ludwig, 2015). However, we exclude children who were in a two-biological parent family at the time of the GPA measurement (n=365,432). In line with the family fixed-effects logic, we consider only families with available GPA values for at least two siblings. This is necessary to enable a comparison between two children with respect to our outcome variable. Therefore, children without siblings are excluded (n = 18,324). Hence, all children in our sample have at least one sibling who has already received a GPA.

For the family fixed effects regression, this results in a total sample of 17,694 siblings from 8,266 families. Among these, 4,486 children from 2,714 families have undergone stepfamily formation between the ages of 7 and 20, contributing to our family-fixed effect estimator of stepfamily formation.

In the OLS regression, we focus on families with a minimum of two children who consistently reside in a two-biological parent family. This should increase comparability with the sample analyzed in the family fixed effects and yields a final sample size of 282,597 children. Within this group, 252,265 children remain within their two-biological parent family until the age of 20, while 24,916 witness their parents' separation, and 5,416 experience the formation of a stepfamily. While in the sample analyzed in the family fixed effects model the focus is on children who lived in a single parent family or a stepfamily at the time of GPA measurement, the post-separation family samples in the OLS regression includes additionally children who spent time in two-biological parent families. Therefore, the figures are higher than in the sample in the fixed effects model.

Educational achievement: As a measure for our outcome variable educational achievement, we use the grade point average (GPA) in grade 10. Students receive their GPA during the final year of compulsory education, typically in the year they turn 16 years old. The GPA is calculated based on grades received in various subjects throughout the

school year. The GPA reflects a student's overall academic performance serving as a key factor for students when applying to higher education institutions or vocational training programs. To ensure comparability across years, we generated a variable indicating percentile ranks ranging from 0 to 100 within each calendar year. A GPA percentile rank of 50 refers to the median grade in the respective year. Lower values than 50 indicate a GPA lower than the median, while higher values indicate higher GPA scores than the median.

Age at family structure transition: We determine the age at family structure transition using two dates. Firstly, we identify the first year when a new family form was registered (January 1st), indicating a family transition in the preceding calendar year. Secondly, we use this information to calculate the age of children in the year of the family transition. To identify transitions, we utilize registry data on the marital status and household composition of the resident parent. Each child is registered in only one household, i.e. we do not discern shared physical custody arrangements between separated biological parents. Instead, we assume that children reside primarily where they are registered. Information regarding a family transition is recorded in the register year beginning on January 1st, referencing the last change in the previous calendar year. This approach allows us to identify the year in which the resident parent and their new partner established a shared household, marking the formation of a stepfamily. Due to the unavailability of precise transition dates, we calculate children's age as the difference between the year of stepfamily formation and their year of birth.

In our OLS regression, we also examine children who never undergo stepfamily formation but remain in either a stable two-biological parent family or a stable single-parent family. For the latter category, we identify the time of parental separation as the initial year when one parent moves out of the family household or when the spouses have filed for divorce (i.e., initiated separation?). We determine children's age at parental separation based on their age during the separation year. Regarding the age classification of children in stable two-biological parent families, we randomly assign an age between 7 and 20 at a "mock" family transition to allow comparisons with children who actually experienced a family transition. Each child in a stable two-biological parent family is assumed to have an equal likelihood of being allocated to any age group.

Table 5.1: Descriptive statistics of the analytical sample used in the family fixed effects model. Means and column percent refer to children.

	Full Sample Mean/ %	Stepfamily Transition Mean/ %	Control Group Mean/ %
Grade Point Average	43.56	41.90	44.12
Age at stepfamily formation (in %)			
7	0.31	0.31	
8	0.80	0.80	
9	1.54	1.54	
10	2.96	2.96	
11	4.41	4.41	
12	5.86	5.86	
13	7.40	7.40	
14	9.83	9.83	
15	10.68	10.68	
16	13.46	13.46	
17	11.93	11.93	
18	14.29	14.29	
19	9.92	9.92	
20	6.58	6.58	
Birth order (in %)			
First	39.22	37.23	39.89
Second	44.29	45.63	43.84
Third or higher	16.49	17.14	16.27
Sex (%)			
Boys	50.72	50.69	50.73
Girls	49.28	49.31	49.27
Year of birth	1997	1997	1997
N (Children)	17,694	4,486	13,208
N (Families)	8,266	2,714	5,552

Notes: Families with at least two children. Source: Norwegian register data, years 2005 to 2017. Siblings in the control group contribute to the unbiased estimation of the effects of control variables. Authors' own calculations.

Control variables in the family fixed effects model: The advantage of the within-family analysis is that characteristics shared between siblings do not bias the results. With regard to confounders that might vary between siblings, we control for children's gender, birth order, and children's year of birth. Children's gender is a dichotomous variable (boy or girl). Parents are more likely to divorce when having a teenage daughter (Kabátek & Ribar, 2021). At the same time, girls have on average better school grades

than boys (Voyer & Voyer, 2014). Birth order is a continuous variable, and an important control variable because later born children are more likely to experience parental separation and birth order effects on educational outcomes have been shown for Norway (Sigle-Rushton et al., 2014). To allow for comparability over different years, we created a variable that represents the percentile rank of math and reading scores within each calendar year, ranging from 0 to 100. For the calculation of the GPA rank, we included also children in stable two biological parent and stable single parent families. Table 5.2 displays the distribution of the variables in the fixed effects analyses. Columns 1 refers to the total sample while column 2 shows the distribution of the variables in families that have experienced a stepfamily formation. Column 3 refers to those who experienced parental separation but who do not see a stepfamily form. This group contributes to the unbiased estimation of coefficients of control variables (Brüderl, 2010; Brüderl & Ludwig, 2015), e.g. birth order. Regarding GPA percentile rank, the table indicates that siblings undergoing the transition to a stepfamily have a mean GPA rank of 41.90, whereas those in the control group (i.e. siblings in stable single parent families) have a mean rank of 44.12.

Control variables in the OLS regression model: To avoid confounding in the OLS-regression, we include also time-constant control variables into the model, namely parental educational background, maternal age at birth and paternal income as additional control variables to the ones mentioned in the family fixed effects regression. Parental highest education and paternal income at the initial observation in the register data serve as indicators for families' socio-economic background. It has been shown that parents with a lower socio-economic background are more likely to separate (P. Amato & James, 2010; Kalmijn & Leopold, 2021; T. H. Lyngstad, 2004). At the same time, children from low income families in Norway have lower school grades (Elstad & Bakken, 2015). In addition, it is an established finding that parents' level of education plays an important role in their children's education (Holmlund et al., 2011). In the register data, paternal income includes salaries, pensions, and estimated income from business activities. To control for potential pre-separation confounding of income, we utilized parental income data from 2005 or the initial observation of a family in our dataset. We make income comparable over time and age-groups by creating year- and age-specific percentile ranks ranging from 0 to 100.

Table 5.2: Descriptive statistics of the analytical sample used in the OLS regression model. Means and column percent refer to children.

	Full sample Mean/ %	Stable two-parent Mean/ %	Single-parent family Mean/ %	Stepfamily Mean/ %
Grade Point Average	50.86	51.66	44.64	41.73
Age at family structure transition (in %)				
7	6.50	7.17	1.04	0.26
8	6.55	7.13	1.94	0.68
9	6.65	7.14	2.79	1.29
10	6.75	7.12	3.92	2.50
11	6.89	7.13	5.17	3.70
12	7.05	7.18	6.18	5.08
13	7.21	7.21	7.42	6.36
14	7.30	7.13	8.71	8.56
15	7.43	7.08	10.36	10.19
16	7.61	7.15	11.26	12.74
17	7.58	7.10	11.51	12.00
18	7.73	7.17	11.97	14.55
19	7.54	7.21	9.94	11.70
20	7.21	7.09	7.78	10.39
Birth order (in %)				
First	39.26	39.54	37.64	33.87
Second	42.96	42.69	44.80	46.94
Third or higher	17.78	17.77	17.56	19.19
Sex (%)				
Boy	51.31	51.40	50.49	50.55
Girl	48.69	48.60	49.51	49.45
Year of birth	1995	1995	1996	1997
Parental highest education (%)				
ISCED 2	3.43	3.35	3.99	4.46
ISCED 3	35.73	35.54	36.57	40.65
ISCED 4/5	5.51	5.45	6.04	5.75
ISCED 6	39.87	39.91	39.79	38.21
ISCED 7	13.63	13.85	12.26	9.43
ISCED 8	1.84	1.90	1.35	1.50
Paternal Income	50.90	51.18	48.81	47.50
Maternal age at birth	29.03	29.06	28.96	27.97
N (children)	282,370	252,265	24,696	5,409
N (families)	129,038	112,261	13,291	3,486

Notes: Families with at least two children. Children in stable two-biological parent families have been randomly assigned to an age group. Household income is measured as percentile-ranked variable ranging from 0 to 100 for each year. Source: Norwegian register data, years 2005 to 2017. Authors' own calculations.

Education was measured using the Norwegian Standard Classification of Education (NUS2000) in the register data. To determine parents' highest educational background, the highest NUS2000 score was used, depending on whether the mother or father had the

highest score. To ensure international comparability, we converted the NUS2000 score to the International Standard Classification of Education (ISCED2011; see Barrabés and Kjølstad Østli (2017)). Young maternal age at birth may be associated with a higher likelihood of experiencing changes in family structure (T. Lyngstad & Jalovaara, 2010; Sweeney, 2010) and lower school performance among children Duncan et al. (2018). The distribution of the variables in the OLS regression model is displayed in Table **??**. Column 1 shows the full model, columns 2 to 4 shows the variable distribution in the three family structure categories: stable biological parent families, those who experience the transition to a (stable) single parent family and those who see a stepfamily formation. The first row indicates that children undergoing the transition to a stepfamily exhibit the lowest GPA percentile rank, averaging at 41.73. Conversely, those experiencing the transition to a single-parent family show a slightly higher mean rank of 44.64. Children raised in a stable two-biological-parent family attain the highest rank, averaging at 51.66.

5.5 Results

Our analyses comprise two parts. Firstly, in order to assess the adaptation and cumulative disadvantage hypotheses, we conduct family fixed effects of siblings' GPA percentile rank. In this first analysis, we focus on siblings who experience stepfamily formation at different ages. Secondly, to examine the selection hypothesis, we present the results of an OLS-regression including a 'placebo test'. Below, we present the results for our key explanatory variable, children's age at stepfamily formation, graphically. Complete regression tables are provided in Appendix A.

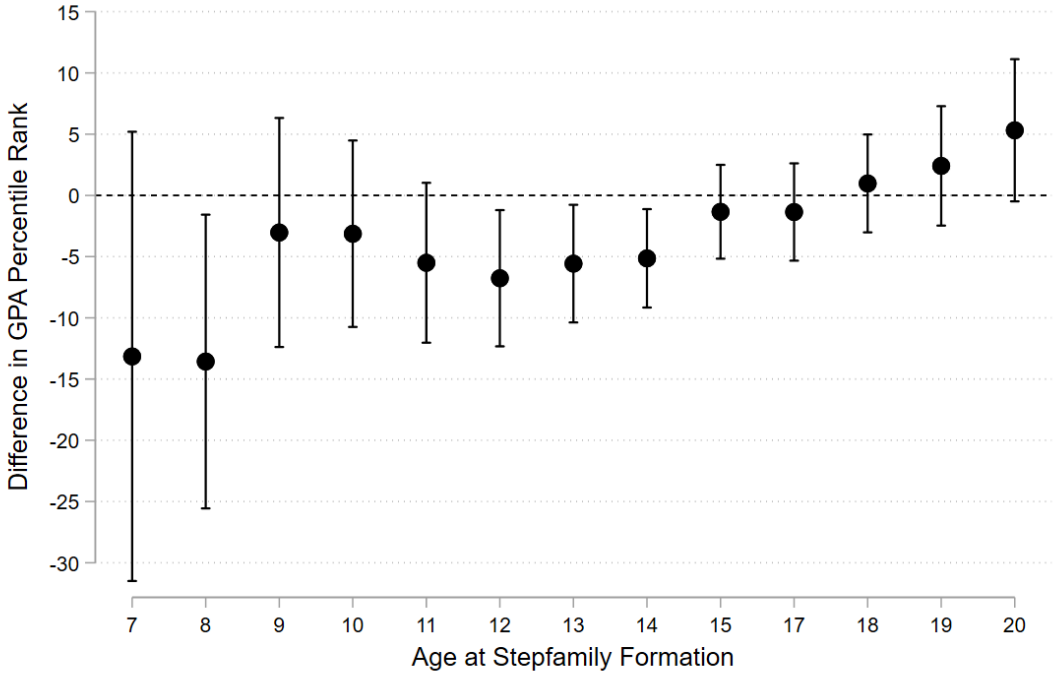
5.5.1 Family Fixed-Effects Modell

Figure 5.1 illustrates the within-family differences in GPA percentile ranks among siblings who experienced the transition from a single parent family to a stepfamily between the ages of 7 (9 years before GPA measurement) and 20 (4 years after GPA measurement). Siblings experiencing the formation of a stepfamily at age 16, corresponding to the year of GPA measurement, are designated as the reference category, represented by the dashed line. The black circles for each age represent the difference in GPA rank

for children who experienced stepfamily formation at that particular age, compared to those who experienced it at age 16, net of the family fixed effect, sibling order, children's sex, and birth year. A stepfamily formation at age 16 corresponds to the effect on GPA for children who saw the transition from a single parent family to a stepfamily in the calendar year when they turn 16. The estimate for a stepfamily formation at age 15 corresponds to the effect for children treated one year before graduation and so forth. The estimates for ages 17–20 show effects for children, who had already graduated at the time of stepfamily formation. Notably, the differences in GPA percentile ranks exhibit a non-linear pattern. The most pronounced negative effect of stepfamily formation (–13 GPA percentile rank) is observed among those experiencing it at age 7, while the maximum positive effect (+5 GPA percentile rank) is evident for those undergoing stepfamily formation at age 20 compared to the reference group. However, the disparity is statistically significant for only four age groups and insignificant for the others. Children who experienced stepfamily formation at ages 8, 12, 13, or 14 had significantly lower percentile ranks than those who experienced the transition at age 16. The difference is rather small, with 5 to 6 lower GPA percentile ranks than the reference. An exception are children who witnessed stepfamily formation at age 8; for them the difference is –14 GPA percentile ranks. However, we are hesitant to strongly interpret the finding for 8 year olds (due to our selection procedure, in this age group merely 36 children experienced stepfamily formation). The GPA difference among those who experienced stepfamily formation when they were 9–11 and 15–20 proves to be small and statistically insignificant.

The interpretation of these results with regard to our hypotheses is not straightforward. The adaptation hypothesis expects an u-shape pattern. Children who encounter stepfamily formation at a younger age would exhibit a higher GPA rank than those experiencing it at age 16, given their longer adaptation period. The magnitude of this difference is expected to decrease as the age at stepfamily formation approaches 16. The GPA rank should be lowest among those who see the transition shortly before or during the year of GPA measurement. This group contends with the disruptive circumstances of a newly formed stepfamily, which may impede their academic performance. Those undergoing stepfamily formation after age 16 may have anticipated the change, albeit to a lesser extent the longer the actual stepfamily formation is delayed, resulting

Figure 5.1: Predicted difference in Grade Point Average (GPA) percentile rank at age 16, by age at stepfamily formation. Family fixed effects model. Reference group (dashed line): sibling experienced parental separation when they were 16 years old.



Notes: 95% confidence intervals. Control variables: sibling order, children's sex, birth year. Source: Norwegian register data, years 2005 to 2017. Authors' own calculations.

in a higher GPA rank compared to the reference group. A pattern aligning with the cumulative disadvantage hypothesis would emerge if children who experienced stepfamily formation at younger ages exhibited the largest negative difference in GPA ranks compared to those who experienced it at age 16 as younger children may find it more difficult to overcome setbacks in their school performance compared to their older siblings.

The pattern in Figure 5.1 differs from these expectations. The differences in GPA ranks among children who saw stepfamily formation at ages 12–20 could be seen as support of the cumulative disadvantage hypothesis: Younger children exhibit a larger negative difference in GPA ranks compared to the reference group while older chil-

dren have a larger positive difference. However, the difference is statistically significant only for three age years (namely 12–14). Still, these significant differences indicate the existence of a causal effect of siblings' age at stepfamily formation on educational achievement. The age range 12–14 might mark a phase in children's development during which they seem to be more responsive to stepfamily formation with regard to GPA rank at age 16 than in other ages. The overall effect of stepfamily formation is small (=1.03) but statistically significant (see Appendix B).

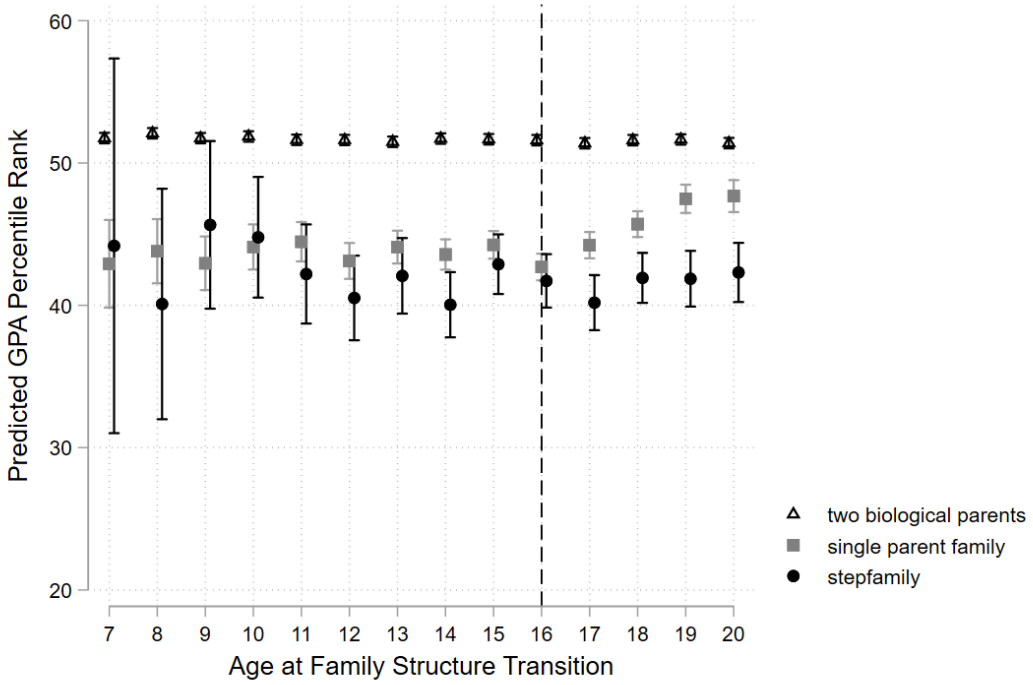
5.5.2 OLS Regression

While the family fixed effects model focused on within-family variation of the age at stepfamily formation and how this is associated with educational achievement, we assess the importance of selection into stepfamilies in an OLS regression (see Figure 5.2 and Table in Appendix C). This analysis allows us to compare (1) children who see the transition to a stepfamily and how they perform in the GPA over different ages at stepfamily formation. In order to provide a comprehensive picture, Figure 5.2 displays also children who experienced the transition to a single parent family. In addition, in the OLS regression, we are able to compare (2) variations between educational achievement of children who witness stepfamily formation, those who experience the transition to a single parent family and those who grow up in a stable two biological parent family over different ages at family transition.

Figure 5.2 illustrates the predicted GPA percentile rank at age 16. The x-axis shows the age of family transition: stepfamily formation or parental separation. Children older than 16 form our 'placebo group' (to the right of the dashed line). White triangles represent stable two-biological-parent families (average GPA percentile rank: 52), gray squares show stable single-parent families (average GPA rank between 43 and 48), and black circles depict stepfamily formation ages (average GPA rank between 40 and 46).

Significance tests of group differences show that children in stepfamilies and in single parent families reach significantly lower GPA percentile ranks than children who grow up in a stable two biological parent family (with the exception of those who experience stepfamily formation at ages 7, 9 and 10, cf. Appendix D). For children in

Figure 5.2: Predicted Grade Point Average (GPA) percentile rank at age 16, by age at stepfamily formation (stepfamilies) and age at parental separation (single parent families). OLS regression model. 'Placebo group': children who experienced family transitions after the GPA assessment (to the right of the dashed line).



Notes: Notes: 95% confidence intervals. Families with at least two children. Children in stable two-biological parent families have been randomly assigned to an age group. Control variables: sibling order, children's sex, birth year, parental highest education, paternal income, maternal age at birth. Source: Norwegian register data, years 2005 to 2017. Authors' own calculations.

stepfamilies, this seems to be largely independent of the age at stepfamily formation, as the GPA-rank between children who experienced stepfamily formation at different ages do not vary significantly between ages 7 and 20 (see Appendix E). Among those who experienced stepfamily formation between ages 17 and 20, hence, after the GPA was measured, the pattern is similar as for those who experienced it at ages 11–16. This implies that there are pre-existing unobserved characteristics (for instance, parental emotional needs) that are responsible for the lower GPA rank of stepchildren. The result supports the selection hypothesis. For single parent families, the pattern in the 'placebo group'

differs, however. Those who experienced parental separation at 20 reach significantly higher GPA ranks than those who underwent it at younger ages (with the exception of those who experienced separation at age 19; see Appendix F). For them, pre-separation unobserved factors seem to drive the effects of parental separation on GPA rank to a smaller extent than for younger children.

5.5.3 Additional Analyses

To ensure the robustness of our findings across different samples and estimation methods, we conducted additional analyses. First, we examined the sensitivity of our results to outliers. One such variable with a skewed distribution is birth order, with a mean value of 1.8 and a maximum of 12. By excluding the upper 1% of the distribution, we omitted birth ranks 4 to 12. However, neither our fixed effects nor OLS regression results changed significantly with this reduced sample (cf. Appendix G and Appendix H). Similarly, the age distribution of mothers, used as a control variable in the OLS regression, exhibited outliers. Yet, our results remained robust when analyzing a reduced sample of children whose mothers were aged between 19 and 40 years (Appendix I).

In the second sensitivity check, we conducted an OLS regression analysis using a sample that includes families with only one child. We excluded this group from the main analyses because the family fixed effects approach necessitates at least two children to explore differences between siblings. Factors such as parental resources, time availability, and parenting styles may vary between families with only one child and those with multiple children. These differences could be relevant for family structure transitions and educational achievement. Consequently, it remains uncertain to what extent our results apply to families with one child. However, the outcomes of our analyses remained largely consistent when utilizing this expanded sample (see Appendix J).

In our third sensitivity analysis, we used an alternative estimation method, namely entropy balancing. Entropy balancing is a statistical method used to reweight data to achieve balance in covariate distributions between treatment groups, thereby reducing confounding bias in observational studies (Hainmueller, 2012). In our data, the results using entropy balancing are almost identical to the results in the OLS regression (cf.

Appendix K and Appendix L). This indicates that there are family characteristics beyond those used in the weighting procedure that are responsible for differences in children's GPA levels - further highlighting the role of selection in family dynamics.

5.6 Conclusion

We aimed to explore the impact of stepfamily formation on children's academic performance, focusing on the age at which it occurs. Guided by life course theory, we formulated two contrasting hypotheses. Firstly, we hypothesized that earlier as compared to later stepfamily formation would lead to better academic outcomes due to more time for adjustment *(adaptation hypothesis)*. Secondly, we proposed the contrasting hypothesis that earlier as compared to later stepfamily formation could have a more pronounced negative effect on academic achievement *(cumulative disadvantage hypothesis)*. However, our family fixed effects analysis did not provide clear support for either hypothesis. Instead, we found that children experiencing stepfamily formation between ages 12 and 14 exhibited lower academic achievements than those experiencing it at age 16. No significant differences were observed for younger or older age groups, except for a small group undergoing the transition to a stepfamily at age 8. With regard to effect sizes, we observed 7 percentile ranks lower predicted Grade Point Average (GPA) among children who experienced stepfamily formation at age 12 compared to their siblings who experienced it at age 16. It has to be noted that this difference is small on a scale with a value range from 1–100.

Our results might indicate that children between 12 and 14 are in a more sensitive phase compared to their older and younger siblings. This finding aligns with a study examining the impact of parental unemployment on families in Norway (Mörk et al., 2020). The authors similarly observed that children who experienced their mother's job loss between ages 13 and 14 exhibited lower educational attainment at age 16, whereas it appeared inconsequential for children who were either older or younger at the time of their mother's unemployment. One factor that might explain this responsiveness to a stepfamily transition in early adolescence might be that in the Norwegian school system, the transition to lower secondary school takes place in grade 8 when the children are around 13. This transition can be challenging, as it involves acquiring abilities nec-

essary for success in lower secondary school, such as independent task organization and managing learning stress (Strand, 2019). In case children who experience stepfamily formation during this school transition have problems to learn these organizational and learning techniques, this might be a lack in abilities that persists and is reflected in lower school outcomes in the year of graduation. Indeed, it has been shown that difficulties in adapting to the new school environment in secondary school negatively impact children's later academic achievement (West et al., 2010).

In the second step of our analysis, our aim was to identify the selection into stepfamilies. We hypothesized that there might be pre-existing unobserved characteristics that impact both the formation of stepfamilies at specific ages of children and their academic outcomes. To examine the *selection hypothesis*, we compared three groups in a cross-sectional setting: (1) children in stable two-biological-parent families, (2) those who experienced parental separation and then lived in stable single-parent families, and (3) those who also experienced the transition to a stepfamily. Our results revealed that children raised in stable two-parent families had significantly higher academic achievement than those in stepfamilies and single-parent families. The pattern persisted among children who experienced stepfamily formation after GPA was assessed at age 16. These findings suggest that indeed, pre-existing characteristics may contribute to the lower academic achievement among stepchildren, regardless of the age at which stepfamily formation occurs, thus supporting the selection hypothesis.

Our study is among the first to investigate the impact of age at stepfamily formation. While prior studies of stepchildren often used cross-sectional data without explicitly using causal methods or surveys with small numbers of stepfamilies, we employed family fixed effects models based on full population register data. The data quality, particularly the large sample sizes, enabled the application of this study design that is highly data intense (Sigle-Rushton et al., 2014). A family fixed-effect model significantly enhances the study of stepfamily formation by automatically controlling for a substantial portion of confounding factors. This is facilitated by the substantial overlap in siblings' family context and socialization. Our findings significantly contribute to the literature by elucidating age-specific effects of stepfamily formation on educational outcomes. They illustrate the complex interplay between selection processes and potential causal effects

in the context of stepfamily formation. While selection undoubtedly plays a central role in differences between children growing up in different family settings, our findings additionally suggest the presence of a causal effect, particularly evident for children experiencing stepfamily formation during the age years of 12–14. This underscores the existence of sensitive phases in children's lives during which they may be more responsive to the effects of family transitions.

However, in addition to its many advantages, the family fixed-effects approach has some limitations. Despite adjusting for unobserved family-constant confounders, bias may arise due to unobserved variation across children within the same families. One such variation could occur because the parent-child relationship quality varies across children in the same family. Given that high relationship quality has been shown to moderate the impact of family transitions on children (Kleinschlömer & Krapf, 2023) and could potentially influence educational outcomes, this variability might introduce bias into our findings. Furthermore, the family fixed-effects method identifies estimated effects from a subset of individuals, specifically families with at least two children and siblings who differ in the timing of experiencing a family structure transition. It is unclear how the results generalize to children in one-child families (McLanahan et al., 2013).

Further exploration is warranted to elucidate the underlying mechanisms driving the identified vulnerabilities. One avenue for investigation pertains to the relevance of these specific age years in relation to the transition to lower secondary school. The challenges inherent in this transition, such as the need for independent task organization and managing learning stress, may exacerbate the impact of stepfamily formation during this period. Alternatively, the developmental stage of children within this age range could also contribute to their heightened susceptibility to the effects of family transitions. Understanding the interplay between these factors could provide valuable insights into the underlying processes shaping children's outcomes in stepfamilies. How best to support stepchildren? Our findings indicate that selection into stepfamilies is to some extend responsible for the lower educational achievement of children who experience stepfamily formation compared to children who grow up in stable two biological parent families. This underscores that it is not only the event of a family transition, that affects children,

but the more general situation of instable families. To support parents and children, family counseling services, should be easily accessible. In Norway, there has been a considerable increase in individuals and couples seeking help from such services (Syltevik, 2017). It may also be beneficial to provide support directly to children rather than solely focusing on parents. School-based psychology services could offer accessible counseling for both children and parents, aiding them in developing strategies to cope with negative emotions and stress. Developing resilience to crises and changes before family transitions take place could help alleviate the negative impacts of family instability.

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Appendix

Appendix A

Table 5.3: Family fixed effects model. Outcome variable: Grade Point Average (GPA) percentile rank at age 16, by age at stepfamily formation.

	Percentile ranked GPA		
	Coefficient	Standard Error	p-value
Age at stepfamily formation (Ref.: Age 16)			
7	-12.08	9.35	0.2
8	-13.42*	6.12	0.03
9	-2.9	4.77	0.54
10	-3.01	3.88	0.44
11	-5.07	3.33	0.13
12	-6.41*	2.83	0.02
13	-5.26*	2.45	0.03
14	-5*	2.05	0.01
15	-1.21	1.95	0.54
16	0	.	.
17	-1.36	2.03	0.5
18	1.02	2.04	0.62
19	2.56	2.48	0.3
20	5.19	2.96	0.08
Birth order			
First	0	.	.
Second	-7.75***	1.52	0.00
Third or higher	-13.21***	3.07	0.00
Sex			
Female	0	.	.
Male	-15.17***	.97	0.00
Year of birth			
1990	0	.	.
1991	-10.62	6.6	0.11
1992	-6.93	5.82	0.23
1993	-2.69	5.89	0.65
1994	-1.79	5.96	0.76
1995	1.8	6.25	0.77
1996	3.6	6.53	0.58
1997	5.47	6.81	0.42
1998	5.57	7.21	0.44
1999	9.97	7.61	0.19
2000	11.87	8.17	0.15
2001	14.54	8.63	0.09
Constant	50.81***	6.6	0.00
Observations		4,486	
R2		0.15	

*** p<0.001, **p<0.01, *p<0.05

Source: Norwegian register data, years 2005 to 2017. Authors' own calculations.

Appendix B

Table 5.4: Family fixed effects model. Overall effect. Outcome variable: Grade Point Average (GPA) percentile rank at age 16, by age at stepfamily formation.

	Percentile ranked GPA		
	Coefficient	Standard Error	p-value
Age at stepfamily formation	1.03*	0.48	0.03
Birth order			
First	0	.	.
Second	-8.00***	1.51	0.00
Third or higher	-13.78***	3.04	0.00
Sex			
Female	0	.	.
Male	-15.14***	0.97	0.00
Year of birth			
1990	0	.	.
1991	-10.37	6.56	0.11
1992	-6.85	5.79	0.24
1993	-2.48	5.83	0.67
1994	-1.57	5.91	0.79
1995	1.86	6.2	0.76
1996	3.61	6.47	0.58
1997	5.56	6.76	0.41
1998	5.64	7.17	0.43
1999	10.37	7.56	0.17
2000	12.4	8.12	0.13
2001	15.34	8.56	0.07
Constant	49.12***	6.83	0.00
Observations		4,486	
R2		0.14	

*** p<0.001, **p<0.01, *p<0.05

Source: Norwegian register data, years 2005 to 2017. Authors' own calculations.

Appendix C

Table 5.5: Grade Point Average (GPA) percentile rank at age 16, by age at stepfamily formation (stepfamilies) and age at parental separation (single parent families). OLS regression model.

	Percentile ranked GPA		
	Coefficient	Standard Error.	p-value
Age at stepfamily formation			
(Ref.: Age 16)			
7	0.15	0.26	0.58
8	0.49	0.26	0.06
9	0.15	0.26	0.58
10	0.27	0.26	0.32
11	0.03	0.26	0.91
12	0.02	0.26	0.95
13	-0.11	0.26	0.68
14	0.12	0.26	0.66
15	0.07	0.27	0.8
16	0	.	.
17	-0.21	0.27	0.42
18	0.01	0.26	0.98
19	0.05	0.26	0.84
20	-0.21	0.27	0.44
Family Structure			
(Ref.: Two-Biological Parent Family)			
Single-Parent Family	-7.85***	0.51	0.00
Stepfamily	-6.55***	0.98	0.00
Age at Transition # Family Structure			
7 # Single-Parent Family	0.08	1.66	0.96
7 # Stepfamily	2.32	6.79	0.73
8 # Single-Parent Family	0.62	1.27	0.63

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Table 5.5 continued from previous page

	Percentile ranked GPA		
	Coefficient	Standard Error.	p-value
8 # Stepfamily	-2.11	4.25	0.62
9 # Single-Parent Family	0.12	1.1	0.92
9 # Stepfamily	3.79	3.16	0.23
10 # Single-Parent Family	1.14	0.98	0.24
10# Stepfamily	2.8	2.38	0.24
11 # Single-Parent Family	1.75*	0.89	0.05
11 # Stepfamily	0.45	2.04	0.82
12 # Single-Parent Family	0.41	0.84	0.63
12 # Stepfamily	-1.22	1.81	0.5
13 # Single-Parent Family	1.51	0.8	0.06
13 # Stepfamily	0.46	1.68	0.78
14 # Single-Parent Family	0.76	0.77	0.32
14 # Stepfamily	-1.79	1.53	0.24
15 # Single-Parent Family	1.49*	0.74	0.04
15 # Stepfamily	1.1	1.46	0.45
17 # Single-Parent Family	1.75*	0.72	0.02
17 # Stepfamily	-1.32	1.4	0.35
18 # Single-Parent Family	3.01***	0.72	0.00
18 # Stepfamily	0.21	1.34	0.88
19 # Single-Parent Family	4.74***	0.74	0.00
19 # Stepfamily	0.1	1.41	0.95
20 # Single-Parent Family	5.19***	0.79	0.00
20 # Stepfamily	0.8	1.45	0.58
Birth order	-3.29***	0.07	0.00
Sex			
(Ref.: Female	0	.	.
Male	-15.35***	0.09	0.00
Highest Education			

Continued on next page

Table 5.5 continued from previous page

	Percentile ranked GPA		
	Coefficient	Standard Error.	p-value
(Ref.: ISCED2)	0	.	.
ISCED 3	11.23***	0.27	0.00
ISCED 4/5	15.54***	0.33	0.00
ISCED 6	25.32***	0.27	0.00
ISCED 7	33.92***	0.30	0.00
ISCED 8	39.22***	0.44	0.00
Parental Income	0.07***	0.002	0.00
Year of Birth	included as a control		
Maternal Age at Birth	included as a control		
Constant	-0.07	25.13	1.00
R2		0.23	
*** p<0.001, **p<0.01, *p<0.05			

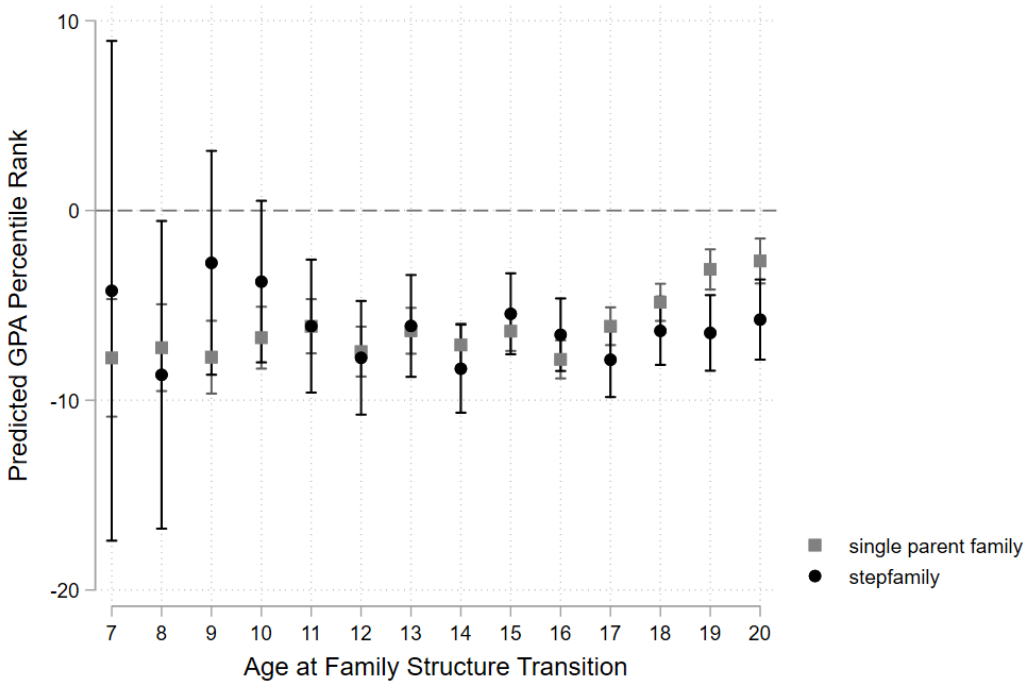
Source: Norwegian register data. Author's own calculations.

Table 5.6: Margin of Family Structure# Age at Transition

Family Structure# Age at Transition						
two biological parents#7	51.75	0.19	277.00	0.00	51.38	52.12
two biological parents#8	52.09	0.19	278.04	0.00	51.73	52.46
two biological parents#9	51.75	0.19	276.50	0.00	51.38	52.12
two biological parents#10	51.87	0.19	276.60	0.00	51.50	52.24
two biological parents#11	51.63	0.19	275.58	0.00	51.27	52.00
two biological parents#12	51.62	0.19	276.51	0.00	51.25	51.99
two biological parents#13	51.50	0.19	276.48	0.00	51.13	51.86
two biological parents#14	51.72	0.19	276.10	0.00	51.35	52.09
two biological parents#15	51.67	0.19	274.83	0.00	51.30	52.04
two biological parents#16	51.60	0.19	275.79	0.00	51.24	51.97
two biological parents#17	51.39	0.19	273.69	0.00	51.02	51.76
two biological parents#18	51.61	0.19	276.19	0.00	51.24	51.98
two biological parents#19	51.66	0.19	277.39	0.00	51.29	52.02
two biological parents#20	51.40	0.19	273.59	0.00	51.03	51.77
single parent family#7	42.92	1.57	27.36	0.00	39.85	46.00
single parent family#8	43.80	1.15	38.08	0.00	41.55	46.06
single parent family#9	42.96	0.96	44.73	0.00	41.08	44.84
single parent family#10	44.11	0.81	54.47	0.00	42.52	45.69
single parent family#11	44.47	0.70	63.17	0.00	43.09	45.85
single parent family#12	43.12	0.64	66.98	0.00	41.86	44.38
single parent family#13	44.10	0.59	75.06	0.00	42.95	45.25
single parent family#14	43.57	0.54	80.37	0.00	42.51	44.64
single parent family#15	44.25	0.50	89.06	0.00	43.28	45.22
single parent family#16	42.70	0.48	89.58	0.00	41.76	43.63
single parent family#17	44.23	0.47	93.79	0.00	43.31	45.16
single parent family#18	45.71	0.46	98.75	0.00	44.80	46.62
single parent family#19	47.49	0.51	93.46	0.00	46.49	48.49
single parent family#20	47.68	0.57	82.95	0.00	46.55	48.80
stepfamily#7	44.19	6.72	6.58	0.00	31.02	57.35
stepfamily#8	40.10	4.13	9.70	0.00	32.00	48.20
stepfamily#9	45.66	3.00	15.20	0.00	39.77	51.54
stepfamily#10	44.79	2.16	20.70	0.00	40.55	49.03
stepfamily#11	42.21	1.78	23.75	0.00	38.72	45.69
stepfamily#12	40.52	1.52	26.74	0.00	37.55	43.49
stepfamily#13	42.08	1.35	31.06	0.00	39.42	44.73
stepfamily#14	40.05	1.17	34.29	0.00	37.76	42.34
stepfamily#15	42.89	1.07	40.07	0.00	40.79	44.99
stepfamily#16	41.72	0.96	43.59	0.00	39.85	43.60
stepfamily#17	40.19	0.99	40.74	0.00	38.26	42.13
stepfamily#18	41.93	0.90	46.79	0.00	40.18	43.69
stepfamily#19	41.87	1.00	41.90	0.00	39.91	43.83
stepfamily#20	42.31	1.06	39.88	0.00	40.23	44.39

Appendix D

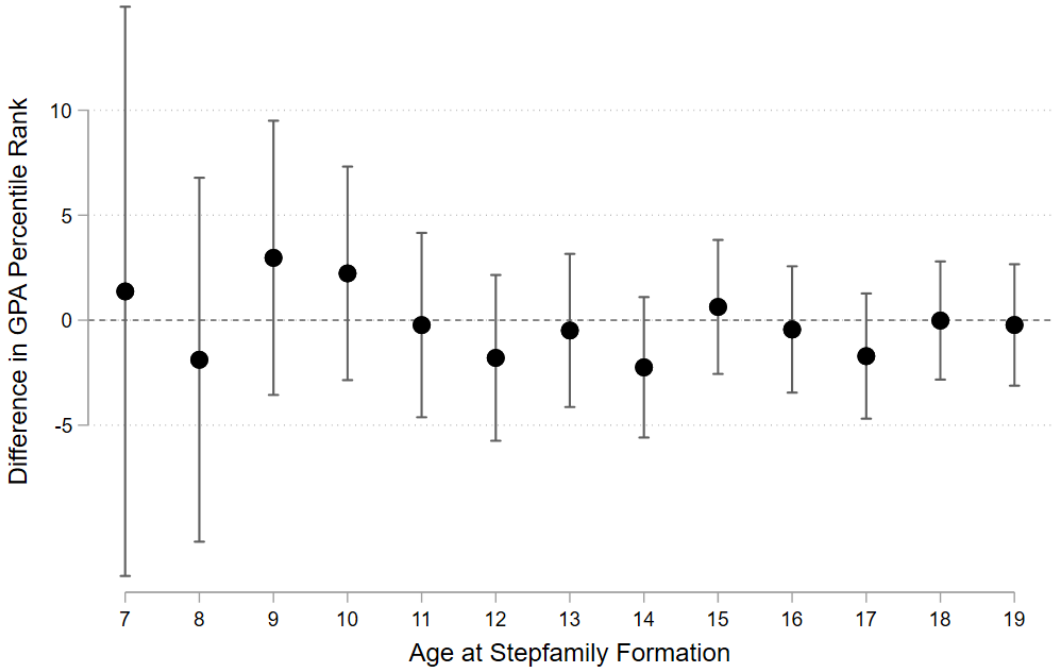
Figure 5.3: Significance tests of group differences between children living in a two-biological parent family and children living in a post-separation family. Predicted Grade Point Average (GPA) percentile rank at age 16. OLS regression model.



Notes: 95% confidence intervals. Families with at least two children. Children in stable two-biological parent families have been randomly assigned to an age group. Control variables: sibling order, children's sex, birth year, parental highest education, paternal income, maternal age at birth. Source: Norwegian register data, years 2005 to 2017. Authors' own calculations.

Appendix E

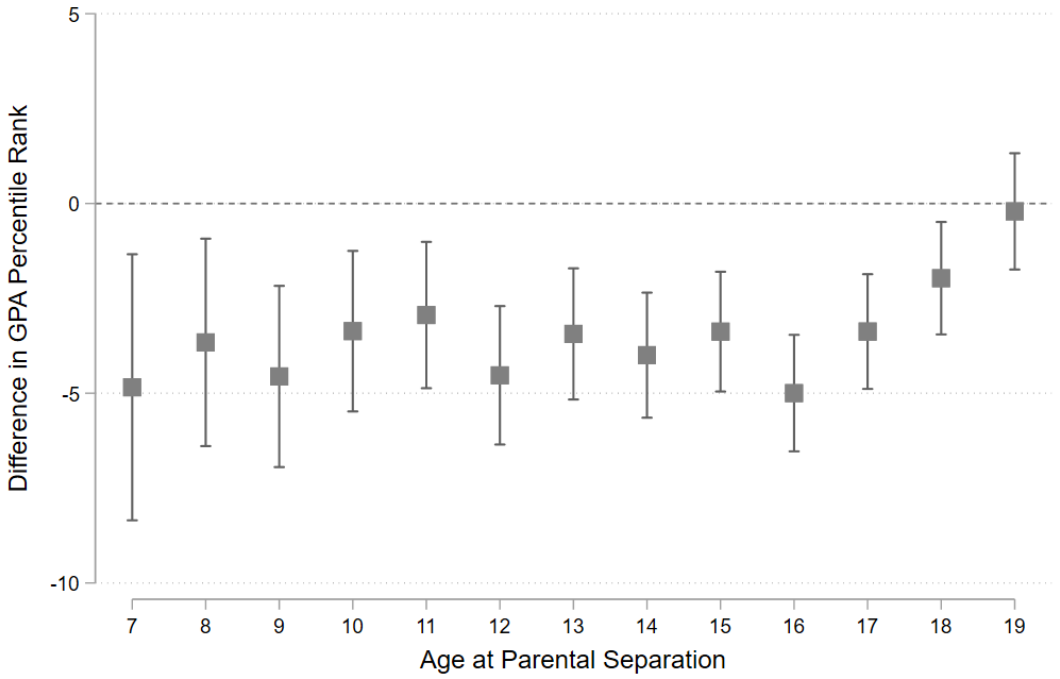
Figure 5.4: Significance tests for children living in a stepfamily, by the age at stepfamily formation. Predicted Grade Point Average (GPA) percentile rank at age 16. OLS regression model.



Notes: 95% confidence intervals. Families with at least two children. Children in stable two-biological parent families have been randomly assigned to an age group. Control variables: sibling order, children's sex, birth year, parental highest education, paternal income, maternal age at birth. Source: Norwegian register data, years 2005 to 2017. Authors' own calculations.

Appendix F

Figure 5.5: Significance tests for children living in a single-parent family, by the age at parental separation. Predicted Grade Point Average (GPA) percentile rank at age 16. OLS regression model.



Notes: 95% confidence intervals. Families with at least two children. Children in stable two-biological parent families have been randomly assigned to an age group. Control variables: sibling order, children's sex, birth year, parental highest education, paternal income, maternal age at birth. Source: Norwegian register data, years 2005 to 2017. Authors' own calculations.

Appendix G

Table 5.7: Family fixed effects model, without upper 1% of birth ranks. Outcome variable: Grade Point Average (GPA) percentile rank at age 16, by age at stepfamily formation.

	Percentile ranked GPA		
	Coefficient	Standard Error	p-value
Age at stepfamily formation (Ref.: Age 16)			
7	-8.62	9.7	0.37
8	-13.03*	6.3	0.04
9	-1.49	4.97	0.76
10	-3.98	3.99	0.32
11	-5.03	3.41	0.14
12	-7.71**	2.9	0.01
13	-4.97*	2.5	0.05
14	-5.47**	2.09	0.01
15	-1.43	1.99	0.47
16	0	.	.
17	-1.64	2.08	0.43
18	.78	2.08	0.71
19	1.98	2.56	0.44
20	3.96	3.04	0.19
Birth order			
First	0	.	.
Second	-8.82***	1.67	0.00
Third or higher	-14.91***	3.35	0.00
Sex			
Female	0	.	.
Male	-14.86***	1.00	0.00
Year of birth			
1990	0	.	.
1991	-9.12	6.81	0.18
1992	-6.38	6.02	0.29
1993	-.92	6.05	0.88
1994	-.38	6.14	0.95
1995	4.36	6.48	0.5
1996	5.89	6.8	0.39
1997	7.8	7.13	0.27
1998	8.66	7.55	0.25
1999	12.79	8.01	0.11
2000	15.55	8.65	0.07
2001	18.53	9.13	0.04
Constant	49.12***	6.83	0.00
Observations		4,366	
R2		0.15	

*** p<0.001, **p<0.01, *p<0.05

Source: Norwegian register data. Author's own calculations.

Appendix H

Table 5.8: OLS regression, without upper 1% of birth ranks. Outcome variable: Grade Point Average (GPA) percentile rank at age 16

	Coefficient	Standard Error.	p-value
Age at stepfamily formation			
(Ref.: Age 16)			
7	0.13	0.27	0.63
8	0.41	0.27	0.12
9	0.09	0.27	0.73
10	0.32	0.27	0.23
11	0.02	0.27	0.93
12	0.02	0.27	0.95
13	-0.13	0.27	0.63
14	0.12	0.27	0.65
15	0.09	0.27	0.75
16	0	.	.
17	-0.21	0.27	0.43
18	-0.01	0.27	0.97
19	0.01	0.27	0.96
20	-0.24	0.27	0.37
Family Structure			
(Ref.: Two-Biological Parent Family)			
Single-Parent Family	-7.73***	0.52	0.00
Stepfamily	-6.49***	0.99	0.00
Age at Transition # Family Structure			
7 # Single-Parent Family	.38	1.69	0.82
7 # Stepfamily	4.7	7.04	0.5
8 # Single-Parent Family	.46	1.3	0.73
8 # Stepfamily	-.94	4.36	0.83
9 # Single-Parent Family	.28	1.12	0.81

Continued on next page

Table 5.8 – continued from previous page

	Coefficient	Standard Error.	p-value
9 # Stepfamily	4.8	3.30	0.15
10 # Single-Parent Family	1.34	0.99	0.18
10# Stepfamily	2.55	2.44	0.3
11 # Single-Parent Family	1.69	0.90	0.06
11 # Stepfamily	.68	2.07	0.74
12 # Single-Parent Family	.4	0.86	0.64
12 # Stepfamily	-1.27	1.84	0.49
13 # Single-Parent Family	1.42	0.81	0.08
13 # Stepfamily	.9	1.7	0.60
14 # Single-Parent Family	.7	0.78	0.37
14 # Stepfamily	-1.87	1.56	0.23
15 # Single-Parent Family	1.36	0.75	0.07
15 # Stepfamily	1.06	1.48	0.48
17 # Single-Parent Family	1.73*	0.73	0.02
17 # Stepfamily	-1.12	1.43	0.43
18 # Single-Parent Family	2.85	0.72	0.00
18 # Stepfamily	.27	1.36	0.84
19 # Single-Parent Family	4.57***	0.75	0.00
19 # Stepfamily	.44	1.43	0.76
20 # Single-Parent Family	5.08***	0.8	0.00
20 # Stepfamily	.86	1.47	0.56
Birth order	-4.04***	0.08	0.00
Sex			
(Ref.: Female	0	.	.
Male	-15.32***	0.10	0.00
Highest Education			
(Ref.: ISCED2)	0	.	.
ISCED 3	11.30***	0.27	0.00

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Table 5.8 – continued from previous page

	Coefficient	Standard Error.	p-value
ISCED 4/5	15.68***	0.33	0.00
ISCED 6	25.40***	0.28	0.00
ISCED 7	33.98***	0.30	0.00
ISCED 8	39.30***	0.45	0.00
Parental Income	0.07***	0.002	0.00
Year of Birth	included as controls		
Maternal Age at Birth	included as controls		
Constant	0.52	25.01	0.98
R2	0.24		

Source: Norwegian register data. Author's own calculations.

Appendix I

Table 5.9: OLS regression, excluding the top 1% of the mother's age. Outcome variable: Grade Point Average (GPA) percentile rank at age 16

	Coefficient	Standard Error.	p-value
Age at stepfamily formation			
(Ref.: Age 16)			
7	0.14	0.27	0.60
8	0.51	0.27	0.05
9	0.12	0.27	0.65
10	0.26	0.27	0.33
11	0.02	0.27	0.93
12	0.01	0.27	0.96
13	-0.11	0.27	0.69
14	0.12	0.27	0.65
15	0.05	0.27	0.86
16	0	.	.
17	-0.21	0.27	0.44
18	0.002	0.27	0.99
19	0.05	0.27	0.85
20	-0.21	0.27	0.42
Family Structure			
(Ref.: Two-Biological Parent Family)			
Single-Parent Family	-7.88***	0.52	0.00
Stepfamily	-6.43***	0.98	0.00
Age at Transition # Family Structure			
7 # Single-Parent Family	.29	1.68	0.86
7 # Stepfamily	2.23	6.79	0.74
8 # Single-Parent Family	.58	1.29	0.65
8 # Stepfamily	-2.21	4.25	0.60
9 # Single-Parent Family	.18	1.11	0.87

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Table 5.9 – continued from previous page

	Coefficient	Standard Error.	p-value
9 # Stepfamily	3.73	3.17	0.24
10 # Single-Parent Family	1.18	.99	0.23
10# Stepfamily	2.71	2.38	0.26
11 # Single-Parent Family	1.83*	.9	0.04
11 # Stepfamily	.44	2.05	0.83
12 # Single-Parent Family	.59	.85	0.49
12 # Stepfamily	-1.23	1.82	0.50
13 # Single-Parent Family	1.58	.81	0.05
13 # Stepfamily	.19	1.69	0.91
14 # Single-Parent Family	.7	0.77	0.36
14 # Stepfamily	-1.81	1.54	0.24
15 # Single-Parent Family	1.62*	.74	0.03
15 # Stepfamily	1.01	1.47	0.49
17 # Single-Parent Family	1.82*	.73	0.01
17 # Stepfamily	-1.51	1.41	0.28
18 # Single-Parent Family	3.08***	.72	0.00
18 # Stepfamily	0.03	1.35	0.98
19 # Single-Parent Family	4.63***	.75	0.00
19 # Stepfamily	0.08	1.42	0.96
20 # Single-Parent Family	5.18***	.8	0.00
20 # Stepfamily	0.76	1.47	0.61
Birth order	-3.36***	.07	0.00
Sex			
(Ref.: Female	0	.	.
Male	-15.36***	0.10	0.00
Highest Education			
(Ref.: ISCED2)	0	.	.
ISCED 3	11.36***	0.27	0.00

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Table 5.9 – continued from previous page

	Coefficient	Standard Error.	p-value
ISCED 4/5	15.62***	0.33	0.00
ISCED 6	25.43***	0.28	0.00
ISCED 7	34.03***	0.30	0.00
ISCED 8	39.30***	0.45	0.00
Parental Income	0.07***	0.002	0.00
Year of Birth	included as controls		
Maternal Age at Birth	included as controls		
Constant	33.81***	0.57	0.00
R2	0.24		

Source: Norwegian register data. Author's own calculations.

Appendix J

Table 5.10: Grade Point Average (GPA) percentile rank at age 16 including families with one children, by age at stepfamily formation (stepfamilies) and age at parental separation (single parent families). OLS regression model.

	Coefficient	Standard Error.	p-value
Age at stepfamily formation			
(Ref.: Age 16)			
7	0.15	0.26	0.58
8	0.49	0.27	0.06
9	0.15	0.26	0.58
10	0.27	0.27	0.32
11	0.03	0.27	0.90
12	0.02	0.26	0.95
13	-0.11	0.26	0.68
14	0.12	0.26	0.66
15	0.07	0.27	0.80
16	0	.	.
17	-0.21	0.27	0.42
18	0.01	0.26	0.98
19	0.05	0.26	0.84
20	-0.21	0.27	0.44
Family Structure			
(Ref.: Two-Biological Parent Family)			
Single-Parent Family	-8.27***	0.43	0.00
Stepfamily	-7.68***	0.76	0.00
Age at Transition # Family Structure			
7 # Single-Parent Family	-.51	1.20	0.67
7 # Stepfamily	1.76	5.54	0.75
8 # Single-Parent Family	.14	0.97	0.88
8 # Stepfamily	2.47	3.19	0.44

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Table 5.10 – continued from previous page

	Coefficient	Standard Error.	p-value
9 # Single-Parent Family	-.06	0.86	0.95
9 # Stepfamily	4.02	2.24	0.07
10 # Single-Parent Family	.69	0.78	0.38
10# Stepfamily	.49	1.76	0.78
11 # Single-Parent Family	2.07	0.73	0
11 # Stepfamily	1.04	1.49	0.48
12 # Single-Parent Family	.73	0.70	0.29
12 # Stepfamily	.13	1.36	0.92
13 # Single-Parent Family	1.18	0.67	0.08
13 # Stepfamily	1.02	1.28	0.42
14 # Single-Parent Family	.41	0.64	0.52
14 # Stepfamily	-.47	1.18	0.69
15 # Single-Parent Family	1.13	0.62	0.07
15 # Stepfamily	.3	1.13	0.79
17 # Single-Parent Family	1.4*	0.60	0.02
17 # Stepfamily	-1.34	1.09	0.22
18 # Single-Parent Family	2.38***	0.59	0.00
18 # Stepfamily	-0.10	1.06	0.93
19 # Single-Parent Family	3.42***	0.62	0.00
19 # Stepfamily	0.45	1.11	0.69
20 # Single-Parent Family	4.48***	0.66	0.00
20 # Stepfamily	1.35	1.16	0.24
Birth order	-3.18***	0.06	0.00
Sex			
(Ref.: Female)	0	.	.
Male	-15.36***	0.09	0.00
Highest Education			
(Ref.: ISCED2)	0	.	.

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Table 5.10 – continued from previous page

	Coefficient	Standard Error.	p-value
ISCED 3	11.15***	0.26	0.00
ISCED 4/5	15.46***	0.31	0.00
ISCED 6	25.26****	0.26	0.00
ISCED 7	33.93***	0.28	0.00
ISCED 8	39.27***	0.43	0.00
Parental Income	0.07***	0.002	0.00
Year of Birth	included as controls		
Maternal Age at Birth	included as controls		
Constant	-0.18	25.15	0.99
R2	0.24		

Source: Norwegian register data. Author's own calculations.

Appendix K

Table 5.11: Entropy balancing. Difference between children living in a single-parent family and children living in a two-biological parent family.

	Percentile ranked GPA		
	Coefficient	Standard Error.	p-value
Age at stepfamily formation			
(Ref.: Age 16)			
7	0.05	0.28	0.86
8	0.47	0.28	0.09
9	0.01	0.28	0.98
10	0.17	0.28	0.53
11	-0.04	0.28	0.88
12	-0.08	0.28	0.76
13	-0.18	0.28	0.52
14	0.05	0.28	0.86
15	0.01	0.28	0.98
16	0	.	.
17	-0.31	0.28	0.26
18	-0.23	0.28	0.42
19	0.01	0.28	0.98
20	-0.28	0.28	0.32
Family Structure			
(Ref.: Two-Biological Parent Family)			
Single-Parent Family	-7.96***	0.51	0.00
Age at Transition # Family Structure			
7 # Single-Parent Family	0.19	1.64	0.91
8 # Single-Parent Family	0.77	1.33	0.56
9 # Single-Parent Family	0.36	1.08	0.74
10 # Single-Parent Family	1.36	0.99	0.17
11 # Single-Parent Family	1.95*	0.89	0.03

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Table 5.11 continued from previous page

	Percentile ranked GPA		
	Coefficient	Standard Error.	p-value
12 # Single-Parent Family	0.55	0.86	0.53
13 # Single-Parent Family	1.66*	0.81	0.04
14 # Single-Parent Family	0.89	0.79	0.26
15 # Single-Parent Family	1.58*	0.75	0.04
17 # Single-Parent Family	1.89**	0.74	0.01
18 # Single-Parent Family	3.24***	0.73	0.00
19 # Single-Parent Family	4.78***	0.76	0.00
20 # Single-Parent Family	5.26***	0.80	0.00
Birth order	-3.61***	0.12	0.00
Sex			
(Ref.: Female	0	.	.
Male	-15.68***	0.17	0.00
Highest Education			
(Ref.: ISCED2)	0	.	.
ISCED 3	11.08***	0.41	0.00
ISCED 4/5	15.35***	0.52	0.00
ISCED 6	24.82***	0.41	0.00
ISCED 7	33.71***	0.47	0.00
ISCED 8	40.47***	0.75	0.00
Parental Income	0.07***	0.002	0.00
Year of Birth	Included as control variables		
Maternal Age at Birth	Included as control variables		
Constant	0.04	0.80	0.96
R2	0.24		

Source: Norwegian register data. Author's own calculations.

Marginal Effects

	Margin	Std.Err.	t	P>t	[95%Conf.	Interval]
Family Structure#						
Age at Transition						
two biological parents#7	50.67	0.20	256.54	0.00	50.28	51.06
two biological parents#8	51.09	0.20	258.16	0.00	50.71	51.48
two biological parents#9	50.63	0.20	254.53	0.00	50.24	51.02
two biological parents#10	50.79	0.20	255.85	0.00	50.40	51.18
two biological parents#11	50.57	0.20	254.54	0.00	50.19	50.96
two biological parents#12	50.53	0.20	256.05	0.00	50.15	50.92
two biological parents#13	50.44	0.20	256.32	0.00	50.06	50.83
two biological parents#14	50.67	0.20	256.11	0.00	50.28	51.06
two biological parents#15	50.63	0.20	255.64	0.00	50.24	51.01
two biological parents#16	50.62	0.20	254.17	0.00	50.23	51.01
two biological parents#17	50.31	0.20	254.81	0.00	49.92	50.69
two biological parents#18	50.39	0.20	254.79	0.00	50.00	50.78
two biological parents#19	50.62	0.20	255.09	0.00	50.24	51.01
two biological parents#20	50.34	0.20	253.96	0.00	49.95	50.73
single parent family#7	42.90	1.54	27.85	0.00	39.88	45.92
single parent family#8	43.90	1.21	36.34	0.00	41.54	46.27
single parent family#9	43.02	0.93	46.16	0.00	41.20	44.85
single parent family#10	44.19	0.82	54.00	0.00	42.59	45.80
single parent family#11	44.57	0.70	63.72	0.00	43.20	45.94
single parent family#12	43.12	0.66	65.57	0.00	41.83	44.41
single parent family#13	44.14	0.60	74.04	0.00	42.97	45.30
single parent family#14	43.59	0.56	77.40	0.00	42.49	44.70
single parent family#15	44.25	0.51	86.11	0.00	43.24	45.25
single parent family#16	42.66	0.47	89.82	0.00	41.73	43.59
single parent family#17	44.23	0.49	90.49	0.00	43.28	45.19
single parent family#18	45.67	0.48	95.86	0.00	44.74	46.60
single parent family#19	47.44	0.52	90.61	0.00	46.41	48.47
single parent family#20	47.64	0.58	82.10	0.00	46.50	48.78

Appendix L

Table 5.12: Entropy balancing. Difference between children living in a single-parent family and children living in a stepfamily

	Percentile ranked GPA		
	Coefficient	Standard Error.	p-value
Age at stepfamily formation			
(Ref.: Age 16)			
7	-0.38	1.79	0.83
8	0.03	1.40	0.98
9	0.12	1.14	0.92
10	1.06	1.05	0.31
11	1.83*	0.92	0.05
12	-0.05	0.89	0.96
13	0.75	0.83	0.36
14	0.70	0.8	0.38
15	1.50	0.77	0.05
16	0	.	.
17	1.60*	0.76	0.03
18	3.30***	0.77	0.00
19	4.57***	0.82	0.00
20	4.28***	0.87	0.00
Family Structure			
(Ref.: Single-Parent Family)			
Stepfamily	1.16	1.09	0.29
Age at Transition # Family Structure			
7 # Stepfamily	2.19	6.32	0.73
8 # Stepfamily	-1.57	4.04	0.70
9 # Stepfamily	3.55	3.12	0.26
10# Stepfamily	1.76	2.59	0.50
11 # Stepfamily	-1.45	2.25	0.52

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Table 5.12 continued from previous page

	Percentile ranked GPA		
	Coefficient	Standard Error.	p-value
12 # Stepfamily	-1.16	1.96	0.55
13 # Stepfamily	-0.63	1.77	0.72
14 # Stepfamily	-2.47	1.69	0.15
15 # Stepfamily	-0.37	1.64	0.82
17 # Stepfamily	-2.93	1.56	0.06
18 # Stepfamily	-3.00*	1.54	0.05
19 # Stepfamily	-4.45***	1.61	0.01
20 # Stepfamily	-3.87*	1.62	0.02
Birth order	-4.40***	0.27	0.00
Sex			
(Ref.: Female	0	.	.
Male	-15.79***	0.38	0.00
Highest Education			
(Ref.: ISCED2)	0	.	.
ISCED 3	9.36***	0.88	0.00
ISCED 4/5	13.11***	1.19	0.00
ISCED 6	21.90***	0.91	0.00
ISCED 7	31.57***	1.07	0.00
ISCED 8	42.38***	1.65	0.00
Parental Income	0.07***	0.002	0.00
Year of Birth	Included as control variables		
Maternal Age at Birth	Included as control variables		
Constant	-0.18	25.15	0.99
R2	0.23		

Source: Norwegian register data. Author's own calculations.

Marginal Effects

	Margin	Std.Err.	t	P>t	[95%Conf.	Interval]
Family Structure# Age at Transition						
single parent family#7	40.21	1.71	23.57	0.00	36.87	43.55
single parent family#8	40.63	1.29	31.38	0.00	38.09	43.16
single parent family#9	40.71	1.01	40.45	0.00	38.74	42.68
single parent family#10	41.65	0.90	46.26	0.00	39.89	43.41
single parent family#11	42.42	0.75	56.60	0.00	40.95	43.89
single parent family#12	40.55	0.71	57.46	0.00	39.16	41.93
single parent family#13	41.35	0.64	64.77	0.00	40.10	42.60
single parent family#14	41.30	0.60	69.05	0.00	40.12	42.47
single parent family#15	42.09	0.56	75.18	0.00	41.00	43.19
single parent family#16	40.59	0.53	77.16	0.00	39.56	41.62
single parent family#17	42.19	0.55	76.88	0.00	41.11	43.27
single parent family#18	43.89	0.57	77.02	0.00	42.77	45.01
single parent family#19	45.17	0.64	70.13	0.00	43.90	46.43
single parent family#20	44.87	0.71	63.28	0.00	43.48	46.26
stepfamily#7	43.56	6.01	7.24	0.00	31.77	55.34
stepfamily#8	40.21	3.69	10.89	0.00	32.97	47.45
stepfamily#9	45.42	2.78	16.37	0.00	39.98	50.86
stepfamily#10	44.57	2.18	20.41	0.00	40.29	48.85
stepfamily#11	42.13	1.84	22.89	0.00	38.52	45.74
stepfamily#12	40.54	1.48	27.37	0.00	37.64	43.45
stepfamily#13	41.87	1.25	33.50	0.00	39.42	44.32
stepfamily#14	39.99	1.15	34.64	0.00	37.72	42.25
stepfamily#15	42.88	1.09	39.27	0.00	40.74	45.02
stepfamily#16	41.75	0.96	43.65	0.00	39.88	43.62
stepfamily#17	40.41	0.98	41.36	0.00	38.50	42.33
stepfamily#18	42.05	0.94	44.91	0.00	40.21	43.88
stepfamily#19	41.87	1.03	40.49	0.00	39.85	43.90
stepfamily#20	42.16	1.03	41.02	0.00	40.14	44.17