Essays in Skill Development and Peer Effects

Inauguraldissertation
zur Erlangung des akademischen Grades
eines Doktors der Wirtschaftswissenschaften
der Universität Mannheim

vorgelegt von
Yasemin Özdemir
im Frühjahrssemster 2020

Abteilungssprecher:	Prof. Volker Nocke, Ph.D
Referent:	Prof. Tom Krebs, Ph.D.
Korreferent:	Prof. Katja Maria Kaufmann, Ph.D

Tag der Verteidigung: 13. August 2020

Annem ve Babama

Acknowledgments

First and foremost, I would like to express my gratitude to my supervisors, Tom Krebs and Katja Kaufmann, for their support and guidance over the years of writing this dissertation. I am thankful to Tom for his invaluable suggestions and critique that helped me in seeing the bigger picture and policy relevance of research. I am grateful to Katja for her help in developing and deepening new research interests, her continuous support of many kinds, and for providing me the opportunity to work on several joint projects.

A special thanks to Cristina Bellés-Obrero, who always had constructive and useful feedback, but also was great motivational support over the past year. I am very happy to have shared many memorable moments with my cohort mates and friends. While it would be a long list to mention all, I am especially grateful to have shared this time with Alessandra Allocca and Yihan Yan. Also, a thank you to my officemate Moritz Drechsel-Grau, who was always open for interesting discussions that are not only on research.

Last but not least, the biggest gratitude is to my parents and sisters for their encouragement and confidence in me. Without their love, endless patience and support, I could have never made it to this point.

Contents

Acknowledgements **iii**

List of Figures **viii**

List of Tables **x**

General Introduction **1**

1 Parental Investment and Peer Effects in Cognitive and Non-Cognitive Skills **5**

1.1 Introduction 5
1.2 Related Literature 9
1.3 Conceptual Framework 11
1.4 Empirical Application 13
1.5 Data and Measures 17
1.5.1 Measures 18
1.5.2 Descriptive Statistics 20
1.5.3 Friendship Networks 21
1.6 Results 25
1.6.1 Main Results 25
1.6.2 Heterogeneous Results 27
1.6.3 Changing Friendship Networks 32
1.7 Robustness 37
1.7.1 Potential Threats 37
1.7.2 Alternative Specifications 41
1.8 Conclusion 41

2 Fragile Boys (or Girls)? Impact of a Macro Shock on Psychosocial Functioning and Longrun Health and Well-being Implications **43**

joint with Ghazala Azmat and Katja Maria Kaufmann

2.1 Introduction . . . 43
2.2 Background . . . 47
2.3 Data . . . 48
2.3.1 Longitudinal Study of Students in East Germany . . . 48
2.3.2 Variable Description . . . 49
2.3.3 Summary Statistics . . . 51
2.4 Empirical Methodology . . . 54
2.4.1 Short-run effects of Reunification on socio-emotional development . 54
2.4.2 Linking socio-emotional development to long-run behavior and outcomes . . . 56
2.5 Results: Short-run Effects of Reunification on Socio- emotional Development 56
2.6 Long-run Behavior and Well-being . . . 60
2.6.1 Externalizing Behavior . . . 60
2.6.2 Internalizing Behavior . . . 63
2.6.3 Behavioral Control Problems . . . 64
2.6.4 Health and Well-being . . . 64
2.6.5 Long-run Academic Outcomes . . . 65
2.7 Conclusion . . . 67

3 Fertility Peer Effects **69**

joint with Katja Maria Kaufmann

3.1 Introduction . . . 69
3.2 Data . . . 72
3.2.1 Data and Sample Description . . . 72
3.2.2 Variable Description . . . 73
3.2.3 Summary Statistics . . . 74
3.3 Empirical Implementation . . . 76
3.3.1 Threats to Identification . . . 78
3.4 Main Results . . . 79
3.5 Heterogeneous Results . . . 81
3.5.1 Results by Gender . . . 82

3.5.2 Results by Age . . . 82
3.5.3 Results by Labor Market Attachment . . . 84
3.5.4 Results by Availability of Grandmother . . . 86
3.6 Robustness . . . 87
3.7 Conclusion . . . 87

A Addendum to Chapter 1 **89**
A.1 Details on Measures . . . 89
A.2 Full Set of Results . . . 93
A.3 Details on Peers' Parents . . . 95
A.4 Full Set of Results on Dynamic Peer Groups . . . 97

B Addendum to Chapter 2 **108**
B.1 Comparison with other Datasets . . . 108
B.2 Full Set of Long-run Results . . . 109

C Addendum to Chapter 3 **123**
C.1 Dutch Fertility: Average Age at First Child . . . 123
C.2 Full Set of Results . . . 123
C.3 Additional Results . . . 126

Bibliography **137**

Curriculum Vitae

Declaration of Authorship

List of Figures

1.1 Overlapping Peer Groups - Example 16
1.2 Overlapping Peer Groups - Observability 40

C.1 Average Age of Parenthood Entry in the Netherlands (1995 - 2017) 124

List of Tables

1.1 Descriptives: Child and Parent Characteristics 22
1.2 Outgoing and Incoming Nominations - Networks with minimum size four . 23
1.3 Characteristics of Nominated Friends 24
1.4 Parental Investment and Child Skills 26
1.5 Heterogeneous Results 28
1.6 Heterogeneous Results - Child's relative ability 32
1.7 Nomination Dynamics 33
1.8 Parental Investment and Child Skills - Changing friendship networks with exogenous peer effects only 34
1.9 Parental Investment and Child Skills - Changing friendship networks 36
1.10 Endogenous Network formation 38
1.11 Number of Nominated Friends 41

2.1 Variable Description 50
2.2 Descriptive Statistics by Gender 52
2.3 The Effect of Reunification on Psychological Measures 58
2.4 The Effect of Reunification by Gender 59
2.5 Longer-Run Outcomes: Behavior 62
2.6 Longer-Run Outcomes: Health and Academics 66

3.1 Descriptive Statistics: Entry into Parenthood 75
3.2 Variable Description - Characteristics 76
3.3 Sibling Spillover - Main Results 80
3.4 Heterogeneous Results: Gender and Age 83
3.5 Heterogeneous Results: Labor Market and Grandmother 85

A1 Description: Main Variables 90

A2 Description: Variables Measuring Health 92
A3 Parental Investment and Child Skills - full results 93
A4 Contact to Peers and Peers' Parents 96
A5 Parental Investment and Child Skills - Changing friendship networks with exogenous effects only - full results 98
A6 Parental Investment and Child Skills - Changing friendship networks - full results 101
A7 Parental Investment and Child Skills - Changing friendship networks by gender 104
A8 Correlations of Skills and Background Characteristics 107
A9 Correlations of Friends' Skill Changes and Composition Changes 107

B1 Longer-Run Outcome: Physical Fighting 110
B2 Longer-Run Outcome: Destroy Property 111
B3 Longer-Run Outcome: Suicidal Thoughts 112
B4 Longer-Run Outcome: Repeated Suicidal Thoughts 113
B5 Longer-Run Outcome: Alcohol Consumption: Regular 114
B6 Longer-Run Outcome: Alcohol Consumption: Heavy 115
B7 Longer-Run Outcome: Cigarette Smoking 116
B8 Longer-Run Outcome: Subjective Health 117
B9 Longer-Run Outcome: Life Satisfaction 118
B10 Longer-Run Outcome: German Grade (in grade 10) 119
B11 Longer-Run Outcome: Math Grade (in grade 10) 120
B12 Longer-Run Outcome: Abitur Degree 121
B13 Comparison of Measures 122

C1 Sibling Spillover - Main Results - Full Set of Covariates 124
C2 Additional Heterogeneous Results 127

General Introduction

This dissertation consists of three self-contained chapters. The underlying themes are the determinants of skill development and the role of social influence on individual decisions. The people that surround us, independent of whether we chose them or interact with them by chance, have a great influence on our decisions. The existence and impact of peer influences have been documented in various areas. At the same time, it has been shown in different ways, how important parental investment and the environment an individual grows up in is for human capital development. In Chapter 1, I combine the two main topics and show how parental investment depends on the social interactions of their child. Chapter 2 investigates the long-run consequences of shocks on the socio-emotional development during adolescence and documents gender differences. In Chapter 3, we underline the importance of social interactions in the decision when to enter parenthood and provide insight on potential spillover mechanisms.

In what follows, I summarize each chapter.

Chapter I: Parental Investment and Peer Effects in Cognitive and Non-Cognitive Skills[1]

In this chapter, I investigate whether and in how far parents adjust their parenting behavior in response to their child's close peers as defined by friendship nominations. I distinguish

[1]This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (http://www.cpc.unc.edu/addhealth). No direct support was received from grant P01-HD31921 for this analysis.

between two types of parenting behavior: parental investment, in particular quality time, such as help with homework and joint activities, and parenting style (monitoring). I show the extent and means of parents' response to two different skills of peers: first, cognitive skills as measured by peers' scholastic performance, and second, peers' non-cognitive skills as measured by self-esteem. Moreover, comparing constant to time-varying peer groups, I allow parents to react to peer skills and peer characteristics.

This chapter contributes to the literature by expanding the focus on how parents respond to the skills, behavior, and characteristics of close peers. Moreover, this study adds to the literature on social interactions, showing how parental behavior might moderate /reinforce the effects of peers, and school-level policy interventions aimed at changing student compositions.

The following three main results emerge from my analysis. First, parents compensate for cognitive skill losses of their child's peer by increasing monitoring. I provide evidence that parents consider both cognitive performance and non-cognitive skills of peers in their investment decision. Response patterns indicate that verbal investment and monitoring are perceived as substitutes to peer cognitive skills, and joint activities are seen as complements to the self-esteem of peers.

Second, I document gender differences in the response of monitoring. While cognitive skill losses of sons' peers are compensated, for daughters, increased peer self-esteem is reinforced. Overall, adjustments in time investment are mainly driven by parents that have no close relationship with peers' parents and parents that expect their child to attend college. However, results do not differ by parental education. Adjustments in monitoring and verbal investment are mainly driven by children with below-median cognitive skills, suggesting that parents try to prevent negative spillovers on their "at risk child".

Third, by exploiting repeated information on friendship nominations, I show that parents take peer characteristics along with peer skills into account. In addition to compensating cognitive skill losses, mothers compensate for decreases in the fraction of white friends, reinforce higher fractions of peers with educated parents. Fathers' response and parental monitoring are mainly driven by changes in peer group characteristics rather than peers' skills.

Chapter II: Fragile Boys (or Girls)? Impact of a Macro Shock on Psychosocial Functioning and Long-run Health and Well-being Implications

This chapter is joint work Ghazala Azmat and Katja Maria Kaufmann. We analyze the determinants and consequences of socio-emotional development during adolescence. We causally estimate the impact of a large macro shock, the German Reunification, on the socio-emotional development of East-German adolescents, finding substantial negative effects in the short-run. In particular, we document an immediate increase in youths' anger and anxiety by 33 and 36 percent of a standard deviation, respectively, and a decrease of more than 40 percent of a standard deviation in youths' self-confidence. Contrary to the belief that boys are more strongly affected by negative changes in their environment, we show that these effects are similar for male and female youths, and in terms of self-confidence even stronger for girls.

Next, we link changes in these socio-emotional dimensions to a wide range of behavioral outcomes and document stark differences by gender. In line with the "fragile males" hypothesis, we find that changes in the socio-emotional development lead to an increase in externalizing behavior, such as physical fighting and destroying property, and behavioral control problems like alcohol and tobacco consumption among boys only. Looking at internalizing behavior, which is often linked to mental-health problems, we find a strong association between changes in socio-emotional development and increased internalizing behavior, but only for girls.

Ultimately, however, the effects on longer-run outcomes such as subjective health, well-being, and educational attainment are grave, and similar, for both genders. Our results highlight that even though boys and girls can be affected similarly in terms of their socio-emotional development, these changes translate into different types of behavior. Overall, this suggests that successful policies require careful targeting.

Chapter III: Fertility Peer Effects

This chapter is joint work with Katja Maria Kaufmann. We analyze family peer effects in the adult fertility decision. Using Dutch administrative data, we provide well-identified causal evidence that a sibling's fertility is contagious, for women starting one year and for

men, starting two years after a sibling enters parenthood. Specifically, a sibling entering parenthood within the last two years can triple the probability of becoming a mother, and double the probability of becoming a father in any given quarter.

Prominent mechanisms of peer effects include, for instance, social learning, or conforming with the norm. We focus on the first child of an individual so that learning from the sibling's (or the sibling's partner's) experience is most pronounced in our analysis. This finding is validated by weaker (in some cases negative) spillovers found for individuals strongly attached to the labor market. In the sense that, for instance, the main breadwinner of the household has to be strategic in decisions affecting their labor supply and is thus less affected by fertility spillovers.

Additionally, two sub-mechanisms prevail. First, we document stronger spillovers for siblings of the same gender (men with brothers), and siblings that are close in age (women and siblings up to one year age difference). This result shows in the context of sibling competition that conforming with the sibling is more likely as an underlying mechanism than differentiation from the sibling. Second, we confirm that support provided by the grandmother is a decisive factor. Siblings seem to compete for grand-maternal resources shown by stronger results in case the grandmother is available in terms of time (i.e. not active in the labor market) and geography (i.e. distance in residences).

While there is a big literature on peer effects, decisions to enter parenthood have been so far mainly considered in the context of teen fertility. Our results contribute to the literature by highlighting that social influences within the family are non-negligible in the fertility decision and could be an influential mediator of policy interventions.

Chapter 1

Parental Investment and Peer Effects in Cognitive and Non-Cognitive Skills

1.1 Introduction

The importance of parental investment for the human capital development of children has been shown in various ways (Cunha and Heckman, 2008; Cunha et al., 2010). Parents continuously adjust their allocation of different investment types over the age of their child (see e.g. Del Boca et al., 2014, 2017). Doing so allows maximizing their child's human capital (cognitive and non-cognitive skills). At the same time, the social environment constructed by classmates, friends, or siblings influences an individual's educational achievement (see e.g. Carrell et al., 2013; Hoxby, 2000). However, little is known about how these two factors interact. Are parents adjusting their parenting behavior to the social environment their child experiences, thereby compensating or reinforcing the influence of peers?

In this paper, I investigate whether and how parents adjust their parenting behavior in response to their child's close peers as defined by friendship nominations. I distinguish between two types of parenting behavior: parental investment, in particular quality time such as talk about schoolwork and joint activities, and parenting style, such as monitoring. I show the extent and means of parents' response to two different skills of peers: first, cognitive skills as measured by peers' scholastic performance, and second peers' non-cognitive skills as measured by their level of self-esteem. Moreover, comparing constant to time-varying peer groups, I allow parents to react on peer skills as well as peer background characteristics. Lastly, I investigate heterogeneous effects to give an insight into mechanisms driving parents' responses.

One way a parent can react to their child's peers is via residential choices. Selecting a neighborhood along the school quality allows parents to restrict their child's set of potential peers and hence close peers such as friends. In this paper, I take this decision as given, so that parents already chose their area of residence and the school their child attends. Thus I focus on whether parents react to the quality of their child's friends - given the "restricted set of potential peers". Depending on whether parents perceive friends as substitutes or complements to their parenting behavior, their response to peers' cognitive and non-cognitive skills and their characteristics will differ. Thereby, the focus of this paper is not on peer effects per se, but rather on parents' response to their child's peers.

Using data from the National Longitudinal Study of Adolescent of Adult Health (Add Health), I investigate how the skill development process of adolescents in grades 7 to 11 depends on own past skills, on past health status, on peers' skills and parental investment and parenting styles and, most importantly, how parental behavior is affected by the skills and characteristics of their child's peers. It has been shown that peers have an important effect on high school students' outcomes, even in the long-run, and thus it is in the parents' interest to take their child's peers into account.[1]

The main challenge in analyses including peer effects is to distinguish between different sources leading to similar outcomes of individuals within the same group (Manski, 1993). Unobserved heterogeneity leading to selection into groups can confound results and lead to a conclusion of behavioral spillovers while the effect is driven by similar environments. To address these challenges and identify causal effects of peers I follow among others Bramoullé et al. (2009) and De Giorgi et al. (2010). I make use of partially overlapping peer groups, which is an instrumental variable strategy exploiting indirect links within a network, together with peer group fixed effects. To solve the problem of endogenous investments I use first-differencing, which differences out family and individual level fixed effects, and instrument skills with their lagged values (see Cunha and Heckman, 2007, 2008, who provide evidence for internal logic and validity of these instruments). To strengthen the instrumental strategy and capture the joint evolution of child skills and parental investment, I simultaneously estimate a system of two skill and one investment equation. This allows to account for direct peer effects on the child's skills and captures the reversed effect of parental investment on child's skills along with parents' response to peers of their children.

In the literature, there is limited evidence on parents' reaction to their child's social

[1]See e.g. Gaviria and Raphael (2001) for drug use, church-going, dropping out of school; Lin (2015) for drugs, smoking, school skipping, physical fighting; Yakusheva and Fletcher (2013) for teenage pregnancy.

environment, though on a more general level. Exploiting the Romanian secondary school system Pop-Eleches and Urquiola (2013) were one of the first to show, that parents reduce their effort in case their child attends a better school. Similarly, Greaves et al. (2019) find in the context of England, that parents belief school quality and time investments to be substitutes. That these response patterns can differ between parents is shown by Fredriksson et al. (2016), who exploit a maximum class size rule in Sweden. In the context of intergenerational transmission of religion, Patacchini and Zenou (2016) show that parental investment (targeting explicitly the transmission of religious values) and peers as measured by close friends are complements. This study aims to contribute to this literature by expanding the focus on how parents respond to the skills, behavior, and characteristics of close peers. Thereby it contributes to shedding light on how parents make decisions concerning investment into their child and providing evidence on parents' perception of their child's skill development process. Moreover, this study adds to the literature on social interactions, since it shows how parental behavior might moderate/reinforce the effects of peers. Lastly, this study can provide insights into how parental response can mediate school level policy interventions aimed at changing student compositions.

To the best of my knowledge, the only other paper looking at individual level friends is Agostinelli (2018), who incorporates peers into the parental investment decision by including average peer skill into the cognitive skill development function. Using a dynamic equilibrium model the author shows that parents and peers constitute a dynamic complementarity. While I do not use a structural model, in contrast to Agostinelli (2018) I investigate parents' response to peers' skills as well as peers' (time-constant) characteristics. Also, instead of constructing one overall parental time investment measure, I distinguish between time mothers and fathers spend on verbal interactions and time spend on joint activities with their child, and given the growing evidence on the importance of parenting style (see e.g. Cobb-Clark et al., 2019; Doepke and Zilibotti, 2017), I provide insight on how parents adjust their parenting as measured by monitoring.

I show that parents change their behavior in response to changes in the skills or the characteristics of their child's peers in three main ways. First, parents compensate for decreases in the cognitive skill of their child's peer by increasing monitoring. Also, I provide evidence that parents not only respond to the cognitive performance of peers but also consider peer non-cognitive skills in their investment decision. In particular, while mothers compensate for cognitive skill losses of their child's peers by increasing verbal investment, fathers reinforce high non-cognitive skills of peers by increasing time spend on

joint activities with their child. These response patterns indicate that verbal investment and monitoring are perceived as substitutes to peer cognitive skills, and joint activities are seen as complements to the self-esteem of peers.

Second, allowing parents to react differently in the case of daughters as opposed to sons, I document gender differences for monitoring. While cognitive skill losses of sons' peers are compensated by increased monitoring, for daughters increased peer self-esteem is reinforced with higher levels of monitoring. Adjustments in time investment are mainly driven by parents that have no close relationship with peers' parents, and parents that expect their child to attend college. However, results do not differ by parental education. Adjustments in monitoring and the verbal investment of mothers are mainly driven by children who have below-median cognitive skills, suggesting that parents try to prevent negative spillovers on their "at risk child".

Third, by exploiting repeated information on friendship nominations, I show that parents take peer characteristics along with peer skills into account. In addition to compensating cognitive skill losses, mothers compensate for decreases in the fraction of white friends by increasing verbal interactions. On the other hand, a higher fraction of peers with educated parents leads mothers to reinforce this peer quality gain by increasing verbal investment into their child. As opposed to that, fathers' response and parental monitoring is mainly driven by changes in peer group quality as measured by the composition of peer characteristics rather than peers' skills.

My findings suggest that school or classroom level interventions changing the composition of students will lead to feedback effects through parents. As I show, parents consider peer quality as measured by skills and characteristics in their parenting behavior. This means, depending on the skill considered, the net effect of policy interventions might be under- or overestimated if parental responses are not taken into account.

The remainder of the paper is structured as follows. In section 1.2 I discuss the related literature. In Section 1.3 I shortly present the conceptual framework, and in Section 1.4 I describe in detail the identification and estimation strategy. The sample and variables are described in Section 1.5 and results are discussed in Section 1.6. Robustness checks are provided in Section 1.7, and Section 1.8 concludes.

1.2 Related Literature

This paper builds on work from the child development literature and in particular parents' role in it, and on work from the peer effects literature in the educational context.

There are a series of papers highlighting the role of parental and public investment in the process of skill development. Distinguishing between cognitive and non-cognitive skills, it is shown that parental inputs are more influential to determine cognitive skills at early and non-cognitive skills at later ages (Cunha and Heckman, 2008). Exploiting non-linearities within a dynamic factor model Cunha et al. (2010) determine substitution patterns between contemporaneous investments and skills inherited from previous periods. They provide evidence for dynamic complementarity[2], suggesting that the optimal strategy in supporting disadvantaged children starts with early childhood interventions in cognitive skills while targeting adolescents should involve the promotion of non-cognitive skills. Even though skill models can pinpoint optimal investment strategies over the childhood, they do not directly incorporate the child's environment. This paper investigates the role of the child's social environment in the optimal parental investment decision.

The literature mainly distinguishes between two forms of parental investment, monetary and non-pecuniary. The first covers expenses for books, private tutoring or extracurricular activities[3], the latter refers to quality time spend with the child such as reading to or with the child. In the British context, Del Bono et al. (2016) show that maternal time investment positively affects cognitive and non-cognitive development of 3-7 year old children. Distinguishing between active time, including direct interaction, and passive time, indicating presence but not an engagement of a parent, Del Boca et al. (2014) underline the importance of both types of time investment on cognitive development. This paper distinguishes between two types of time investment, verbal interactions and joint activities.[4] The former includes only interactions between parent and child that occur on a verbal basis, covering topics such as school work, grades, and personal problems the child is having. The latter focuses on interactions during joint activities such as sports or social

[2]Dynamic complementarity captures the feature that skills produced in one stage of childhood increase the productivity of investments a subsequent stages.

[3]e.g. see Plug and Vijverberg (2005) who shows how important parental income is the context of education in general, Del Boca et al. (2017) who analyze the role of monetary investment over the childhood, and Carneiro et al. (2015) who show how parental income shocks at different times in childhood can reflect itself in intergenerational mobility via the education of the child

[4]The importance of active time investment is also underlined indirectly by the literature looking at effects of day care, e.g. see Fort et al. (2019).

events and support for school work.

Finding from the literature in health economics show that the (early) health of an individual is related to educational outcomes like achievement and can have even implications in terms of intergenerational mobility (see e.g. Currie, 2009). Hereby it has been shown that health shocks during early childhood can have long lasting drawbacks (see e.g. Oreopoulos et al., 2008), while interventions targeting the improvement of health during childhood can have long-run benefits (see e.g. Butikofer et al., 2019). These results suggest that it should be interest of a parent to respond to the health status of their child, which is why in this paper I allow parents to adjust their investment and monitoring in response to their child's current health. Yi et al. (2015) and Nicoletti and Tonei (2017) show, parents do respond to their child's health with both monetary and time investment so that leaving it out could confound results. In line with that, I show that parents compensate health losses of their child by higher levels of time investment.

The existence and importance of peer influences have been documented in various areas. Depending on the particular topic at hand, mechanisms and thus reasons for these effects differ. Peers or social networks can serve as a source of information so that individuals can learn from others (see e.g. Banerjee et al., 2013; Cai et al., 2015), but can also lead to the encouragement of imitating one another (see e.g. Patacchini and Arduini, 2016). This possible effect due to peer pressure or a desire to conform has been documented in the context of education decisions (see e.g. De Giorgi et al., 2010) as well as risky behavior.[5] In the education context, it has been shown that indirect influences of disruptive behavior in class negatively affects performance (see e.g. Neidell and Waldfogel, 2010) and can have long-lasting consequences (see e.g. Carrell et al., 2018), while good peers creating an atmosphere easing teachers' instructions is positively related to achievement (see e.g. Golsteyn et al., 2017; Lavy and Schlosser, 2011). While it is not always possible to pin down the channel of peer effects, a consensus has been reached that all students benefit from higher achieving schoolmates (see e.g. Hoxby and Weingarth, 2005) and might suffer from very bad performing ones (see e.g. Lavy et al., 2012b). In line with this, I find positive peer effects in cognitive skills, indicating that having friends with high cognitive performance supports the own cognitive development.

The Literature provides to main ways to reach causal identification in the analysis of peer effects. The first exploits quasi-experimental variation in the reference group com-

[5]See e.g. Gaviria and Raphael (2001) for drug use, church-going, dropping out of school; Lin (2015) for drugs, smoking, school skipping, physical fighting; Yakusheva and Fletcher (2013) for teenage pregnancy.

position (see e.g. Lavy and Schlosser, 2011) or random assignment rules provided by an administrative instance (see e.g Feld and Zölitz, 2017; Sacerdote, 2001). The second makes use of the existing network structure and is more data demanding. Individual specific peer groups are created to exploit variations in group sizes (see e.g. Lee, 2007) or the existence of indirect links (i.e. peers of peers) (Bramoullé et al., 2009; De Giorgi et al., 2010). This paper is based on the Add Health database which has rich individual-level network information. Exploiting individual friendship nominations I follow the second approach and make use of intransitivities within the available networks.

1.3 Conceptual Framework

In what follows, bold letters capture vectors, subscripts mark individuals (i) and time (t), and superscripts indicate different skills with N referring to non-cognitives and C denoting cognitives. Suppose parental utility depends on own consumption c, child's acquired skills $\boldsymbol{\theta}_{it}$, and parental human capital level $\theta_{Parent,i}$.

$$U(c_{it}, \boldsymbol{\theta}_{it}, \theta_{Parent,i})$$

where $\boldsymbol{\theta}_{it} = [\theta_{it}^C, \theta_{it}^N]$ is a vector containing two skills, with θ_{it}^C indicating cognitive skills and θ_{it}^N non-cognitive or socio-emotional skills. At each developmental stage $t = 1, ..., T$ of their child, parents maximize the expected discounted sum of their future utility subject to the child's skill production function (1.1) and parental budget constraint (1.2).

$$\theta_{i,t+1}^k = g^k(\boldsymbol{\theta}_{i,t}, \theta_{Parent,i}, I_{i,t}, \boldsymbol{\theta}_{Peer,t}, \mu_i^k, \eta_{it}^k), \quad k = C, N \tag{1.1}$$

$$Y_{it} = c_{i,t} + p_t^I I_{i,t} + s_{i,t} \tag{1.2}$$

where I_{it} captures parental investment, $\boldsymbol{\theta}_{Peer,t}$ are peer skills, μ_i^C and μ_i^N are child and/or family level time-constant unobservables in each skill function, η_{it}^C and η_{it}^N capture idiosyncratic shocks in each skill function, Y_{it} is family income, p_t^I captures the price of investment, and $s_{i,t}$ allows for savings. Solving this dynamic problem will yield a policy function for parental investment

$$I_{it} = f_t(\boldsymbol{\theta}_{it}, \theta_{Parent,i}, \boldsymbol{\theta}_{Peer,t}, Y_{it}, p_t^I, \mu_i^C, \mu_i^N, \mu_i^I, \eta_{it}^C, \eta_{it}^N, \eta_{it}^I) \tag{1.3}$$

Parental investment is a function of their child's set of skills ($\boldsymbol{\theta}_{it}$), their own level of human capital ($\theta_{parent,i}$), their child's peers' set of skills ($\boldsymbol{\theta}_{Peer,t}$), parental income ($Y_{it}$), price of parental investment (p_t^I), child and/or family level time-constant unobservables in the skill (μ_i^C, μ_i^N) and investment function (μ_i^I), idiosyncratic shocks in the skill function (η_{it}^C, η_{it}^N), and idiosyncratic shocks in the parental investment function (η_{it}^I). While this and similar frameworks have been widely used,[6] the inclusion of peers is usually not considered.[7] However, if parents take the peer group quality of their children into account while making their decision, leaving peers out of the analysis will lead to misleading results.

As a simplified example suppose there are only two periods, the first where the child can receive investment from the parent and a second in which the child already reaches adulthood. For clarity of notation suppose there is one joint measure $\theta_{i,t}$ including both, cognitive and non-cognitive skills. Then the parents' problem will be

$$max \quad U(c_{i,1}, \theta_{i,1}, \theta_{Parent,i}) + \beta U(c_{i,2}, g(\theta_{i,1}, I_{i,1}, \theta_{Peer,1}), \theta_{Parent,i})$$

$$s.t. \quad c_{i,1} + p^I I_{i,1} + \frac{c_{i,2}}{(1+r)} = Y_{i,1} + \frac{Y_{i,2}}{1+r}$$

The optimal investment decision will then be derived from

$$p^I(1+r)\frac{\frac{\partial U(c_{i,2},\theta_{i,2},\theta_{Parent,i})}{\partial c_{i,2}}}{\frac{\partial U(c_{i,2},\theta_{i,2},\theta_{Parent,i})}{\partial \theta_{i,2}}} = \frac{\partial g(\theta_{i,1}, I_{i,1}, \theta_{Peer,1})}{\partial I_{i,1}}$$

Whether and how exactly peer skills enter the parental investment function depends on the specified functional form of the parental utility $U(c_{i,t}, \boldsymbol{\theta}_{it}, \theta_{Parent,i})$ and the child's skill production function $g(\theta_{i,t}, I_{i,t}, \theta_{Peer,t})$.However, from the simple first-order condition above, it can be seen that parental response to peers will depend on two things. First, the direct influence of parents on their children which is captured by how $I_{i,t}$ enters $g(\theta_{i,t}, I_{i,t}, \theta_{Peer,t})$, and second, the way peer skills and parental investment interact in the child's skill production.

Ex ante it is not clear whether parents should increase or decrease their investment with higher skills of their children's peers. Suppose parents have a positive influence on the child's skill development, i.e. $\frac{\partial g(\theta_{i,1}, I_{i,1}, \theta_{Peer,1})}{\partial I_{i,1}} = g_I' > 0$, if in addition peers skills

[6] see for instance Cunha and Heckman (2008), Del Boca et al. (2014), Almond et al. (2018)

[7] As of my knowledge, only Agostinelli (2018) incorporates peers into a similar conceptual framework considering a single skill dimension.

and parental investment foster each other ($g''_{I\theta_{Peer}} > 0$), then parents should increase their investment with increasing peer skills. However, if peer skills and parental investment enter as substitutes, i.e. $g''_{I\theta_{Peer}} < 0$, then parents should not increase their investment with increasing peer skills.

The main question aimed to be answered here is whether parents are sensitive to their children's social interactions. Which means whether parents adjust their investment in case they observe or perceive peer influences on their child. Hereby the exact functional forms of utility and production function leading to a parental investment function as described in (1.3) are not of main interest here. For this reason, in the following the optimal parental investment decision will be approximated by a linear function that is additively separable in its inputs.

1.4 Empirical Application

Assuming f_t, the parental investment function, is linear and additive in its inputs, it can be written as

$$I_{it} = \beta_0 + \beta_1 time_t + \boldsymbol{\theta'_{i,t}\beta_2} + \beta_3 \theta_{Parent,i} + G\boldsymbol{\theta'_{i,t}\alpha} + X'_{it}\boldsymbol{\gamma} + \mu_i + \mu_g + \epsilon_{it} \tag{1.4}$$

where I_{it} captures parental investment of child i in period t; $\boldsymbol{\theta_{i,t}} = [\theta^C_{i,t}, \theta^N_{i,t}]$ measures human capital of child i in period t and includes cognitive and non-cognitive skills respectively; $\theta_{Parent,i}$ captures the human capital level of i's parent; $G\boldsymbol{\theta}_{it}$ captures the peer group quality of i's close peers in period t, hereby G is a spatial weighting matrix capturing how the individuals are connected so that the average skill level of peers is captured by $\frac{1}{n_g}\sum_{j=1}^{n_g} g_{ij}\theta_{jt}$ with n_g being the total number of close peers in group g and g_{ij} indicating a link between students i and j being the entries of G; X_{it} includes controls referring to parent or child; μ_i captures individual and family unobservables; μ_g represents peer group level unobservables; ϵ_{it} are idiosyncratic shocks. Equation (1.4) is basically the specification Nicoletti and Tonei (2017) use extended by peer effects. In contrast to Nicoletti and Tonei (2017), I specify parental investment to depend on contemporaneous skills instead of one period lagged skills. This is mainly for data reasons, information is available on a yearly basis, thus one lag could be too much reaction time for the parent. Also note, that parental investment and peer skills enter the skill development of child i in the same period, so that a contemporaneous specification allows parents to react on static complements or

substitutes to their investment.

To estimate the above equation, unobservable characteristics of i and/or i's parent captured by μ_i, and peer group level unobservables measured by μ_g have to be eliminated. Hereby μ_g captures that friendship networks are not formed exogenously, which means there might be unobservables inducing both, changes in $\boldsymbol{\theta_{i,t}}$ as well as in the close peer group and thus $G\boldsymbol{\theta_{i,t}}$. This endogenous selection bias is controlled for by the use of peer group fixed effects. Under the assumption that conditional on individual and group unobservables peer groups are formed exogenously, i.e. $E[\epsilon_{it}|\mu_i, \mu_g, G] = 0$, I de-group-mean the whole equation for each period using $J = \mathbf{1_{n_g}} - \frac{\mathbf{1}}{\mathbf{n_g}} \iota_{\mathbf{n_g}} \iota'_{\mathbf{n_g}}$ which eliminates μ_g. Hereby J is a transformation matrix based on a n_g dimensional identity matrix $\mathbf{1_{n_g}}$, and two n_g dimensional vectors of ones, where n_g is the number of individuals in friendship group g. This conditional exogeneity assumption is violated if unobservables leading to friendship formation and skill development vary over time. The validity of this assumption is assessed in the robustness section.

In addition to peer group fixed effects, I use first-differences to cancel out time invariant individual and family unobservables μ_i. Doing so relates changes over time in parental investment to changes over time in peer quality as well as child's quality as measured by their skills, which is summarized in equation (1.5).

$$\Delta J I_{it} = \beta_1 + \Delta J \theta'_{i,t} \boldsymbol{\beta_2} + \Delta J G \theta'_{it} \boldsymbol{\alpha} + \Delta J X'_{it} \boldsymbol{\gamma} + \Delta J \epsilon_{it} \tag{1.5}$$

Equation (1.5) as it is cannot be estimated due to two endogeneity issues. The first potential issue is that adjustments in parenting possibly induce changes in the child's peer group quality, at the same time since there is evidence of peer effects on skills there is a likely correlation between the child's skills $\boldsymbol{\theta'_{i,t}}$ and the peers' skills $G\boldsymbol{\theta'_{i,t}}$. These issues can be circumvented by instrumenting i's close peer group by second-order friends, i.e. friends of friends, which is referred to as partially overlapping peer group strategy.

This is the typical way of solving the endogeneity problem in the context of peer effects proposed and employed among others by Bramoullé et al. (2009), and Calvó-Armengol et al. (2009). Creating individual specific reference groups identification is reached using variations in group sizes (Lee, 2007), or given knowledge on who is not connected to whom, indirect peers (i.e. peers of peers) can be exploited (see e.g. Blume et al., 2015; De Giorgi et al., 2010). In this approach, the model is expressed in a spatial autoregressive way, wherein the specification of the weighting matrix, capturing the network structure, is the

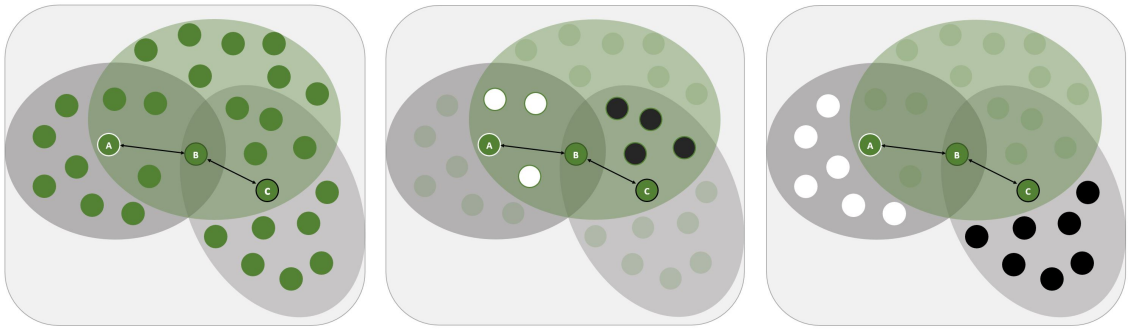
crucial point. With available data, networks can be taken as conditionally exogenously given so that the weighting matrix is specified directly from the data (see e.g. Lee et al., 2010; Lin, 2010, 2015).[8] Assuming that conditional on group fixed effects peer networks are exogenous, I specify the weighting matrix directly from the data.[9]

To understand the main idea behind the instrumental variable strategy of partially overlapping peer groups consider Figure 1.1. Figure 1.1a depicts a network in form of a big square. Located within the network, there are three partially overlapping peer groups in form of two gray ovals and one light green oval. Each small green circle stands for one individual, and individuals A, B, and C are highlighted. The arrow between individuals A and B indicates, that there is a reciprocated link between the two of them. This means, A is influencing B, and at the same time B is influencing A. A similar relationship is indicated between individuals B and C. Further arrows indicating links between individuals (green circles) within each peer group (bigger ovals) are omitted for clarity of presentation. Suppose the aim is to estimate peer effects on individual B. All small circles located within the light green oval represent B's peers. Figure 1.1b highlights peers that A and B have in common by white circles, and peers that B and C have in common by black circles. Consider individual A, as the arrow between A and B indicates, the influence goes in both directions. Thus, in order to estimate the influence of A on B, instruments for A are required. Individuals that are peers of A but not of B, as depicted by the white circles in Figure 1.1c will serve this purpose. Characteristics and outcomes of all white circles individuals in Figure 1.1c can be used to instrument the outcome of individual A, when estimating its effect on individual B. Analogously, characteristics and outcomes of all black circle individuals in Figure 1.1c can be used as instruments for the outcome of individual C, when estimating its effect on individual B. Both, white and black circle individuals in Figure 1.1c are indirect or second-order peers of individual B. For clarity of presentation Figure 1.1 shows only second-order peers, however, the partially overlapping peer group strategy can be employed with higher-order peers in the same way. Exploiting intransitivities, i.e. indirect links between individuals within a network relies on the correct representation of

[8] With less strict assumptions, endogenous networks can be included by joint modeling of outcome of interest and network formation directly see e.g. Goldsmith-Pinkham and Imbens (2013); Patacchini and Arduini (2016).

[9] Alternatively, exogenous peer group variations could be used. With the argument in mind that children are more likely to befriend others that are similar to them, quasi-random variations in the potential pool of fiends like cohort mates can be used, e.g. Hanushek et al. (2003); Hoxby (2002); Lavy et al. (2012a); Lavy and Schlosser (2011). This strategy wouldn't work in the current analysis since first differences are considered and exogenous peer characteristics like gender or ethnic background don't vary over time.

Figure 1.1: Overlapping Peer Groups - Example



(a) Whole network (b) Overlapping peers (c) Non-overlapping peers

Figure 1.1a depicts a network in form of a big gray square, with three partially overlapping peer groups marked by two gray and one light green oval. Each peer group includes several individuals depicted by small green circles. Three individuals (A, B, C) are highlighted. Figure 1.1b emphasizes in white common peers of individual A and C, and in black common peers of individual B and C. Figure 1.1c highlights non-overlapping peers of individual A in white, and non-overlapping peers of individual B in black.

connections within networks. Incomplete information on a link between individuals A and C in Figure 1.1 could bias results. This potential issue will be discussed in length in the robustness section.

The second issue arises due to potential unobservables affecting both, parental investment as well as human capital leading to a correlation between errors term and skills. In order to overcome this as well as possible reversed causality between investment and skills, $\Delta J\boldsymbol{\theta_{i,t}}$ should be instrumented. The usual approach in this is to use a lag that is far enough in the past so break the correlation, which means in the current context, that e.g. $\Delta J\theta^C_{i,2} = J\theta^C_{i,2} - J\theta^C_{i,1}$ is instrumented $J\theta^C_{i,0}$.

In order to strengthen the instrumental strategy and capture the joint evolution, equation (1.5) is extended to a simultaneous equation system accounting for changes in i's skills directly. This allows to account for direct peer effects on i's skills ($\boldsymbol{\delta_4}$) and captures the reversed effect of parental investment on i's skills (δ_3), which would otherwise confound the $\boldsymbol{\alpha}$ in (1.5).

$$\Delta JI_{it} = \beta_1 + \Delta J\theta'_{i,t}\boldsymbol{\beta_2} + \Delta JG\theta'_{it}\boldsymbol{\alpha} + \Delta JX'_{it}\boldsymbol{\gamma} + \Delta J\epsilon_{it} \qquad \text{(1.5 revisited)}$$

$$\Delta J\theta^C_{it} = \delta^C_1 + \Delta J\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}^C_2 + \Delta JI_{i,t-1}\delta^C_3 + \Delta JG\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}^C_4 + \Delta JX^C_{i,t-1}\delta^C_5 + \Delta\eta^C_{i,t} \qquad \text{(1.6a)}$$

$$\Delta J\theta_{it}^{N} = \delta_1^N + \Delta J\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}_2^N + \Delta JI_{i,t-1}\delta_3^N + \Delta JG\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}_4^N + \Delta JX_{i,t-1}^{N}\delta_5^N + \Delta\eta_{it}^N \quad (1.6b)$$

In the final system, $\boldsymbol{\alpha}$ will show whether parents are responsive to any changes in peers in general (i.e. whether $\boldsymbol{\alpha}$ is significant). Further, the sign will give an indication of whether parents try to compensate for depreciated peer skills thus perceiving them as substitutes to their own investment (i.e. $\boldsymbol{\alpha} < 0$), or whether they consider peers as potential complements or multipliers (i.e. $\boldsymbol{\alpha} > 0$).

The system is structurally identified by using behavioral problems at school as an excluded instrument for cognitive skills, and emotional attachment to the school as an excluded instrument for non-cognitive skills. The investment equation controls for household characteristics that are excluded from the two skill development functions leading to an overall identification of the system. I estimate the system via three-stage least squares (3SLS) using iterated generalized method of moments (GMM).

In the final estimation, both skill equations (1.6a) and (1.6b) have a set of 5 endogenous variables (two skill dimensions of own skills, two peer skill dimensions, and parental investment), and the investment equation has a set of 4 endogenous variables (two child skills, and two peer skills). For the latter, lagged skills for each dimension, and 2nd and 3rd order lagged peer skills compose the set of instruments. For the skill equations, in addition, lagged investment outcomes are included in the set of instruments.

1.5 Data and Measures

The analysis is based on the Add Health database, which has been designed to study the impacts of the social environment on adolescents' behavior in the United States. The survey was conducted in the academic year of 1994-1995 and collected information on a nationally representative sample of 7th-12th graders in US public and private schools. Around 90,000 students from 132 schools were surveyed in a first In-School sample. Later a sub-sample of around 20,000 students was followed up in In-Home surveys during the years 1996, 2001/02, and 2007/08 (Wave I - Wave IV).[10] Besides information on the respondent's demographics, family background, and daily activities, Add Health contains rich information on individual social networks. Here I focus on students that were first surveyed in school and subsequently followed up for two waves at home.

[10] For details on the research design see Harris et al. (2009).

1.5.1 Measures

While some data sources provide time-use diaries that specify exact amounts of time spend with the child, Add Health lacks this kind of detailed information. Add Health provides among other things information on performance, behavior, and family relationships which can be considered as proxies for cognitive and non-cognitive skills as well as parental investment.

Skills

The dataset includes measures that aim to capture different dimensions of skills. In terms of *cognitive skills*, yearly updated school grades in the subjects English, Mathematics, Science, and History [11] are used. With this set of measures principal component analysis is employed to predict one factor that can be interpreted as a cognitive skill. This way higher cognitive skills can be understood as better academic performance.

While cognitive skills are easily related to IQ, *non-cognitive* or *socio-emotional skills* don't have a single definition. Complete inventories of commonly used personality measures like the Big Five are not available for the first waves. However, there are six questions that fit into the Neuroticism of the Big Five. These questions are answered on a five-point likert scale and are described in detail in Table A1a.[12] Three of these questions also relate directly to the Rosenberg self-esteem scale, which measures global self-worth accounting for both positive and negative feelings about the self. In line with the cognitive skill, I use principal component analysis to extract one common factor out of these six measures, which I call self-esteem. Throughout the paper higher non-cognitive skill thus relates to higher self-esteem and self-worth.

For both types of skills also simple measures such as the GPA of all courses taken, or the GPA of only Math and English can be considered, the main results are robust in this regard.

[11] Provided that the student took this course. English and Mathematics are taken by most students, but Science and History are less frequently chosen.

[12] Young and Beaujean (2011) show how questions within the first wave relate to the Big Five Inventory, and that few items available are internally consistent.

Parental Investment

In the following, two different types of non-pecuniary parental investments will be described. First consider *time investment*. The data includes activities pursued by mothers or fathers together with the child. These activities can be split into "verbal interactions" and "activity interactions".[13] For the first, I consider talk about dating someone, talk about schoolwork or grades, talk about things done at school, talk about personal problems, and have a serious argument on the child's behavior. In terms of activities, I consider all social events (movie, play, museum, concert, sport event), play a sport, go shopping, and church-related activities. These time investment measures are asked as binary questions and refer to the past 4 weeks as of the interview date. For each set of measures principal component analysis is employed. However, I also use measures constructed by standardized averages that yield similar results. Higher time investment thus indicates that parent and child are pursuing more verbal or activity interactions together. The implicit assumption here is that pursuing more of these interaction types is a proxy for more actual time spend together.

Second, consider *monitoring* which refers to the number of decisions the child is allowed to make without a parent. These decisions include among others, with whom the child is allowed to spend time, at what time to be home, or what and how much TV to watch. For this parenting style measure, I take the average number of decision the child is not allowed to make. This means increasing monitoring is in line with the parent making more decisions in the name of the child.

Peer Influence

Exploiting the panel structure of the data allows the inclusion of peers in two different ways. On the one hand, friendship groups can be assumed to stay constant so that the change in peers refers to peer skill changes. On the other hand, exploiting the rich information, an updating in friendship networks could be allowed. This would mean along with the peers' skill development, exogenous network characteristics would also vary over time. The second approach is less stringent in its assumptions on how friendships evolve over time, it requires however that there is sufficient variation in individual networks between two academic years.

[13] A detailed list on the questions used to create parental investment measures see Table A1b.

In the main part of the analysis, I assume peer groups are constant and effects can only be driven by cognitive and non-cognitive skills of peers. Hereby skills are defined as described above, i.e. cognitive skills are based on scholastic performance, and non-cognitive skills refer to self-esteem. The peer measure then captures the average skill level of an individual's friends. In the second part of the paper in addition to average peer skills, average peer characteristics are included.

Other Variables

To assess *health* an index out of ten different health measures is constructed. The index is increasing in better health and is generated using principal component analysis based on questions like *"In the last month, how often did you wake up feeling tired?"* or *"In the last month, how often did you have chest pain?"*. For a full list of items can be found in table A2.

Add Health updates information on household composition in each survey. This allows accounting for changes in the *household size*. This captures that mothers might give birth again, older siblings could move out or back home, and new living arrangements could lead to new household members.

There is no information on whether or how much time students spend on studying, but various questions target free-time activities. Combining four categories, one variable that increases in the amount of time spend on *free time* activities is created. First there are hobbies like playing a musical instrument, reading, or doing arts and crafts; second, active sports like baseball, softball, or swimming; third, exercise like jogging, karate, gymnastics or dancing; and fourth, spending time with friends.

To control for the *family atmosphere* affecting interactions between parents and children, a variable that subjectively measures how much fun the family has together is included.[14]

1.5.2 Descriptive Statistics

Due to the differencing strategy and lagged instruments, the present analysis requires information on skills from at least three periods and non-missing values for all control variables restricting the sample to 9,492 observations. Further, friendship nominations,

[14] Alternatively, a question measuring a negative shock like a death in the family could be used. In the analysis, it makes no big difference which of these two measures are employed.

and in particular nominations that can be linked to survey data are required, which reduces the sample to 7,044 students. In the final analysis, students that are in school grade 12 during the first In-Home interview, i.e. Wave I, are excluded. Since those students are in their last school year, including them would result in including only students that repeat the 12th grade, which are likely to be different from students of similar age. Also, in order to make sure that the partially overlapping peer groups exist, very small networks of sizes 2 and 3 are excluded. This leaves a final sample of 3,424 high school students, which is summarized in Table 1.1.

The sample is balanced in terms of gender and consists mainly of students in their junior years of high school which corresponds to grades 9 and 10. While the majority of students are white, the biggest minority is composed of black students with 17 % of the sample. The majority of mothers and fathers in the sample have at least a high-school degree, while 31% of mothers and 34% of fathers are also college-educated. Only 13 % of mothers are reported to not have an occupation, while around a third is a professional which includes among other doctors, lawyers, or teachers. In contrast to that, only 4% of the fathers are reported to not have an occupation, while the majority with around 57% has an occupation that does not fall into the category of a professional or technical worker. Since Add Health is a self-reported survey, information on earnings and wealth includes many missing entries. However, on the question of whether the family has enough money to pay their bills, only 15% responded to have financial problems. Around half of the students in the sample are the firstborn child in their family and 17% have no siblings. For those who are not a single child, the number of siblings ranges between one and eleven with an average number of 2 siblings.

1.5.3 Friendship Networks

During In-School data collection in 1994/95, each student was asked to nominate up to five male and five female friends from a school roaster listing all students enrolled in a given school. In the follow up In-Home survey, students were asked to nominate again one male and one female friend. Even though students had the possibility to nominate anyone within their school, not all nominated friends are followed up. So it is very well possible that a student nominates a total of 8 friends but only half of them can be considered in the analysis. I restrict the analysis to students that are in peer groups of at least four people in order to avoid results driven by very small group sizes and to guarantee that enough

Table 1.1: Descriptives: Child and Parent Characteristics

	Mean	Std.Dev.	Min.& Max.	N
Female	0.5470	0.4979	0 1	3424
Age	15.1209	1.3965	12 19	3424
Stage in High-School				
Freshmen	0.3034	0.4598	0 1	3424
Junior	0.4889	0.4999	0 1	3424
Senior	0.2077	0.4057	0 1	3424
Race				
White	0.6186	0.4858	0 1	3424
Black	0.1700	0.3757	0 1	3424
Asian	0.0464	0.2105	0 1	3424
Latin	0.1159	0.3202	0 1	3424
Education of Mother				
no degree	0.1159	0.3202	0 1	3424
only HS degree	0.5467	0.4979	0 1	3424
college degree	0.3090	0.4621	0 1	3424
Education of Father				
no degree	0.1082	0.3107	0 1	2596
only HS degree	0.5069	0.5000	0 1	2596
college degree	0.3386	0.4733	0 1	2596
Occupation of Mother				
professional	0.3140	0.4642	0 1	3424
technical, office, sales	0.2418	0.4282	0 1	3424
other job	0.3122	0.4635	0 1	3424
no job	0.1294	0.3357	0 1	3424
Occupation of Father				
professional	0.3151	0.4646	0 1	2596
technical, office, sales	0.0728	0.2599	0 1	2596
other job	0.5705	0.4951	0 1	2596
no job	0.0389	0.1934	0 1	2596
Household Characteristics				
Single Child	0.1732	0.3785	0 1	3424
Number of Siblings	1.9376	1.2286	1 11	3155
First-born Child	0.4822	0.4998	0 1	3397
Enough money to pay bills	0.8482	0.3589	0 1	3352

networks satisfy the exclusion restrictions for third-order peers.[15]

Table 1.2 compares nomination patterns of my main sample, with the unrestricted

[15]Out of the 193 non-overlapping networks, 77 have a diameter of at least 4, and 135 have a diameter of at least 3.

Table 1.2: Outgoing and Incoming Nominations - Networks with minimum size four

	Main[a]				Unrestricted[b]			
	Mean	Std.Dev.	Min	Max	Mean	Std.Dev.	Min.	Max
Nominations out	2.036	1.755	0	9	2.103	1.884	0	9
Nominations in	2.036	1.993	0	16	2.103	2.102	0	17
Reciprocated Links	0.870	1.127	0	7	0.866	1.156	0	8
Networksize	17.416	40.279	4	407	19.203	53.371	4	720

[a] Main refers to the peer-groups in the sample that is used throughout the analysis in the paper.
[b] Unrestricted refers to peer-groups including all individuals that can be followed in the used data waves, including individuals with missings in variables of interest.

sample which refers to all individuals that can be followed in two In-Home interviews irrespective of their response pattern. Excluding individuals with missings in variables of interest leads to a decrease in the average network size from 19 to 17, however not in the average number of incoming and outgoing nominations. Hereby incoming nominations count how often an individual was listed as a friend by someone, and outgoing nominations are the number of friends an individual listed herself.

Even though every student can nominate up to 10 total friends, in the considered sample students nominate on average 2.02 friends. A concern might be that excluding some friends due to missing data could lead to a completely different peer group. To check whether this is a concern here, I compare average peer characteristics of the peer groups that are used in the analysis, with the average peer group characteristics in the networks based on the unrestricted sample, i.e. before students with missings are excluded. Results in Table 1.3 indicate that for the students in my main sample, the average peer composition stays stable after excluding friends with missing information. Only age seems a little concerning since after the exclusion, peers are on average 0.35 years younger. However, everything else including gender, race and parental background are comparable for both sets of peers. Also, there is no difference in the average level of the PPVT[16] score indicating that the average peer cognitives are not affected by the exclusion of peers with missing information.

Looking at children inside the same classroom, usually, it can be observed, that gender or similar background and interests increases the likelihood of becoming friends. Documenting and accounting for endogenous network formation is very important (Carrell et al., 2013). Neglecting to do so can bias findings and result in misleading interventions.

[16]This is a computerized and abridged version of the Peabody Picture Vocabulary Test-Revised. The test works as follows, the interviewer reads out loud a word and the respondent has to select the illustration that fits best to the meaning.

In the present study, homophily in exogenous characteristics like gender or race would not be a problem since a differencing approach under the assumption of time-constant friendships is used. However, skills are allowed to evolve, which is not necessarily taken care of by differencing. Homophily in skills, for instance, would mean, that the source of a positive relationship between peer and own skills can be due to social influence of interest as well as sorting of students along with skills. Using network fixed effect partially controls for this, wherein an assessment of how good this works in my context is provided in the robustness section.

Table 1.3: Characteristics of Nominated Friends

	Peer-groups		
	Main	Unrestricted	Difference
Female	0.4637	0.4709	-0.0072
	[0.4069]	[0.394]	[0.4599]
Male	0.3715	0.3848	-0.0133
	[0.3878]	[0.3779]	[0.151]
Race			
white	0.5362	0.5417	-0.0056
	[0.4788]	[0.4738]	[0.6288]
black	0.131	0.1373	-0.0063
	[0.3197]	[0.3241]	[0.4216]
asian	0.0357	0.039	-0.0033
	[0.1741]	[0.1794]	[0.4411]
other	0.0401	0.0407	-0.0000
	[0.1626]	[0.155]	[0.8769]
Age	12.6789	13.0071	-0.3282**
	[5.7651]	[5.4833]	[0.0158]
PPVT Score	44.6539	45.2603	-0.6063
	[29.4611]	[28.3531]	[0.3856]
College Degree			
Mother	0.2514	0.2541	-0.0027
	[0.3628]	[0.3533]	[0.7519]
Father	0.212	0.211	0.001
	[0.3369]	[0.3239]	[0.8995]
N Individuals	3,424	3,424	3,424

Notes: Main refers to peer-groups in the sample that is used throughout the paper. Unrestricted refers to peer-groups including all individuals that can be followed in the used data waves, irrespective of missings.

1.6 Results

1.6.1 Main Results

The focus here is on how far parents adjust their investment patterns in case their child's skills change. Hereby observing a negative coefficient indicates that parents pursue a compensating strategy. For example, suppose there is a decrease in cognitive skill of the child which can be observed by a decrease in school performance, where we observe parents increase their investment to compensate for the "skill loss". In case a positive sign of the coefficient is observed, parents would rely on a reinforcing strategy. This means that if there is an increase in the child's skill, then parents increase their investment to further boost its development.

The main results are presented in Table 1.4, wherein the first two columns refer to maternal investment, columns three and four refer to paternal investment, and column five focuses on monitoring which does not distinguish between mothers and fathers. Each column presents results from a separate estimation of a system with two skill equations, referred to as *Supplementary Equations*, and an investment equation which is the main equation of interest and reported under *Main Equation*. Results on controls are omitted from the table for clarity but can be found in Table A3 in the appendix.

Comparing columns the top panel of Table 1.4 it can be seen that both, mothers and fathers respond to changes in their own child's as well as their peers' skills. However, there is no uniform response in the sense that depending on the skill dimension and the particular parent, the underlying strategy seems to differ. Column one shows, that mothers do not respond to cognitive or non-cognitive skill changes of their child in terms of verbal investment. However, whenever their child's health decreases by one standard deviation, mothers on average increase their verbal investment by 0.055 standard deviations. An even stronger verbal compensation occurs, whenever their child's peers experience a decrease in their cognitive skills. In contrast to this, mothers adjust their activity investment solely in response to their own child's non-cognitive skills. In particular, a one standard deviation increase in the child self-esteem leads on average to a 0.233 standard deviation increase in the joint activities of mother and child.

While mothers distinguish between in their means of a reaction between their own child and its peers, for fathers a different pattern emerges. In contrast mothers, fathers are unresponsive to health changes of their children. Fathers react to changes in cognitive

Table 1.4: Parental Investment and Child Skills

	Parental Investment				
	Mother		Father		
	Verbal [1]	Activity [2]	Verbal [3]	Activity [4]	Monitoring [5]
			Main Equation		
Dep.Var.: Parental Investment					
Cognitive Skill	0.026	0.011	0.118	0.173*	-0.035
	[0.124]	[0.126]	[0.102]	[0.104]	[0.136]
Self-Esteem	0.042	0.233**	0.054	0.065	-0.087
	[0.117]	[0.118]	[0.050]	[0.049]	[0.128]
Health	-0.055**	-0.013	-0.027	-0.016	0.031
	[0.024]	[0.022]	[0.017]	[0.017]	[0.026]
Peer Cognitive Skill	-0.138**	-0.025	0.002	0.055	-0.146*
	[0.069]	[0.067]	[0.069]	[0.076]	[0.079]
Peer Self-Esteem	0.009	-0.002	0.051	0.133*	0.000
	[0.097]	[0.102]	[0.077]	[0.080]	[0.106]
			Supplementary Equations		
Dep.Var.: Cognitive Skill					
Lag-Cognitive Skill	0.332***	0.336***	0.294***	0.289***	0.321***
	[0.042]	[0.042]	[0.048]	[0.048]	[0.042]
Lag-Self-Esteem	0.039	0.041	0.062	0.070*	0.039
	[0.039]	[0.039]	[0.042]	[0.042]	[0.039]
Lag-Health	0.040	0.046	0.076*	0.077*	0.047
	[0.037]	[0.037]	[0.045]	[0.045]	[0.037]
Lag-Investment	0.039**	0.039**	0.042*	0.042*	0.035*
	[0.019]	[0.019]	[0.022]	[0.023]	[0.019]
Lag-Peer Cognitive Skill	0.113*	0.107	0.136*	0.131*	0.119*
	[0.066]	[0.066]	[0.073]	[0.073]	[0.067]
Lag-Peer Self-Esteem	0.028	0.029	0.020	0.020	0.023
	[0.061]	[0.062]	[0.069]	[0.069]	[0.060]
Dep.Var.: Non-Cognitive Skill					
Lag-Cognitive Skill	-0.025	-0.026	-0.037	-0.037	-0.030
	[0.038]	[0.038]	[0.046]	[0.046]	[0.038]
Lag-Self-Esteem	0.135***	0.137***	0.088*	0.091**	0.122***
	[0.039]	[0.039]	[0.046]	[0.046]	[0.039]
Lag-Health	-0.010	-0.006	-0.033	-0.032	-0.003
	[0.037]	[0.036]	[0.045]	[0.045]	[0.037]
Lag-Investment	0.020	0.019	0.009	0.009	0.018
	[0.018]	[0.019]	[0.022]	[0.022]	[0.018]
Lag-Peer Cognitive Skill	-0.015	-0.014	0.024	0.020	-0.019
	[0.064]	[0.064]	[0.072]	[0.072]	[0.064]
Lag-Peer Self-Esteem	0.064	0.063	0.064	0.066	0.056
	[0.057]	[0.057]	[0.065]	[0.065]	[0.056]
Observations	3424	3424	2299	2299	3332
Test of Overidentifying Restrictions	9.3560	7.3964	14.1539	15.1552	14.1515
p-value	(0.8980)	(0.9648)	(0.3631)	(0.2978)	(0.5874)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$; Robust standard errors in brackets. Cognitive skill equation controls for time spend on free time activities, behavioral problems in school, and the peer analogs. Non-cognitive skill equation controls for time spend on free time activities, emotional attachment to school, and the peer analog. Investment equation controls for family atmosphere, household size, living conditions, time spend on free time activities, and peer health. For the full set of results including controls see Table A3.

skills of their own child and change in non-cognitive skills of their child's peers. With a one standard deviation increase in cognitive skills of their own child fathers increase on average their joint activities by 0.173 standard deviations. Similarly, a higher level of average peer self-esteem is reinforced with more frequent activities of fathers and children.

Overall, both parents reward their children for improved skills using joint activities, but while mothers reinforce non-cognitive skills gains, fathers do so for cognitive skills. In terms of peers, parents react to the opposite skill as they do for their own child. Mothers are responsive to cognitive skills changes of friends, while fathers respond to changes in peers' self-esteem.

The last column considers monitoring as a form of investment, wherein a higher level of monitoring is in line with the parent making more decisions in the name of the child. This measure does not distinguish between a particular parent of the child so that the response could be driven by the mother, the father, or as a joint decision. Parents are not responsive to their own child's skill, but in contrast to that for peer cognitive skills, a weak compensation effect prevails. With peers that perform worse in school, parents increase the extent of control over their child's daily decisions.

At the bottom of Table 1.4 the Hansen J statistic testing for overidentifying restrictions is reported. This statistic is commonly used to test for the validity of instruments and other misspecifications with a significant value indicating concern about the estimation. Across all investment measures this test of overidentifying restrictions cannot be rejected.

1.6.2 Heterogeneous Results

To assess the underlying drivers of the main results, Table 1.5 allows for heterogeneous responses on peer skills. The first panel shows results for maternal verbal investment, the middle panel considers paternal activity investment, and the bottom panel shows results on monitoring. Each panel consists of results from five separate estimations, wherein the supplementary equations and some coefficients from the main equation are omitted for clarity but can be found in the appendix.

Column [1] in part (a) of Table 1.5 tests for differences in the mothers' reaction to peers of their daughters as compared to peers of their sons. Even though the effect seems to be stronger for sons, mothers do not significantly discriminate by the gender of their child. The sample includes students between the ages of 12 to 19, which makes it likely that the mother does not employ the same parenting practices over this whole age range.

Table 1.5: Heterogeneous Results

(a) Verbal Investment of Mother

Interaction Variable X	Female	Under Age 15	First-born	Expect College	Met peer parents
	[1]	[2]	[3]	[4]	[5]
Dep. Var.: Investment					
Peer Cognitive Skill	-0.224**	0.005	0.005	0.010	-0.212**
	[0.100]	[0.123]	[0.091]	[0.098]	[0.085]
Peer Cognitive Skill * X	0.195	-0.297*	-0.279*	-0.293**	0.352**
	[0.147]	[0.180]	[0.156]	[0.145]	[0.177]
Peer Self-Esteem	-0.135	0.022	0.004	0.093	0.015
	[0.125]	[0.157]	[0.127]	[0.113]	[0.125]
Peer Self-Esteem * X	0.103	-0.049	-0.159	-0.349*	0.009
	[0.196]	[0.197]	[0.205]	[0.209]	[0.203]
Observations	3424	3424	3397	3399	3424
Supplementary Equations	YES	YES	YES	YES	YES
Test of Overidentifying Restriction	13.0353	13.2819	13.2503	12.1360	10.4969
p-value	(0.8368)	(0.7746)	(0.7193)	(0.8401)	(0.8815)

(b) Activity Investment of Father

Interaction Variable X	Female	Under Age 15	First-born	Expect College	Met peer parents
	[1]	[2]	[3]	[4]	[5]
Dep. Var.: Investment					
Peer Cognitive Skill	0.131	0.160	0.079	0.024	-0.018
	[0.115]	[0.114]	[0.070]	[0.087]	[0.073]
Peer Cognitive Skill * X	-0.075	-0.135	-0.005	0.153	0.284*
	[0.177]	[0.157]	[0.119]	[0.174]	[0.148]
Peer Self-Esteem	0.234*	0.209	0.083	-0.035	0.138
	[0.126]	[0.144]	[0.105]	[0.070]	[0.107]
Peer Self-Esteem * X	-0.215	-0.134	-0.042	0.238*	0.004
	[0.177]	[0.174]	[0.162]	[0.124]	[0.167]
Observations	2299	2299	2279	2287	2299
Supplementary Equations	YES	YES	YES	YES	YES
Test of Overidentifying Restriction	16.7724	15.4224	19.7153	18.8881	15.6142
p-value	(0.2685)	(0.3499)	(0.1831)	(0.2189)	(0.4081)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Robust standard errors are in brackets. Cognitive and non-cognitive skill equations are omitted for clarity. Investment equation controls for family atmosphere, household size, living conditions, time spend on free time activities, and peer health.

Table 1.5: Heterogeneous Results continued

(c) Monitoring

Interaction Variable X	Female	Under Age 15	First-born	Expect College	Met peer parents
	[1]	[2]	[3]	[4]	[5]
Dep. Var.: Investment					
Peer Cognitive Skill	-0.267**	-0.205	-0.071	-0.077	-0.246***
	[0.121]	[0.132]	[0.099]	[0.109]	[0.095]
Peer Cognitive Skill * X	0.300*	0.163	-0.111	-0.122	0.395**
	[0.178]	[0.177]	[0.173]	[0.156]	[0.197]
Peer Self-Esteem	-0.177	0.048	0.045	0.034	0.098
	[0.124]	[0.178]	[0.144]	[0.131]	[0.117]
Peer Self-Esteem * X	0.317*	-0.048	0.009	-0.013	-0.178
	[0.176]	[0.229]	[0.230]	[0.225]	[0.232]
Observations	3332	3332	3305	3308	3332
Supplementary Equations	YES	YES	YES	YES	YES
Test of Overidentifying Restriction	25.9433	18.8312	17.4152	18.4282	16.6386
p-value	(0.2541)	(0.3383)	(0.4266)	(0.4278)	(0.4791)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Robust standard errors are in brackets. Cognitive and non-cognitive skill equations are omitted for clarity. Investment equation controls for family atmosphere, household size, living conditions, time spend on free time activities, and peer health.

This is confirmed in column [2] which tests for age differences in the response pattern. The compensation strategy is entirely driven by children that are 15 years of age or younger, which could be because mothers are more aware of the friends during their child's early adolescence or older children might refuse the investment offered by the mother. However, the latter seems more likely given that around 96% of parents report to have met the best friend of their child. This contact with peers does not differ between children that are of age 15 or younger as compared to older students (see part (b) of Table A4). Column [3] allows the response to differ by the child's birth order and shows that the effect is mainly driven by the response to peers of children that are the firstborn in their family. This indicates that verbal investment is time-consuming so that mothers respond to peers when they have a single child but with additional children at home their time constraint gets more stringent.

If the compensation behavior is strategically driven, then this effect should be stronger in case the mother expects there to be a substantial influence on her child or in case her child is already on risk. Results in column [4] show that the response is driven by

mothers who have high educational expectations of their child. The variable *expect college* takes a value of one in case the parent reports to be disappointed if their child does not attend college. So it seems, that only mothers who expect their child to succeed in high-school counteract cognitive skill losses of their children's peers. In addition, mothers that have high educational expectations also compensate for non-cognitive skill losses of their children's peers.

If mothers know the parent of their child's friends, then expectations over these friends and knowledge about their skills might be more accurate. The last column in Table 1.5 tests the difference in the response of mothers who report to have talked to at least four parents of their child's peers in the past month. As can be seen in Table A4, many parents report to have met the parents of the best friend of their child. On average parents seem to talk to around 2 peer parents within a month. For mothers who had contact to more parents, the compensation effect is significantly weaker. In fact, the net effect even turns positive, so that mothers reinforce cognitive skill gains by increasing verbal investment. It could mean that those mothers have no uncertainty about the parenting behavior of the peers' parents, so that they do not feel the need to take precautions about possible negative spillovers on their child.

Part (b) of Table 1.5 test for heterogeneities in fathers' activity investment. Overall results are in line with those of mothers reported in part (a). Column [1] shows that also fathers do not discriminate by their child's gender, though the effect seems stronger for sons. Fathers do not differ their response to their child's friends by the age of their child. A reason for that could be that the investment measure is composed of a range of activities so that by the age of the child the exact activity changes but not the sensitivity with respect to peer non-cognitives. Column [3] shows that fathers, as opposed to mothers, do not seem to have time constraint issue. In the case of joint activities, a higher number of children would not necessarily make the fathers' time constraint more stringent. It is possible to include multiple children in these activities so that response to peer skill changes does not differ by the child's birth order.

In line with the results of mothers, the reinforcement strategy is mainly driven by parents who report being disappointed if their child would not attend college. The last column tests for differences by contact with peer parents. If fathers have more contact with the peers' parents, then knowledge about the actual skill level might be more accurate. While the response to changes in peer self-esteem does not differ by the contact to peer parents, fathers with more contact in addition to reinforcing non-cognitive skills also reinforce

cognitive skill gains of their children's friends by increasing joint activities.

Part (c) of Table 1.5 provides heterogeneous results for monitoring. In contrast to time investment of mothers and fathers, parents react differently to peers of sons and peers of daughters when monitoring is considered. Increased control as a reaction to cognitive skill loss of peers is entirely driven by sons, for daughters the non-cognitive dimension seems more important. In particular, in case a daughters' friends have higher self-esteem, parents increase their monitoring by taking more decisions in the name of their daughter. These response patterns are in line with findings in the literature, in the sense that education literature usually finds an academic performance gap favoring girls (see e.g. Pomerantz et al., 2002), so that parents worrying about their sons' but not daughters cognitive performance is reasonable. The psychology literature shows that boys tend to have higher self-esteem during adolescence, and while girls tend to have problems influencing boys, the opposite does not seem to hold (see Zahn-Waxler et al., 2008). So the increase in monitoring due to higher peer self-esteem could be driven by parents' concern about their daughters having certain type of friends influencing their behavior. This can be confirmed by allowing parents to respond to skills and characteristics (see Section 1.6.3 for detail), estimated separately for boys and girls. Table A7 shows that more male and minority friends actually drive the results for girls reported in column [1] in part (c) of Table 1.5.

As can be seen in column [2], even though responses to peer cognitive skill changes seem stronger for children that are 15 years or younger, there is no significant difference in the monitoring adjustment by the age of a child. Similarly, birth order as measured by being the firstborn in the family does not lead to a stronger adjustment of monitoring. Even though parents that have high educational expectations of their children seem to react stronger to cognitive skill losses, there seems to be no significant difference to parents with lower expectations.

In line with heterogeneities in time investment, compensation for cognitive skill losses with increased monitoring is driven by parents that had only contact less than four of their child's peers' parents. Those who talked to at least four parents, indicating that they have a better notion of the peers' skills respond significantly less. In fact, the net effect turns not only positive but also insignificant.

Overall heterogeneous indicate that parents respondent strategically to counteract negative spillovers on their own child. To provide an additional test for this conclusion, I allow parents to respond differently along with their own child's ability. In particular, Table 1.6 allows parents to respond differently to their child's peers in case their own child

Table 1.6: Heterogeneous Results - Child's relative ability

Investment Measure	Mother Verbal		Father Activity		Monitoring	
Interaction Variable X	below median		below median		below median	
	cognitive	selfesteem	cognitive	selfesteem	cognitive	selfesteem
	[1]	[2]	[3]	[4]	[5]	[6]
Dep.Var.: Investment						
Peer Cognitive Skill	0.027	-0.055	0.046	0.092	0.024	-0.044
	[0.098]	[0.103]	[0.068]	[0.077]	[0.113]	[0.115]
Peer Cognitive Skill * X	-0.295**	-0.112	0.056	-0.068	-0.319*	-0.141
	[0.148]	[0.150]	[0.123]	[0.118]	[0.167]	[0.164]
Peer Self-Esteem	-0.131	-0.052	0.081	0.108	0.125	0.000
	[0.097]	[0.103]	[0.079]	[0.076]	[0.110]	[0.110]
Peer Self-Esteem * X	0.141	-0.053	-0.099	-0.149	-0.207	0.059
	[0.150]	[0.148]	[0.113]	[0.116]	[0.172]	[0.170]
Observations	3424	3424	2299	2299	3332	3332
Supplementary Equations	YES	YES	YES	YES	YES	YES
Test of Overidentifying Restriction p-value	15.9523 (0.6605)	12.8141 (0.8025)	20.4552 (0.2004)	19.1014 (0.2634)	18.7602 (0.4723)	21.3331 (0.2629)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Robust standard errors are in brackets. Cognitive and non-cognitive skill equations are omitted for clarity. Investment equation controls for family atmosphere, household size, living conditions, time spend on free time activities, and peer health.

has below-median cognitive or non-cognitive skills. For both, verbal investment of mothers and monitoring, it can be seen that the compensation behavior is significantly stronger in case the own child has below-median cognitive skills. As opposed to that, fathers' response to peer non-cognitives does not depend on their own child's skill level.

1.6.3 Changing Friendship Networks

One case in which the assumption of time constant group effects is violated is if there are actual changes in the peer networks. If the group composition changes, it is also likely that group-level characteristics will differ. In this case, changes in network compositions as measured by exogenous characteristics need to be accounted for as well since the parents' reaction might not be a response to peer skills but rather the peers themselves. This possibility will be considered in this section, where the equation system consisting of (1.5), (1.6a), and (1.6b) will be extended by exogenous peer-group characteristics in each equation.

While allowing for dynamic peer groups is a less stringent assumption as compared to

assuming groups to stay constant, it requires that there is sufficient variation in individual networks between two academic years. Table 1.7 compares friendship nominations over different waves, wherein old nominations refer to those used in the analysis up until now, and new nominations make use of information form follow-up waves. While the average number of friends a student nominates (outgoing nominations), as well as the average number of friends by which a student gets nominated (incoming nominations), is quite stable over time, only on average 37% of friendships indicated during the in-school survey are renewed during follow-up interviews. This low renewal percentage is partly due to the lower number of nominations the students were allowed to make during the follow-up, but also because students indicated new friendships instead. This suggests that for the majority of students in my sample, the peer group composition changes over time. I exploit these changes to identify parental responses to peer characteristics along with peer skills.

Table 1.7: Nomination Dynamics

	Nominations				Fraction Renewed	
	Old		New			
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Nominations out	2.262	1.927	2.105	2.076	0.370	0.383
Nominations in	2.262	2.174	2.105	2.456	0.361	0.386
Reciprocated Links	1.057	1.219	0.952	1.270		
Network size	54.196	72.836	7.302	34.272		

This approach allows for the inclusion of additional instruments that naturally occur in the dynamic context. In the previous section, peer skills were instrumented by lagged skills of higher-order friends. In this section these instruments will be combined with the changes in the network members. As an example, in addition to friends-of-friends, old-friends-of-new-friends and new-friends-of-old-friends are used to instrument skills and characteristics of immediate friends. In what follows, I first present results on estimations allowing for exogenous peer effects only (in Table 1.8), and in second step I allow an influence from both peer skills and peer characteristics.

Table 1.8 reports results from 5 separate estimations of a system with two skill and one investment equations. Results on the two skill equations as well as additional controls in the investment equation are omitted clarity (for the complete results see Table A5). The first two columns use maternal investment, columns [3] and [4] use paternal investment,

Table 1.8: Parental Investment and Child Skills - Changing friendship networks with exogenous peer effects only

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
Dep. Var.: Investment					
Cognitive Skill	0.015	0.068	0.011	0.169***	-0.030
	[0.071]	[0.070]	[0.067]	[0.063]	[0.099]
Self-Esteem	0.035	0.207*	0.095	0.024	-0.095
	[0.063]	[0.123]	[0.058]	[0.057]	[0.083]
Health	-0.158	-0.195	-0.086	0.053	-0.040
	[0.130]	[0.145]	[0.095]	[0.097]	[0.183]
Peer Characteristics					
Female	0.007	-0.038**	-0.016	-0.040**	-0.049*
	[0.020]	[0.019]	[0.018]	[0.017]	[0.026]
Mother high-school	0.061*	0.036	0.001	-0.003	-0.052
	[0.031]	[0.031]	[0.032]	[0.028]	[0.043]
White	-0.071*	0.068*	0.007	0.023	0.067
	[0.042]	[0.041]	[0.041]	[0.036]	[0.056]
Minority	-0.016	0.031	-0.017	0.006	0.104**
	[0.033]	[0.033]	[0.036]	[0.036]	[0.047]
Father Professional	0.021	-0.005	0.000	0.043***	-0.024
	[0.017]	[0.017]	[0.015]	[0.014]	[0.024]
Observations	1818	1818	1156	1156	1745
Test of Overidentifying Restrictions	27.9191	35.4492	31.4379	29.4473	27.4869
p-value	(0.3625)	(0.1902)	(0.2124)	(0.2457)	(0.2823)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Robust standard errors are in brackets. Cognitive and non-cognitive skill equation are omitted for clarity, they include as controls all peer characteristics presented in the table. Investment equation controls for family atmosphere, household size, living conditions, time spend on free time activities, and peer health. For the full set of results see Table A5.

and the last column uses parental monitoring as the investment measure.

Allowing parents to respond to peer characteristics only, I show that both mores and fathers value the peers' background. with a higher fraction of peers with at least high-school educated mothers, mother increase the verbal investment into their own child. A higher fraction on white friends is perceived as a substitute leading mothers to decrease their verbal investment.

In contrast to the main results, where mothers did not respond to the skills of their child's peers in terms of joint activities, they do take peer group composition into account. With a higher fraction of white students in their child's peer group, mothers increase the joint activities with their child. Further, a higher fraction of female friends leads to a

decrease of joint activities the mother offers her child.

In line with the main results, fathers do not use verbal investment as a response to their child's or their child's peers' skills. However, when activity investment is considered, it can be seen that when fathers are allowed to consider the peer group composition along with peer skills, they respond to changes in peers. It seems that having a higher fraction of peers with professional fathers is reinforced with more activities. In addition, a higher fraction of girls in the friend group is considered as a substitute for joint activities with fathers.

Similar to this, also for parental monitoring, peer characteristics are important. A higher fraction of female peers is seen as a substitute to monitoring, while more minority friends lead to a higher level of parental control.

Since background characteristics and skills are correlated, a concern of the main results presented in Table 1.4 and in Table 1.8 actually capture the same response.[17] To test whether parents respond to both peer skills and characteristics, in Table 1.9 I report results from 5 separate estimations of a system with two skill and one investment equations including both sets of peer measures. Results on the two skill equations as well as additional controls in the investment equation are omitted clarity (for the complete results see Table A6). The first two columns use maternal investment, columns three and four use paternal investment, and the last column uses parental monitoring as the investment measure.

In line with results in Table 1.4 mothers compensate cognitive skill losses of their child's peers by increasing their verbal investment. The response to peer group composition presented in column [1] of Table 1.8 persists, and even gets stronger. In addition to increasing verbal investment with a higher fraction of white friends and decreasing it with more female friends, a higher fraction of friends fathers being professionals[18] is perceived complementary to verbal investment. This effect did not prevail in when mother were only allowed to respond to peer group characteristics because both, average peer cognitives and average peer self-esteem, is positively correlated with the fraction of educated fathers.

Comparing results on mothers' activity investment, when peer skills are included, the negative response to a higher fraction of female friends becomes insignificant. The reason for this is that average peer cognitive skills is positively correlated with the fraction of female friends, so that leaving skills out the fraction of female friends partially measures peer cognitive skills.

[17] For details on the correlation patterns see Tables A8 and A9.

[18] The definition of being a professional includes occupations such as doctors, lawyers, teachers etc.

Table 1.9: Parental Investment and Child Skills - Changing friendship networks

	Parental Investment				
	Mother		Father		
	Verbal [1]	Activity [2]	Verbal [3]	Activity [4]	Monitoring [5]
Dep. Var.: Investment					
Cognitive Skill	0.064	0.077	0.017	0.157**	-0.041
	[0.074]	[0.073]	[0.069]	[0.067]	[0.106]
Self-Esteem	0.030	0.177*	0.075	0.022	-0.093
	[0.063]	[0.104]	[0.057]	[0.058]	[0.080]
Health	-0.070	-0.189	-0.049	0.072	-0.061
	[0.126]	[0.135]	[0.100]	[0.102]	[0.180]
Peer Skills					
Cognitives	-0.113**	-0.007	-0.043	0.020	0.021
	[0.054]	[0.052]	[0.051]	[0.053]	[0.070]
Self-Esteem	-0.013	0.042	0.042	-0.004	0.087
	[0.047]	[0.041]	[0.044]	[0.046]	[0.057]
Peer Characteristics					
Female	0.028	-0.034	-0.004	-0.043**	-0.044
	[0.026]	[0.024]	[0.021]	[0.021]	[0.031]
Mother high-school	0.077**	0.025	0.005	-0.008	-0.081*
	[0.033]	[0.032]	[0.032]	[0.029]	[0.045]
White	-0.085**	0.070*	-0.010	0.022	0.070
	[0.043]	[0.042]	[0.041]	[0.038]	[0.057]
Minority	-0.045	0.034	-0.034	0.013	0.111**
	[0.035]	[0.036]	[0.036]	[0.036]	[0.050]
Father Professional	0.035*	-0.001	0.011	0.043***	-0.019
	[0.018]	[0.018]	[0.006]	[0.016]	[0.025]
Observations	1818	1818	1156	1156	1745
Test of Overidentifying Restrictions	38.1680	34.5425	33.1427	34.9175	32.6385
p-value	(0.1455)	(0.2200)	(0.2720)	(0.2073)	(0.2493)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Robust standard errors are in brackets. Cognitive and non-cognitive skill equation are omitted for clarity, they include as controls all peer characteristics presented in the table. Investment equation controls for family atmosphere, household size, living conditions, time spend on free time activities, and peer health. For the full set of results see Table A6.

Comparing results in columns [3] and [4] of Table 1.8 with those in columns [3] and [4] of Table 1.9, it can be seen that the significant effect with respect to peer self-esteem documented in the main results disappears. Similarly, also for parental monitoring, peer characteristics rather than peer skills are the main drivers. Note that when peer skills are included, higher monitoring with less female friends loses significance, while more friends with high-school educated mothers leads to less monitoring. This change in pattern can be explained by the positive correlations between peer skills and the fraction of peers with

educated mothers, as well as the positive correlation between the fraction of female friends with the fraction of educated mothers.

Overall results in Table 1.9 show that while mothers consider both peer quality dimensions, fathers and parental monitoring is mainly based on peer quality as measured by the peer group composition.

1.7 Robustness

1.7.1 Potential Threats

Endogenous Network Formation

The estimation employed above rests on the assumption that potential peer-group level unobservables are time constant and thus eliminated through the combination of first-differences and group fixed effects. This is in line with keeping peer networks constant within the estimation period. Peer groups are based on the first nomination lists available and assumed to stay the same over throughout the analysis. This assumption was relaxed in section 1.6.3.

In a single period context network fixed effects are used to control for sorting into networks due to unobservables that are common to all individuals within a group. The data is treated as a quasi-panel to average-out group constant unobservables. With an actual panel available, the key assumption of group-level conditional exogeneity, $E[\epsilon_{it}|\mu_g, G] = 0$, can be changed into $E[\epsilon_{it}|\mu_i, G] = 0$ or extended to $E[\epsilon_{it}|\mu_i, \mu_g, G] = 0$.

The first, $E[\epsilon_{it}|\mu_g, G] = 0$, will lead to inconsistent estimates if there are unobserved shocks that are not common to all individuals within a group. The second, $E[\epsilon_{it}|\mu_i, G] = 0$, assumes that conditional on individual level unobservables, peer groups are formed exogenously. However, if there are unobservables common to individuals in a given group that vary over time, estimation results will be inconsistent. The third combines these two by conditioning exogeneity on both, individual and group level unobservables. Conditioning period wise on group fixed effects and across periods on individual fixed effects takes time-varying group level unobservables into account. However, in case there are time-varying unobservables on individual level affecting both, the friendship link formation and the skill and investment development, results will be inconsistent.

I check the validity of these exogeneity assumptions using a network formation model that is commonly used in the literature on dyadic network formation based on homophily

(see e.g. Fafchamps and Gubert, 2007; Graham, 2017). Assuming that homophily, i.e. the tendency of individuals to socialize with those similar to themselves, is an appropriate approximation of the underlying network formation, the likelihood of observing a link can be described in characteristic distances of two individuals.

$$g_{ij,g} = \beta + \sum_{k=1}^{K} \gamma_{1k} \mathbb{1}\{\ x_{ik,g} = x_{jk,g}\} + \sum_{l=1}^{L} \gamma_{2l} \frac{1}{|x_{il,g} - x_{jl,g}|} + \delta|\eta_{i,g} - \eta_{j,g}| + \mu_g + u_{ij,g} \quad (1.7)$$

Where the distance between the K categorical and binary variables is defined by their equality and distances between the L continuous variables is measured by the inverse of their absolute difference. In addition to observable characteristics, the error terms from the main equations $\eta_{i,g}$ are included as well. The parameter δ is of main interest, it captures time-varying unobservables in the main equation. A significant coefficient would indicate that homophily in time-varying unobservables partly explains initial network formation. This would indicate that the approach intended to control for selection bias in the main equation failed, leading to inconsistent estimates.

I estimate this network formation model separately for a specification including only individual level first differences, and one combining first-differences with group fixed effects. Hereby each equation of the system composed by (1.5), (1.6a), and (1.6b) is tested separately.

Table 1.10: Endogenous Network formation

	No Group Fixed effects			Main Specification		
	Cognitive	Non-Cognitive	Investment	Cognitive	Non-Cognitive	Investment
	[1a]	[1b]	[1c]	[2a]	[2b]	[2c]
Residuals	0.000012	-0.00142	-0.00016	0.00004	0.00013	-0.00010
	[0.00004]	[0.00109]	[0.00018]	[0.00005]	[0.00011]	[0.00018]
Individual and Peer Controls	YES	YES	YES	YES	YES	YES
Group Fixed Effects	NO	NO	NO	YES	YES	YES
Observations	167025	167025	167025	167025	167025	167025

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Robust standard errors are in brackets. Residuals included in columns [1a]-[1b] are based on a simultaneous system including first differences. Residuals in columns [2a]-[2c] are based on a simultaneous system combining group fixed effects and first differences. Each column in a separate logistic regression.

Table 1.10 shows results from logistic regressions based on residuals from the main specification and one that uses solely first-differences. Results in columns 1a through 1c show that for both, skill and investment equations, using only first differences is enough to control for unobservables influencing friendship formation. In addition to that, columns

2a-2c provide results from a specification including both, first differences and group fixed effects. For none of the three equations there is a significant correlation in the likelihood of a link and the residuals of each equation.

In my analysis, I follow the more conservative strategy of combining first differences and group fixed effects. Even though also first differencing seems to solve the potential endogenous network formation, using network fixed effects means comparing students that are exposed to similar schools, teachers, and social events.

Observability of Excluded Peers

The strategy of partially overlapping peer groups relies on the observability and inclusion of all connections of an individual. Thus a threat to exogeneity emerges if the observed networks do not depict the real networks. To give an example, see Figure 1.2 which is an extension of Figure 1.1.

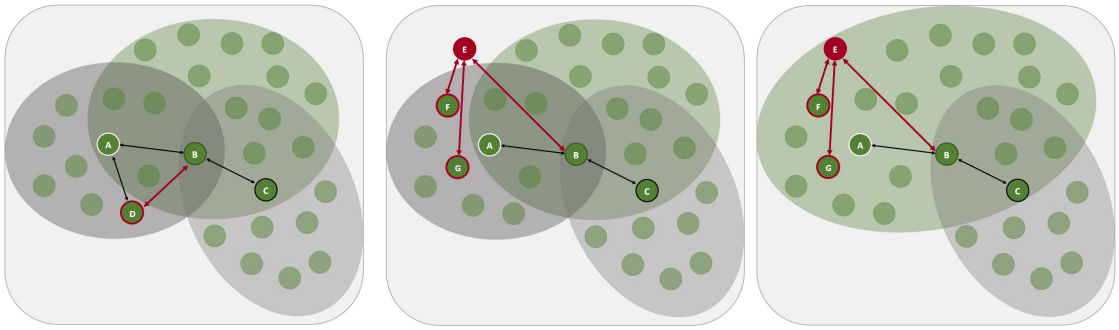
Consider Figure 1.2a and suppose all highlighted individuals, A, B, C, and D are observed, but only the links depicted by black arrows are observed in the data. Based on that individual D would qualify as an instrument for individual A, however, if in reality there is a direct connection between individual D and B (red arrow) then the exclusion restriction would be violated. In the Add Health survey students are allowed to nominate up to five male and five female friends. If the total number of 10 friends is too restrictive, then non-observability of some friends could be a severe problem.[19]

Figure 1.2b depicts a case in which an individual (here E) is entirely not observed. Based on observable information individuals F and G qualify as instruments for individual A since they are connected to B only via A. However suppose there exists an individual E, that is connected to individuals B, F, and G. Then the exclusion restriction, that the influence of F (or G) on B only works through A is violated. In particular, while with observed information (left) the network (big gray square) would be partitioned in 3 subgroups (the ovals), in reality, the network would only consist of two subgroups (right).

In the Add Health survey students are allowed to nominate not only students that are part of the study, but also others that attend the same school, or the sister school. This means that there is a chance, that some existing links as depicted in 1.2b are likely to be not observed. Table 1.11 compares the total number of nominated friends in column 1 with

[19]One possibility could be to use undirected networks, which means if A indicates a link with B the reverse is also assumed to hold. This would increase the restriction of 10 friends, however, at the same time, it would decrease the intransitivity within networks leading to weaker instruments.

Figure 1.2: Overlapping Peer Groups - Observability



(a) Unobservable Link (b) Unobservable Individual

Figure 1.2a depicts a network in form of a big gray square, with three partially overlapping peer groups marked by two gray and one light green oval. Each peer group includes several individuals depicted by small green circles. Four individuals (A, B, C, D) are highlighted. The Individuals A, B, C and the links between them (depicted by the black arrows) are observed, individual D surrounded in red is observed, but the link between D and B (red arrow) is not observed by the econometrician. The two Figures 1.2b depict a case in which an individual E (in red) and the links of individual E (red arrows) are not observed by the econometrician. The left figure captures the partially overlapping peer groups that are constructed based on observed information, the right contrasts the actually situation.

the number of nominated friends that are part of the Add Health study in column 2. While the number of overall nominated friends (column 1) significantly differs from nominated friends that are part of the survey (column 2), for the majority of students in my sample the overall nominated friends completely coincide with nominated friends that are part of the Add Health study (column 4).

To ensure that higher-order links exist and milden threats to exogeneity by non-observed links, I exclude very small peer groups of the sizes two and three, which could be small subgroups of bigger peer networks with a non-observable friend to link them. In addition, I re-weight the adjacency matrix based on the interaction intensity between two students. Exploiting information on whether and how students report having interacted with their nominated friends in the weeks prior to their interviews, friendships with more interaction are given a higher weight. Doing so allows to focus on the most prevalent friendships of an individual and implicitly assumes that the influence of a link depends on the "strength" of that connection as measured by frequency of interaction.

The present analysis is limited to friendships within the high school a student attends. Each student may have friends living in the same neighborhood but attending a different

Table 1.11: Number of Nominated Friends

	Total	Add Health	difference	all coincide
Total nominations	7.0441	6.5908	0.4533***	0.7757
	(2.9549)	(3.0172)	[0.0000]	(0.4172)
Male nominations	3.4547	3.2012	0.2535***	0.8496
	(1.7757)	(1.815)	[0.0000]	(0.3575)
Female nominations	3.5894	3.3896	0.1998***	0.8674
	(1.7893)	(1.8113)	[0.0000]	(0.3392)
Observations		3,424		

Notes: Column 1 refers to the total number of nominations. Column 2 includes only those nominations that refer to students part of the Add Health study. Column 3 reports the difference in means between the original number of nominated friends and those friends who can be followed up on. The last column reports the fraction of individuals for whom all initial nominations were within the Add Health sample.

school. Since the data only allows one to follow friendships within the sampled schools, the results are limited to within-school friends and are likely to be prone to measurement error with respect to the peer group definition.

1.7.2 Alternative Specifications

The results presented are robust with respect to alternative definitions of variables. If for parental investments and both skills simpler measures such as averages or weighted averages of measures are used, the results look very similar. Also using clustered standard errors on the peer group level does not have a major impact on the results.

The above-presented results are robust to alternative lower bounds of peer group sizes. If instead of a minimum group size of four a minimum of ten students is chosen, the sample size decreases by around 700. Due to this, the effects get slightly weaker in terms of their significance but still persist.

1.8 Conclusion

The aim of this paper is to answer three questions describing parenting behavior. First, whether and in how far parents take potential peer effects into account when they invest in their child. Second, who is driving the response to peer quality. And third, what peer quality dimension is the parent reacting on. I show that parents change their behavior in response to changes in the skills or the characteristics of their child's peers. Interestingly, I

find that mothers and fathers respond in different ways. The following three main results emerge from my analysis. First, parents compensate for cognitive skill losses of their child's peer by increasing monitoring. Also, I provide evidence that parents not only respond to the cognitive performance of peers but also consider peer non-cognitive skills in their investment decision. In particular, while mothers compensate for cognitive skill losses of their child's peers by increasing verbal investment, fathers reinforce high non-cognitive skills of peers by increasing time spend on joint activities with their child. These response patterns indicate that verbal investment and monitoring are perceived as substitutes to peer cognitive skills, and joint activities are seen as complements to the self-esteem of peers.

Second, allowing parents to react differently in the case of daughters as opposed to sons, I document gender differences for monitoring. While cognitive skill losses of sons' peers are compensated by increased monitoring, for daughters increased peer self-esteem is reinforced with higher levels of monitoring. Adjustments in time investment are mainly driven by parents that have no close relationship with peers' parents, and parents that expect their child to attend college. However, results do not differ by parental education. Adjustments in monitoring and the verbal investment of mothers are mainly driven by children who have below-median cognitive skills, suggesting that parents try to prevent negative spillovers on their "at risk child".

Third, by exploiting repeated information on friendship nominations, I show that parents take peer characteristics along with peer skills into account. In addition to compensating cognitive skill losses, mothers compensate for decreases in the fraction of white friends by increasing verbal interactions. On the other hand, a higher fraction of peers with educated parents leads mothers to reinforce this peer quality gain by increasing verbal investment into their child. As opposed to that, fathers' response and parental monitoring is mainly driven by changes in peer group quality as measured by the composition of peer characteristics rather than peers' skills.

My findings suggest that school or classroom level interventions changing the composition of students will lead to feedback effects through parents. These type of interventions change the potential set of peers and thus can influence friendships that are actually formed. As I show, parents consider peer quality as measured by skills and characteristics in their parenting behavior. This means, depending on the skill considered, the net effect of policy interventions might be under- or overestimated if parental responses are not taken into account.

Chapter 2

Fragile Boys (or Girls)? Impact of a Macro Shock on Psychosocial Functioning and Longrun Health and Well-being Implications

joint work with Ghazala Azmat[*] and Katja Maria Kaufmann[‡]

2.1 Introduction

There is a growing interest in the importance of the determinants, as well as the consequences, of socio-emotional development (or non-cognitive skills). From a number of perspectives, the literature has investigated the development and formation of these skills (see, for instance, Cunha and Heckman, 2007; Cunha et al., 2010). Important links have been established between socio-emotional development and economic and educational outcomes (see, for example, Almlund et al., 2011; Borghans et al., 2008; Deming, 2017; Heckman et al., 2013, 2006; Jackson et al., 2020). What is less well understood, however, is whether the determinants of socio-emotional development differ by gender and whether socio-emotional development (and changes in these skills) manifest differently for males and females in terms of behavior and longer-term outcomes.

Understanding the gender differences in the determinants and consequences of socio-emotional development (SED, hereafter) is important from an academic and policy perspective. From a biological perspective, the medical literature has well-established evidence in favor of the "fragile males" hypothesis, showing that the male fetus is more at risk than the female fetus, and certain disadvantages exist in utero and continue throughout life (Krae-

[*]Sciences Po and Centre for Economic Performance (LSE)
[‡]Department of Economics, Johannes Gutenberg University Mainz, briq, CESifo, HCEO and IZA

mer, 2000). From a behavioral perspective, males have been shown to engage more in unhealthy (or "risky") behavior, which has important consequences for health outcomes, such as the development of cardiovascular disease (Juutilainen et al., 2004). Consistent with the medical literature, in economics, it has been shown that for school-aged children, a worse home or school environment has a stronger impact on disruptive behavior and schooling outcomes for boys (Autor et al., 2019; Bertrand and Pan, 2013; Brenøe and Lundberg, 2018; Fortin et al., 2015) and that early childhood interventions that enrich the environments of disadvantaged children are more affective on the behavior and health outcomes of boys than girls (Conti et al., 2016).

In this paper, we causally estimate the impact of a large exogenous macro shock on the SED of young adolescents. We then link changes in SED to a wide range of behavioral changes, (including both, *externalizing* and *internalizing* behavior), as well as long-term consequences for their health, life satisfaction and educational outcomes as young adults. We document that there is an immediate (negative) and sizeable impact on youths' anger, anxiety and self-confidence, which then has long-term negative consequences for their behavior and outcomes. Importantly, we find a gender-neutral impact of the shock on most dimensions of SED. However, focusing on the link between changes in SED and different types of behavior, we see striking gender differences. While changes in SED lead to an increase in the *externalizing* behavior of boys, we see no impact on this type of behavior among girls. This is consistent with the "fragile males" hypothesis and with gender asymmetries in "acting out" when adolescents are subjected to similar adverse circumstances. Similarly, when we examine the impact of SED on behavioral "control" problems, such as alcoholism and other types of risky behavior, we see that changes in SED are more strongly associated with longer-run problems for male than female youths. However, when we investigate *internalizing* behaviors (such as suicidal thoughts), which are often linked to depression and other mental-health problems, we see that changes in SED are strongly associated with increases in internalizing behavior, but only for girls.[1] By examining a wide range of outcomes, we see that changes in SED play an important role for both genders. In terms of more general long-run outcomes, such as subjective health and life satisfaction,

[1] According to the Centers for Disease Control and Prevention (CDC), suicide attempts and thoughts have nearly doubled for US children and teenagers over the last decade, with the rate of 6.7 suicides per 100,000 people in 2007 increasing to 11.8 suicides per 100,000 people by 2017. The agency determined that suicide is the second leading cause of death among teenagers aged 15 to 19. Also, for the first time in more than thirty years, mental-health problems have displaced physical conditions as the leading causes of disabilities in U.S. children (Slomski, 2012).

as well as objective measures of educational success, we see similar impacts on male and female youths', suggesting that both genders are impacted, albeit on somewhat different dimensions, by changes to their SED. From a policy perspective, these results are key, since, if the focus is mostly on conduct in the classroom, such as attendance and disciplinary incidents (e.g., fighting and disturbances), this would largely measure *externalizing* behavior, biasing attention towards the behavior of boys and thereby fostering investments in skills and SED that put a stronger focus on boys than on girls.

In our study, we estimate changes in the SED of adolescents using the natural experiment of German Reunification in October 1990. Through Reunification, Germany witnessed some of the most important structural changes in Germany's recent history (see Hunt, 2002; and Krueger and Pischke, 1995, for a detailed overview). In particular, East Germany transitioned from a socialist system with a planned economy to a capitalistic and democratic system in line with that of West Germany in a very short time period. The enormous and rapid economic, cultural and political changes implied a drastic rise in uncertainty about the economic and social environment.[2] Work in psychology (see, for instance, Kirkcaldy et al., 1999; Krauss and Faas, 1994 and Schmitt and Maes, 1998), documents that after Reunification East German adults exhibited substantially higher stress and anxiety levels, with important implications for their mental well-being, and the incidence of suicides increased. Among other channels, the changes and the resulting adaptive pressures as well as the political revolution in East Germany threatened individuals' psychological identity. The focus of this paper is on East Germans during their adolescence – a particularly relevant time for socio-emotional development – and, more specifically, the short-run impact of the large shock on their SED and the longer-run implications for important behavioral outcomes as well as their health, well-being and educational success as young adults.

Using a unique detailed dataset on cohorts of youths in East Germany, where students were interviewed annually for several years, when they were aged 9 to 20, we measure their SED (as measured by their anger, anxiety and self-confidence) shortly before and shortly after Reunification. We use variation in the timing of Reunification for two different cohorts of students, to identify its effect on SED. We then link SED to later behavioral, health and educational outcomes. In particular, we analyze the change in SED for the younger cohort

[2]Shortly after Reunification, East Germany experienced a sharp rise in unemployment. According to Krueger and Pischke (1995) and Hunt (2008) employment decreased by up to 3.3 million people from 1989 to 1992 and unemployment rose to more than 15 percent in East Germany in the mid-nineties.

between 1989 and 1991 (shortly before and after Reunification), using as the counterfactual trend the evolution of the older cohort's SED between the same ages (both of which were before Reunification). To understand the impact of SED on students' later outcomes as young adults, we link the changes in SED to externalizing (fighting, destroying things) and internalizing behavior (suicidal thoughts), as well as to behavioral control problems (alcoholism and smoking), health (subjective health and life satisfaction) and education (academic grade point averages and college entrance requirement).

We show that the large macro shock of Reunification had substantial negative effects on youths' socio-emotional skills and psychosocial functioning. In particular, Reunification led to increases of 33 and 36 percent of a standard deviation in anger and anxiety levels, respectively, while it decreased youths' self-confidence by more than 40 percent of a standard deviation. Importantly, these negative effects are present for both genders. Contrary to the belief that boys are more strongly affected by negative changes to their environment, we show that, the anger and anxiety levels of boys and girls increased similarly, while self-confidence decreased for both but, actually, even more strongly for girls.

We next document that changes in SED for adolescents have important implications for them as young adults. We show that changes in SED are associated in an important way with longer-run *externalizing* behavior (fighting and destroying property), *internalizing* behavior (suicidal thoughts and their frequency) and *behavioral control* problems (alcohol and cigarette consumption). However, there are striking gender differences in these links. While we see a change in externalizing behavior only for boys, as well as more negative behavioral control problems, we see a change in internalizing behavior only for girls. Analyzing the association between SED and longer-run global measures on life satisfaction, well-being, and objective academic success, we find that all these measures are gravely affected by a negative change in SED and in a very similar way for both genders. Our findings are, therefore, consistent with a "fragile males" hypothesis in that adverse shocks impact boys' disruptive behavior and behavioral control problems. However, we also find evidence to suggest that negative shocks affect girls on important mental health dimensions, and ultimately, they appear to have similar consequences on longer-run health, life satisfaction and educational success.

Looking more closely at the different components of SED, we show that an increase in anger is strongly related to youths' longer-run propensity of "fighting" and "destruction of property", which is entirely driven by male teenagers. Turning to behavioral control problems, we find that changes in anger are strongly related to youths' propensity to

smoke cigarettes and consume heavy quantities of alcohol, and again the effects are mostly driven by male youths. However, in terms of the effects on suicidal thoughts and the persistence of such thoughts, we see that all SED components (changes in anger, anxiety and self-confidence) play a role, albeit much more strongly for female teenagers. With respect to health outcomes, we find that all SED components are linked to life satisfaction and subjective well-being. Increased anger and anxiety and decreased self-confidence are all linked to worse health outcomes. This is the case for both, male and female youths. Finally, in terms of educational attainment, increased anger and anxiety and lower self-confidence are associated with lower GPAs in German and math, as well as a lower probability of completing the entrance requirement for college, the Abitur degree, and again the effects are very similar for males and females.

2.2 Background

Until 1945, East and West Germany were united as a single country. When separation occurred after Germany's defeat in the Second World War, it was exogenously imposed by the winning Allies. In the fall of 1989, change swept through Eastern Europe and led to the fall of the Berlin Wall in November 1989. On October 3, 1990, East Germany joined the Federal Republic of Germany (FRG), creating a sovereign unified German state ("Reunification"). Importantly, the former German Democratic Republic (GDR), instead of experiencing a change of government within its borders or newfound independence like other countries in this area, ceased to exist as a separate state. In this process, East Germany switched from state socialism to liberal democratic capitalism in a short period of time and without a gradual transition.

This large and unexpected change in the entire economic and political system created a substantial amount of uncertainty. Upon Reunification, the economic system in East Germany was replaced and led to a substantial rise in unemployment (Hunt, 2008; Krueger and Pischke, 1995).[3] Bhaumik and Nugent (2011), for example, show that economic uncertainties (especially employment-related uncertainty) driven by Reunification led to an important decrease in childbirths. In general, the consequences of Reunification had important effects on individuals' stress levels and well-being. Psychologists have shown that the Reunification led to substantially higher stress levels related to the adaptive pres-

[3]During state socialism under the GDR there was no official unemployment, i.e. people were employed even though their productivity were low, which changed upon Reunification.

sures associated with changes, as well increased threat of unemployment (Kirkcaldy et al., 1999). Beyond the changes in economic pressure, Krauss and Faas (1994), among others, note that beyond the changes in economic pressures, the political revolution in East Germany threatened individuals' psychological identity and the previously held notion that individuals have only one reality, which could lead to increased anxiety. Krauss and Faas (1994) conducted extensive interviews during which they saw "very intense and powerful feelings", which ranged from "visible euphoria about the anticipation of more closeness and new possibilities for the relationships to anxiety over being accepted or outright panic."

Our study focuses on the impact of Reunification on the anxiety, anger and self-confidence among adolescents and changes in them, shortly before and after Reunification. We causally estimate the impact of a large macro shock on these youth social-emotional development as well as the long-run consequences of changes in these psychological measures.

2.3 Data

2.3.1 Longitudinal Study of Students in East Germany

The data used in the following analysis come from the Longitudinal Study of Students (1985-1995). The study follows two parallel cohorts of students in East Germany from 1985 to 1995. Students in the younger cohort were surveyed from ages 9/10 to 18/19, while students in the older cohort were surveyed in the same years from ages 11/12 to 20/21. The goal of the study was to understand the determinants of the development of cognitive abilities and mental health as well as of values, goals, and attitudes during childhood and adolescence. The data are ideal for our purpose in that the survey followed the same individuals from before to after German Reunification, covering a wide range of topics, including educational achievement and attainment, as well as psychological well-being measures and health-related behavior.

Importantly, the survey asks students about their socio-emotional development and their psychological well-being at several points in time before and after Reunification, allowing us to study whether and to what extent these measures translate into long-run outcomes. Given the longitudinal nature of the study, we can link exogenously driven changes in psychological functioning (in particular anxiety, anger and self-confidence) to longer-run behavioral, educational and health outcomes post Reunification, when students

are young adults.

2.3.2 Variable Description

In Table 2.1a, we describe the three main variables used in our analysis. Our main outcome of interest is the socio-emotional development (SED) of adolescents, as measured by their levels of anger, anxiety, and self-confidence. We use students' level of agreement with items related to the different psychological measures. Possible answers for each item range from 4 ("very strongly") to 1 ("not at all"). In the case of anger and anxiety, we use factor analysis to combine the different items, since there is more than one item available.[4] Since these measures do not have a natural unit, we standardize them, i.e., subtract the mean and divide by the standard deviation to be able to interpret regression coefficients in terms of standard deviation changes.

In Table 2.1b, we describe the long-run outcomes, as measured when individuals are aged 18 to 21, which are linked to their early (exogenous) changes in psychological well-being around the time of Reunification. We classify these outcomes into the following five categories: *externalizing* behavior, *internalizing* behavior, *behavioral control* issues, *health* outcomes, and *educational* outcomes.

For externalizing behavior, we measure self-reported deviant behavior during the past 12 months. There are two main measures: (1) *Physical fighting*, which captures whether the individual has deliberately beaten or hurt someone, (2) *Destroy property*, which captures whether the individual has deliberately destroyed or damaged private public property.

In terms of internalizing behavior, we measure individuals' suicidal tendencies, where (1) *Suicidal thoughts* capture whether the individual has thought of committing suicide at least once and (2) *Repeated suicidal thoughts* indicates whether the individual has had thoughts of committing suicide more than once.

With respect to behavioral control problems, we focus on (1) *Alcohol consumption*, where we can measure the extent of consumption, specifically (a) regular alcohol consumption and (b) heavy alcohol consumption, over the past three months and (2) *Cigarette*

[4] In terms of the variable anger, individuals are asked about their agreement with the following statements: *"I have destroyed things out of anger."* and *"When provoked, I lose my temper"*. In terms of the anxiety variable, individuals are asked about their agreement with the following two statements: *"Sometimes I am too nervous to speak in class."*, and *"I am afraid of being laughed at by my classmates."* Self-confidence is measured as the extent of agreement to the statement *"I struggle with low self-confidence."* To interpret higher values as higher self-confidence, while in the raw data higher-value answers imply lower self-confidence, we revert the scale.

Table 2.1: Variable Description

(a) Variables in the short-run

	Description	Values
Psychological Measures		
Anger	Combined score of 2 items.	1 4
Anxiety	Combined score of 2 items.	1 4
Self-Confidence	Problems with low self-confidence.	1 4

(b) Variables in the long-run

	Description	Values
Externalizing Behavior		
Physical Fighting	Indicator for having started or been in a physical fight in the past 12 months.	0 1
Destroy Property	Indicator for having destroyed someone's property in the past 12 months.	0 1
Internalizing Behavior		
Suicidal Thoughts	Indicator for having thought of committing suicide at least once.	0 1
Repeated Suicidal Thoughts	Indicator for having thought of committing suicide more than once.	0 1
Behavioral Control Problems		
Alcohol Consumption: Regular	Indicator for drinking alcohol 1-2 times per month.	0 1
Alcohol Consumption: Heavy	Indicator for drinking at least once per week.	0 1
Cigarette Smoking	Indicator for smoking regularly/ occasionally.	0 1
Health & Well-being		
Subjective Health	Subjective health measure (1 lowest, 5 highest).	1 5
Life Satisfaction	Satisfaction about life in general/ overall (1 lowest, 4 highest).	1 4
Academic Outcomes		
German Grade	German grade in school grade 10 (1 lowest, 5 highest).	1 5
Math Grade	Math grade in school grade 10 (1 lowest, 5 highest).	1 5
Abitur Degree	Indicator for having a degree permitting university studies.	0 1

Smoking, indicating if the individual is a regular smoker.

Physical health and general well-being are captured using measures of (1) *Subjective health*, which ranges from 5 ("very good") to 1 ("bad") and is referring to the current health status perceived by the adolescent and (2) *Life satisfaction*, which measures the individual's life satisfaction in general. It is defined in four categories (where 1 is "not at all satisfied" and 4 is "completely satisfied").

Finally, we can measure academic outcomes using (1) *Students' academic GPAs* in Math and German during 10th grade, i.e. the highest grade with mandatory education, (where 1 is the lowest grade and 5 is the highest) and the obtainment of (2) *"Abitur"*, the university entrance certificate necessary for admission to university.

2.3.3 Summary Statistics

In Table 2.2a, we present the summary statistics for the three SED measures by gender when the youths are between ages 12 and 14. The first column presents the averages for girls, the second column presents the averages for boys, and the third column tests for a difference between the two. Overall, boys, on average, report higher levels of anger and higher levels of self-confidence than girls at the same age. Girls, however, report, on average, higher levels of anxiety than boys do.

In Table 2.2b, we similarly report the summary statistics for each of the long-run outcomes, when individuals are aged 18 to 21. The prevalence of externalizing behavior, in terms of physical fighting and destroying property, is higher for young men than for young women at the same age. However, internalizing behavior, in terms of suicidal tendencies, is higher for young women than for young men. Among men, for instance, approximately 10 percent have gotten into a physical fight, compared with only 2-3 percent of women. With respect to suicide, while only 19 percent of men have thought about suicide, more than 34 percent of women have had these thoughts.[5]

[5]In Appendix Table B13 we compare our measures on externalizing and internalizing behaviors with similar measures from another German and a US survey targeted at the surveillance of risky behaviors among youths (the German survey KiGGS from 2003 on youths aged 14-17 and the US survey "Youth Risk Behavior Surveillance" on 12th graders in 1995). Despite the fact that the age of the youths and the year when the survey was conducted are not exactly the same and also the exact survey questions and reference periods differ somewhat, average incidence and in particular patterns in terms of gender differences are similar. For example, in our survey of 18-21 year olds in 1995 the likelihood of female (male) youths to get into fights is 2-3 percent (10 percent) compared to 10 percent (21 percent) in the younger sample from the more recent German survey and compared to 6 percent (16 percent) in the US sample. In terms of suicidal thoughts, in our sample 34 percent (19 percent) of female (male) youths have ever had thoughts about

With respect to behavioral control problems,the gender differences are less stark than those that appear in terms of externalizing and internalizing behavior. While smoking and regular drinking are similar for boys and girls, heavy drinking is more prevalent among young men. In terms of smoking cigarettes, on average, 36 to 38 percent of adolescents consume tobacco. In terms of alcohol consumption, around 60 to 70 percent of men and women drink regularly. However, while 55 percent of men are heavy drinkers, this is the case for only 40 percent of women.[6]

With respect to health and educational outcomes, we similarly see that there are no strong gender differences. Both, young men and women, report similar levels of life satisfaction. However, young men report a higher level of subjective health. In terms of academic performance, we see no gender difference in taking the university entry exam (the Abitur), with approximately 40 to 45 percent taking it. Looking at academic performance at the end of high school, we see that, while girls tend to perform better in German, there is no significant difference in math.

Table 2.2: Descriptive Statistics by Gender

(a) Variables in the short-run

	Girls	Boys	Diff.
Psychological Measures			
Anger	-0.1746	0.0486	0.22***
	[0.9129]	[0.9629]	[0.00]
Anxiety	-0.0024	-0.1701	-0.17***
	[0.9725]	[0.8897]	[0.00]
Self-Confidence	-0.0646	0.1143	0.18***
	[1.0224]	[0.9096]	[0.00]
N Individuals	462	394	

committing suicide at least once, while 17 percent (8 percent) of 14-16 year olds had suicidal thoughts in the past 14 days in the German part of the European survey SEYLE conducted in 2010 and 24 percent (16 percent) of the US 12th-graders had seriously thought about attempting suicide in the past 12 months.

[6] Also in terms of these measures of behavioral control problems, average incidence and gender differences are similar (see Appendix Table B13). In our survey around 36 to 38 percent of female and male youth report to smoke (regularly and occasionally), while in the younger KiGGS sample of 14-17 year olds around 31% of both, female and male youth, report to be current smokers. In comparison, around 34 percent of US 12th graders smoked at least once in the past 30 days. In terms alcohol consumption, 38 percent (58 percent) of 18-21 year old female (male) youths in our sample consume alcohol at least once per week compared to 23 percent (41 percent) among the German survey of 14-17 year olds. 54 percent (60 percent) of female (male) US 12th graders drink alcohol once per week, 32 percent (47 percent) of American females (males) are heavy drinkers.

Table 2.2: Descriptive Statistics by Gender continued

(b) Variables in the long-run

	Girls	Boys	Diff.
Externalizing Behavior			
Physical Fighting	0.0238	0.0950	0.07***
	[0.1525]	[0.2936]	[0.00]
Destroy Property	0.0324	0.1150	0.08***
	[0.1772]	[0.3194]	[0.00]
N Individuals	463	400	
Internalizing Behavior			
Suicidal Thoughts	0.3480	0.1979	-0.15***
	[0.4769]	[0.3989]	[0.00]
Repeated Suicidal Thoughts	0.0859	0.0264	-0.06***
	[0.2805]	[0.1605]	[0.00]
N Individuals	454	379	
Behavioral Control Problems			
Alcohol Consumption: Regular	0.6740	0.7546	0.08*
	[0.4693]	[0.4309]	[0.01]
Alcohol Consumption: Heavy	0.4053	0.5594	0.15***
	[0.4915]	[0.4971]	[0.00]
Cigarette Smoking	0.3855	0.3615	-0.02
	[0.4872]	[0.4811]	[0.48]
N Individuals	454	379	
Health & Well-being			
Subjective Health	-0.0262	0.1977	0.22***
	[1.0387]	[0.9156]	[0.00]
Life Satisfaction	-0.0084	0.0432	0.05
	[1.0199]	[0.9000]	[0.44]
N Individuals	459	400	
Academic Outcomes			
German Grade	0.4777	0.0295	-0.45***
	[0.9124]	[0.9247]	[0.00]
Math Grade	0.2655	0.3016	0.04
	[0.9521]	[0.9705]	[0.62]
Abitur Degree	0.4684	0.4085	-0.06
	[0.4996]	[0.4923]	[0.11]
N Individuals	395	328	

Notes: For a description of the variables, see Table 2.1. In Panel (a), we pool both cohorts and show the means of the psychological measures for youths at ages 12/13 and 13/14 (i.e. before and after Reunification for the young cohort) as in the analysis of short-run effects. The psychological measures anger and anxiety are created using factor analysis based on two items in each case. In the analysis, all categorical variables are used as standardized scores. In Panel (b), we display means of the longer-run outcomes when youths are between ages 18 and 21, using the same (pooled) sample as in the short-run analysis.

2.4 Empirical Methodology

2.4.1 Short-run effects of Reunification on socio-emotional development

We causally estimate changes in SED using the natural experiment of German Reunification in October 1990, whereby students' birth cohort and the timing of Reunification jointly determine their exposure to the change in regime. We use this variation to identify the effect of regime change on three dimensions of SED: anger, anxiety and self-confidence. In particular, we analyze the change in the SED of the younger cohort before and after Reunification, using as the counterfactual trend the evolution of the older cohort's psychological well-being at the same age before Reunification. Importantly, the regime change allows us to isolate a change in SED that is not driven by age effects. In a second step, we study how these changes in SED translate into changes in longer-term behavior and outcomes.

The survey follows two cohorts – one being three years older than the other cohort is – between 1985 and 1995. We exploit the comparability across cohorts at the same age and the structure of the data, which at regular (annual) intervals, surveys the students on the same questions, to identify the effect of regime change on SED. The "treatment" of interest is that of regime change on the SED of the younger cohort. The older cohort serves as the "control" group, capturing how socio-emotional skills would have evolved if there had been no Reunification. For instance, the older cohort at age 14 (in 1988) is in the pre-Reunification period, while the younger cohort at age 14 (in 1991) is in the post-Reunification period.

We estimate the change in SED for the younger cohort from before to after Reunification (i.e., between 1989 and 1991), using the older cohort as a control for the trend across the same ages for the younger cohort. The empirical design is such that we focus closely on the ages directly pre- and post-Reunification for the younger cohort, i.e., when aged 12 to 14, which allows us to identify the short-run effects of Reunification. More generally, we estimate the following equations:

$$SED_{ic} = \beta_0 + \beta_1 T_i + \beta_2 P_{ic} + \beta_3 (T_i P_{ic}) + \beta_4 F_i + X_{ic}\delta + \epsilon_{ic} \tag{2.1}$$

$$SED_{ic} = \beta_0 + \beta_2 P_{ic} + \beta_3 (T_i P_{ic}) + D_i + \epsilon_{ic} \tag{2.2}$$

where SED_{ic} is the measure of the socio-emotional development of student i in cohort

c. T_i is a dummy indicating "treatment" (i.e., taking the value of one if the individual belongs to the younger cohort and zero otherwise), and P_{ic} indicates the "post" period, representing the student's age. Since we restrict the analysis to ages 12 to 14, P_{ic} is a dummy variable that takes the value of one if the age of the individual is 14 (where age 12 is the excluded category); F_i is a gender dummy taking the value of one if the student is female. X_{ic} is a vector of pre-determined individual-specific characteristics. In a second specification, we include individual fixed effects D_i (see equation (2)).

To understand the gender differences in impact on SED, we estimate equations (1) and (2) by fully interacting the specification with the female dummy F_i, leading to:

$$\begin{aligned} SED_{ic} = \beta_0 + \beta_1 T_i + \beta_1^F (T_i F_i) + \beta_2 P_{ic} + \beta_2^F (P_{ic} F_i) \\ + \beta_3 (T_i P_{ic}) + \beta_3^F (T_i P_{ic} F_i) + \beta_4 F_i + X_{ic}\delta + (X_{ic} F_i)\delta^F + \epsilon_{ic} \end{aligned} \tag{1.1}$$

$$SED_{ic} = \beta_0 + \beta_2 P_{ic} + \beta_2^F (P_{ic} F_i) + \beta_3 (T_i P_{ic}) + \beta_3^F (T_i P_{ic} F_i) + D_i + \epsilon_{ic} \tag{2.1}$$

The main coefficients of interest are β_3 and β_3^F, which capture the effect of a change in regime (β_3), and whether this effect differs by gender (β_3^F). The interaction term ($T_i P_{ic}$) takes the value of one if a student is from the younger cohort and is 14 years old, which is in the post-Reunification period for the young cohort, while ($T_i P_{ic} F_i$) takes the value of one if the student is female, in the young cohort and in the post-Reunification. All equations are estimated using ordinary least squares with standard errors that are clustered at the individual level.

One possible way to apply the Difference-in-Differences approach is to compare the young and the old cohorts in the same years before and after Reunification. However, the older cohort is also likely affected by Reunification, such that we might expect a response within the "control" group as well. In our application of the Difference-in-Differences approach, we compare the younger and the older cohorts at the same age. In this way, the older cohort is not affected by Reunification since the relevant ages are all before Reunification, and it allows us to control for age (life-cycle) effects, which are likely to be particularly important during adolescence. More specifically, we control for how the younger cohort's socio-emotional development would have developed without Reunification by making use of the change in these measures within the control group at the same ages.

Under the parallel trend assumption, it is assumed that without the German Reunifi-

cation, the young cohort's psychological development between ages 12 and 14 would have been the same as the older cohort's psychological development between ages 12 and 14. We test this parallel trend assumption by conducting a placebo test in which we compare the evolution of the SED for the younger cohort in the pre-period with that of the older cohort.

2.4.2 Linking socio-emotional development to long-run behavior and outcomes

In this section, we discuss how we study the link between SED and long-run behavior and outcomes. We measure whether anger, anxiety, and self-confidence – and changes in these variables – impact students' longer-run externalizing/internalizing behavior, as well as behavioral control issues, health and well-being, and academic performance, and whether this relationship differs by gender.

We estimate the following equations:

$$B_{ic} = \gamma_0 + \gamma_1 \Delta SED_{ic} + \gamma_2 SED_{ic,pre} + \gamma_3 T_i + \gamma_4 F_i + \epsilon_{ic} \tag{2.3}$$

$$\begin{aligned} B_{ic} = \gamma_0 + \gamma_1 \Delta SED_{ic} + \gamma_1^F (\Delta SED_{ic} F_i) + \gamma_2 SED_{ic,pre} \\ + \gamma_2^F (SED_{ic,pre} F_i) + \gamma_3 T_i + \gamma_3^F (T_i F_i) + \gamma_4 F_i + \epsilon_{ic} \end{aligned} \tag{3.1}$$

where B_{ic} is an indicator for a certain behavior (or a measure of health, well-being or academic performance) of individual i in cohort c, $SED_{ic,pre}$ captures the level of a certain socio-emotional skill at age 12 (i.e., before Reunification for both cohorts), and ΔSED_{ic} captures how a certain SED indicator changed from age 12 to age 14 (i.e. before vs. after Reunification for the young cohort). The coefficient of interest is γ_1, which measures how an exogenous change in SED affects individuals' later behavior and outcomes. Equation (3.1) repeats the exercise but measures the heterogeneity by gender.

2.5 Results: Short-run Effects of Reunification on Socio-emotional Development

The macro shock of Reunification had drastic effects on adolescents' SED and psychological well-being. In Table 2.3, we present the impact of Reunification on anger, anxiety and self-

confidence. According to columns (1) and (2), Reunification increased the level of anger by 33 percent of a standard deviation. In particular, those in the younger cohort have a level of anger that is 33 percent of a standard deviation higher after Reunification as compared to before, controlling for how their anger level would have evolved without Reunification between the relevant ages. The counterfactual anger levels are measured by subtracting the change in anger level for the old cohort between the same age (both of which took place before Reunification). Results are very similar without and with controls for individual fixed effects (compare columns (1) and (2)). Similarly, Reunification led to substantially increased levels of anxiety among adolescents – with an increase of 36 percent of a standard deviation (columns (3) and (4)) and their levels of self-confidence decreased by 44 percent of a standard deviation (columns (5) and (6)).

In Table 2.4, we analyze whether the macro shock affects the SED of adolescent boys and girls differently. Columns (1) to (4) show that (with and without fixed effects), anger and anxiety increase similarly for both genders. This finding is important in that when we focus only on changes in *behavior* (such as disruptive and aggressive behavior) following a major life disruption, those changes are predominantly observed in boys, while girls appear to be unaffected (or less affected). This might give the impression that the SED of boys is more severely affected by adverse shocks. However, by directly measuring SED, we show that the effects are similar for both girls and boy. As we will discuss in the next section, what differs by gender is how SED is *linked* to different types of behavior.

Columns (5) and (6) show that compared with that of adolescent boys, the self-confidence of girls is more negatively impacted by the macro shock, in that girls' self-confidence levels decrease by 62 percent of a standard deviation but only by 23 percent of a standard deviation for boys. This highlights again that, if anything, girls are more strongly affected by the shock than boys.

In Panel B of Tables 2.3 and 2.4, we conduct a placebo experiment to test whether the pre-trends in SED are similar for the two cohorts. We estimate a Differences-in-Differences specification (without and with fixed effects, respectively) comparing the evolution of youths' SED before age 12. The results are consistent with the parallel trends assumption in that pre-trends for both cohorts are very similar (the estimated coefficient is close to zero and not significantly different from zero). This lends support to our causal interpretation of the effect of Reunification on youths' socio-emotional skills.

Table 2.3: The Effect of Reunification on Psychological Measures

Panel A	**Main Results**					
	Anger		Anxiety		Self-Confidence	
	[1]	[2]	[3]	[4]	[5]	[6]
Treated x Post	0.334***	0.334***	0.362***	0.362***	-0.439***	-0.439***
	[0.071]	[0.071]	[0.068]	[0.068]	[0.077]	[0.076]
Treated	-0.061		-0.020		0.034	
	[0.066]		[0.066]		[0.067]	
Post	-0.080*	-0.080*	-0.130***	-0.130***	0.005	0.005
	[0.046]	[0.046]	[0.045]	[0.045]	[0.047]	[0.047]
Constant	-0.079*	-0.106***	-0.086**	-0.095***	0.097**	0.112***
	[0.046]	[0.018]	[0.043]	[0.017]	[0.044]	[0.019]
N Observations	1712	1712	1712	1712	1712	1712
N Individuals	856	856	856	856	856	856
Individual FE	NO	YES	NO	YES	NO	YES
R-squared	0.012	0.030	0.017	0.033	0.031	0.065
Panel B	**Placebo-Tests**					
Treated x Post	0.046	0.043	0.051	0.070	0.060	0.059
	[0.071]	[0.071]	[0.070]	[0.071]	[0.080]	[0.080]
Treated	-0.028		0.056		-0.031	
	[0.069]		[0.066]		[0.069]	
Post	-0.078*	-0.078*	-0.127***	-0.127***	0.006	0.006
	[0.046]	[0.046]	[0.044]	[0.044]	[0.049]	[0.049]
Constant	-0.002	-0.013	-0.046	-0.026	0.010	-0.004
	[0.046]	[0.018]	[0.042]	[0.018]	[0.045]	[0.020]
N Observations	1688	1688	1689	1689	1685	1685
N Individuals	856	856	856	856	856	856
Individual FE	NO	YES	NO	YES	NO	YES
R-squared	0.001	0.004	0.005	0.011	0.000	0.001

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post" represents the student's age. In Panel A, "Post" is a dummy variable that takes the value of one if the age of the individual is 13/14 (this is pre-Reunification for the older cohort and post-Reunification for the younger cohort) and zero when aged 12/13 (i.e., pre-Reunification for both cohorts). "Treatment x Post" indicates changes in the outcome for the younger cohort, after versus before Reunification. In Panel B, we perform a placebo test that compares the change in outcomes of both cohorts in the pre-Reunification period to lend support to the parallel trend assumption.

Table 2.4: The Effect of Reunification by Gender

Panel A	**Main Results**					
	Anger		Anxiety		Self-Confidence	
	[1]	[2]	[3]	[4]	[5]	[6]
Treated x Post	0.300***	0.300***	0.302***	0.302***	-0.226**	-0.226**
	[0.110]	[0.109]	[0.099]	[0.099]	[0.109]	[0.109]
Treated x Post x Female	0.062	0.062	0.111	0.111	-0.392**	-0.392**
	[0.144]	[0.144]	[0.137]	[0.137]	[0.152]	[0.152]
Treated	-0.176*		-0.127		0.075	
	[0.100]		[0.095]		[0.094]	
Treated x Female	0.217		0.194		-0.074	
	[0.132]		[0.131]		[0.133]	
Post	-0.107	-0.107	-0.107	-0.107	-0.047	-0.047
	[0.071]	[0.071]	[0.066]	[0.066]	[0.067]	[0.067]
Post x Female	0.052	0.052	-0.044	-0.044	0.098	0.098
	[0.093]	[0.093]	[0.090]	[0.090]	[0.095]	[0.095]
Female	-0.360***		0.077		-0.106	
	[0.091]		[0.087]		[0.088]	
Constant	0.114	-0.106***	-0.127**	-0.095***	0.154**	0.112***
	[0.069]	[0.018]	[0.062]	[0.017]	[0.066]	[0.019]
N Observations	1712	1712	1712	1712	1712	1712
N Individuals	856	856	856	856	856	856
Individual FE	NO	YES	NO	YES	NO	YES
R-squared	0.031	0.031	0.029	0.034	0.046	0.073
Panel B	**Placebo-Tests**					
Treated x Post	0.166	0.145	0.060	0.082	0.156	0.141
	[0.106]	[0.107]	[0.108]	[0.109]	[0.104]	[0.105]
Treated x Post x Female	-0.221	-0.188	-0.016	-0.023	-0.179	-0.152
	[0.143]	[0.142]	[0.142]	[0.143]	[0.157]	[0.157]
Treated	-0.236**		-0.080		-0.030	
	[0.100]		[0.090]		[0.100]	
Treated x Female	0.389***		0.248*		0.002	
	[0.137]		[0.130]		[0.138]	
Post	-0.105	-0.105	-0.104	-0.104	-0.048	-0.048
	[0.072]	[0.072]	[0.065]	[0.065]	[0.069]	[0.069]
Post x Female	0.051	0.051	-0.043	-0.043	0.101	0.101
	[0.094]	[0.093]	[0.088]	[0.088]	[0.097]	[0.097]
Female	-0.366***		0.075		-0.109	
	[0.092]		[0.084]		[0.090]	
Constant	0.194***	-0.013	-0.086	-0.026	0.068	-0.004
	[0.070]	[0.018]	[0.060]	[0.018]	[0.067]	[0.020]
N Observations	1688	1688	1689	1689	1685	1685
N Individuals	856	856	856	856	856	856
Individual FE	NO	YES	NO	YES	NO	YES
R-squared	0.021	0.006	0.017	0.011	0.004	0.003

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post" represents the student's age. In Panel A, "Post" is a dummy variable that takes the value of one if the age of the individual is 13/14 (this is pre-Reunification for the older cohort and post-Reunification for the younger cohort) and zero when aged 12/13 (i.e., pre-Reunification for both cohorts). "Treatment x Post" indicates changes in the outcome for the younger cohort, after versus before Reunification. In Panel B, we perform a placebo test that compares the change in outcomes of both cohorts in the pre-Reunification period to lend support to the parallel trend assumption.

2.6 Long-run Behavior and Well-being

In this section, we study how the change in socio-emotional skills as young adolescents, due to the macro shock, transmit to their longer-run outcomes as young adults. In particular, we look at their behavior (externalizing, internalizing and control issues), their psychological health and well-being, and their long-run academic outcomes.

To analyze how the effect of the macro shock on SED is transmitted to longer-run outcomes, we link the change in each of the three socio-emotional skills (anger, anxiety, self-confidence) at the ages after versus before Reunification (Post-Pre) to outcomes approximately five years later. In each specification, we investigate the overall impact, as well as the differential impact by gender. In all specifications, we control for the pre-Reunification level of socio-emotional skills, a cohort ("treatment") dummy and a gender dummy and in the columns with gender interactions (columns (2), (4), (6)), we also interact each of these controls with the gender dummy.

We present the results in terms of externalizing and internalizing behavior and behavioral control problems in Table 2.5 and results for health, well-being and longer-run educational outcomes in Table 2.6, displaying only the main coefficients of interest, i.e., the coefficients on the change in socio-emotional skills, to analyze the impact on long-run outcomes, and the coefficients on the interaction of the change in socio-emotional skills with gender (for the full set of coefficients for each of the longer-run outcomes, see Appendix Tables B1 to B12). Columns (1) to (6) refer to the three socio-emotional skills (with the main effect of the change in anger in column (1) and female interaction in column (2), the main effect of the change in anxiety and female interaction in columns (3) and (4), and the main effect of the change in self-confidence and female interaction in columns (5) and (6)), while the different longer-run outcomes are displayed in different rows (for example, in Table 2.5, externalizing behaviors such as physical fights and destroying property appear in rows (1) and (2), internalizing behaviors such as suicidal thoughts and repeated suicidal thoughts in rows (3) and (4) and behavior control problems such as regular and heavy alcohol consumption and cigarette smoking in rows (5) to (7)).

2.6.1 Externalizing Behavior

To understand the impact of changes in SED on externalizing behavior as a young adult, we take into account two main measures: (1) *Physical fighting*, which captures whether

the individual has deliberately beaten or hurt someone. (2) *Destroying property*, which captures whether the individual has deliberately destroyed or damaged private or public property.

Table 2.5, row (1), shows that the level of physical fighting is strongly linked to changes in anger (columns (1)). In particular, a one-standard-deviation change in anger post versus pre-Reunification increases the likelihood of physical fighting by 4 percentage points (significant at the one percent level). Since about 8 percent of youths engage in physical fighting, this is equivalent to a 50 percent increase in physical fighting. This regression controls for the pre-Reunification level of anger, which is also strongly correlated with longer-run physical fighting, that is a pre-Reunification level that is one standard deviation higher increases longer-run physical fighting by 4.6 percentage points (see Online Appendix Table B1 for the full set of coefficients).

While male and female youths' socio-emotional skills (in particular anger and anxiety) are similarly affected by Reunification, the change in anger relates to the likelihood of physical fighting as a young adult only for male teenagers. The coefficient on the interaction of the change in anger with the girl dummy is -5.3 percentage points (significant at the 5 percent level) and thus nearly as large as the main coefficient on the change in anger (6.8 percentage points). From columns (3) to (6), we see that changes in anxiety and self-confidence do not influence the level of physical fighting, with coefficients close to zero.

The results in terms of destroying property are very similar (see row (2) of Table 2.5), in that engaging in the destruction of property is strongly linked to changes in anger (see column (1)), but only for male youths (see column (2)). In particular, a one-standard-deviation increase in anger increases the likelihood of destroying property by 4 percentage points in the full sample (significant on one percent). This effect is almost entirely driven by males, whose likelihood increases by 7 percentage points (significant at the one percent level), while the coefficient on the female interaction is -0.056 (significant at the 5 percent level). Changes in anxiety and self-confidence do not influence the incidence of destroying property in the pooled sample (see columns (3) to (6)).

To conclude, in terms of the impact of changes in SED on externalizing behavior as young adults, we find that the key relevant psychological measure is anger which is linked to fighting and property destruction, but only for male youths.

Table 2.5: Longer-Run Outcomes: Behavior

Explanatory Variable:	**Change in SED**					
	Anger		Anxiety		Self-Confidence	
	main coef.	female int.	main coef.	female int.	main coef.	female int.
Outcomes:						
Externalizing Behavior						
Fighting	0.041***		0.000		-0.003	
	[0.012]		[0.010]		[0.010]	
	0.068***	-0.053**	-0.002	0.006	0.012	-0.025
	[0.021]	[0.025]	[0.019]	[0.022]	[0.020]	[0.022]
Destroy Property	0.041***		-0.001		-0.007	
	[0.013]		[0.010]		[0.009]	
	0.071***	-0.056**	0.028	-0.047**	-0.008	-0.003
	[0.023]	[0.026]	[0.021]	[0.023]	[0.020]	[0.021]
Internalizing Behavior						
Suicidal thoughts	0.070***		0.040**		-0.050**	
	[0.019]		[0.020]		[0.019]	
	0.040	0.053	-0.006	0.071*	0.022	-0.110***
	[0.026]	[0.039]	[0.027]	[0.039]	[0.026]	[0.037]
Repeated Suicid. thoughts	0.021*		0.021*		-0.017	
	[0.011]		[0.012]		[0.012]	
	0.012	0.016	-0.017	0.063***	0.014	-0.046**
	[0.010]	[0.022]	[0.010]	[0.021]	[0.010]	[0.020]
Behavioral Control						
Alcohol regular	0.016		0.005		-0.005	
	[0.021]		[0.021]		[0.020]	
	0.054*	-0.073*	0.012	-0.013	0.000	-0.007
	[0.029]	[0.042]	[0.029]	[0.041]	[0.030]	[0.040]
Alcohol heavy	0.037*		0.026		0.020	
	[0.022]		[0.022]		[0.022]	
	0.066**	-0.055	0.056*	-0.053	0.040	-0.031
	[0.032]	[0.045]	[0.033]	[0.044]	[0.035]	[0.045]
Cigarette Smoking	0.058***		0.015		0.017	
	[0.022]		[0.022]		[0.021]	
	0.085***	-0.052	-0.011	0.042	0.061*	-0.067
	[0.032]	[0.045]	[0.034]	[0.045]	[0.033]	[0.043]

Notes: Standard errors are in brackets. The "main coefficient" is the coefficient on the change in the particular socio-emotional skill (i.e. anger, anxiety, or self-confidence, as indicated by the column) between age 12/13 to 13/14, i.e. prior versus post Reunification for the young cohort. The "female interaction" is the coefficient on the previously described variable (change in SED) interacted with a dummy for "female". All regressions include as controls the level of the relevant socio-emotional skill at age 12/13 (i.e. prior to Reunification for the young cohort), a "treatment" dummy, which is a dummy for being part of the young cohort, and a "female" dummy. Columns (2), (4), and (6) include further interactions between the "Pre-"level of the socio-emotional skill and "female" and between "treatment" and "female". The full set of coefficients, including all included controls for the relevant outcomes in this Table, are displayed in Online Appendix Tables B1 to B7.

2.6.2 Internalizing Behavior

To understand the impact of adverse shocks in adolescence on internalizing behavior, we measure individuals' suicidal tendencies, where (1) *Suicidal thoughts* capture whether the individual has thought of committing suicide at least once and (2) *Repeated suicidal thoughts* indicates whether the individual has had thoughts of committing suicide more than once. In Table 2.5, rows (3) and (4), we show that unlike the externalizing behavior effects, any impact of the shock on internalizing behavior is almost entirely driven by female youths, and all three socio-emotional skills are related to the longer-run propensity towards suicidal thoughts (see Online Appendix Tables B3 and B4 for the full set of coefficients).

Row (3) in Table 2.5 (columns (1) and (2)) shows that a one-standard-deviation increase in anger post versus pre-Reunification increases the likelihood of suicidal thoughts by 7 percentage points (equivalent to a 41-percent increase and significant at one percent). This effect does not significantly differ according to gender, but the point estimate is twice as large for girls. From columns (3) to (6), however, we do see that changes in anxiety and self-confidence are only related to suicidal thoughts for female youths. A change in anxiety level by one-standard deviation increases the likelihood of experiencing suicidal thoughts by 4 percentage points (significant at the 5 percent level). This is entirely driven by female youths (see column (4)), for whom the coefficient on the interaction term is 7 percentage points (while the main effect is zero), equivalent to an increase of 24 percent in girls' likelihood of experiencing suicidal thoughts. Moreover, a fall in self-confidence is strongly and significantly related to longer-run suicidal thoughts. A one-standard-deviation decrease in self-confidence increases the likelihood of suicidal thoughts by 5 percentage points (significant at the 5 percent level). Again, this effect is entirely driven by female youths for whom the coefficient on the interaction term is -11 percentage points(while the main effect is zero), equivalent to an increase the likelihood of experiencing suicidal thoughts of 38 percent (significant at the one percent level).

In Table 2.5, row (4), we see similar patterns when we focus instead on the likelihood of having repeated suicidal thoughts. Increases in anger or anxiety and decreases in self-confidence are linked to (repeated) suicidal thoughts in young adulthood, but only for females.

2.6.3 Behavioral Control Problems

In this section, we analyze the effect of changes in SED on later engagement in "risky" behavior – often referred to in the psychology literature as behavioral control issues. We focus on (1) *Alcohol consumption*, which was measured for the past three months and we distinguish between regular (versus irregular or no) alcohol consumption and heavy drinking (versus no heavy drinking), and (2) *Cigarette Smoking*, indicating whether the individual is a regular smoker.

Table 2.5, rows (5) and (6), displays the effect of changes in anger, anxiety and self-confidence on alcohol consumption.[7] We find that a change in anger is positively related to regular alcohol consumption leading to an increase of 5 percentage points, but only for male youths. When focusing on heavy alcohol consumption, we see even stronger effects. In particular, a one-standard-deviation increase in anger post versus pre-Reunification leads to an increased likelihood of heavy alcohol consumption of 7 percentage points for males, while the coefficient on the interaction tern of the change in anger with the female dummy is -6 percentage points (albeit not significant).

In terms of the effect of changes in SED on longer-run smoking behavior (see Table 2.5, row (7)), we find that the change in anger post versus pre-Reunification is strongly related to regular cigarette consumption. In particular, a one-standard-deviation change in the degree of anger increases the likelihood of smoking by 6 percentage points (equivalent to an increase of 17 percent and significant at 1 percent).

As in the cases of the other types of behavioral control problems and of externalizing behavior, the relationship between the change in anger and the likelihood of smoking is strongly driven by male youths, whose likelihood of smoking increases by 9 percentage points when anger increases by one standard deviation, while the coefficient on the change in anger when interacted with a female dummy is -5 percentage points. Additionally, as with externalizing behavior, the changes in anxiety and self-confidence are generally not related to longer-run behavioral control problems.

2.6.4 Health and Well-being

In this section, we relate changes in socio-emotional development due to Reunification to longer-run health and life satisfaction measures. Unlike the behavioral measures, these

[7] The full set of coefficients for behavioral control problems can be found in Online Appendix Tables B5 to B7.

measures potentially provide a useful summary of individual well-being. We consider two measures: (1) *Subjective health*, which refers to the current health status as perceived by the adolescent and (2) *Life satisfaction*, which measures the individual's life satisfaction in general.

For both measures, we find that changes in all SED measures are linked to later health/ well-being outcomes (see Table 2.6, rows (1) and (2)).[8] We find substantial negative effects of the increases in anger and anxiety, and the decrease in self-confidence on longer-run subjective health and life satisfaction. In the case of subjective health, a one-standard-deviation increase in anger post versus pre-Reunification decreases subjective health by 12 percent of a standard deviation, an increase in anxiety of the same magnitude decreases young adults' health status by 8 percent of a standard deviation and a one-standard-deviation decrease in self-confidence decreases subjective health by 9 percent of a standard deviation. Similarly, for life satisfaction, an increase in anger of one standard deviation reduces life satisfaction by 10 percent of a standard deviation, while similar increases in anxiety decrease satisfaction by 12 percent of a standard deviation. A fall of one standard deviation in self-confidence, reduces life satisfaction by 8 percent of a standard deviation.

Interestingly, the effects are similar for male and female youths. For subjective health as well as life satisfaction, most of the interaction terms with gender are close to zero and not significant (columns (2), (4) and (6)), with the exception of anxiety being more strongly linked with subjective health for women and self-confidence being more strongly linked with life satisfaction for men. Thus, while changes in SED due to adverse shocks are linked to behaviors (whether externalizing or internalizing) in very different ways for male and female youths, their longer-run impact on health and well-being appears to be very similar.

2.6.5 Long-run Academic Outcomes

We have shown so far that causal changes in socio-economic development affect longer-run behaviors and measures of health and well-being. In this last section, we ask whether changes in SED as an adolescent have lasting economic impacts. In particular, we analyze the effects of changes in SED on longer-run academic performance and individuals' likelihood of completing the "Abitur" degree, which is the entrance ticket to university and thus ultimately highly relevant for success in the labor and marriage market (see Card,

[8] The full set of coefficients can be found in Online Appendix Tables B8 and B9.

Table 2.6: Longer-Run Outcomes: Health and Academics

Explanatory Variable:	**Change in SED**					
	Anger		Anxiety		Self-Confidence	
	main coef.	female int.	main coef.	female int.	main coef.	female int.
Outcomes:						
Health & Well-being						
Subjective Health	-0.115**		-0.084*		0.085*	
	[0.045]		[0.044]		[0.045]	
	-0.138**	0.057	0.014	-0.162*	0.082	-0.013
	[0.064]	[0.089]	[0.061]	[0.088]	[0.068]	[0.092]
Life Satisfaction	-0.103**		-0.118***		0.083*	
	[0.044]		[0.043]		[0.043]	
	-0.100*	-0.001	-0.093	-0.043	-0.014	0.158*
	[0.059]	[0.088]	[0.067]	[0.088]	[0.062]	[0.086]
Academic Outcomes						
German Grade	-0.086*		-0.101**		0.053	
	[0.046]		[0.044]		[0.041]	
	-0.111*	0.058	-0.047	-0.084	-0.079	0.205**
	[0.065]	[0.092]	[0.069]	[0.090]	[0.064]	[0.083]
Math Grade	-0.072		-0.066		0.023	
	[0.048]		[0.044]		[0.043]	
	-0.128**	0.110	-0.084	0.028	0.034	-0.017
	[0.065]	[0.097]	[0.073]	[0.092]	[0.071]	[0.090]
Abitur Degree	-0.044*		-0.050**		0.003	
	[0.023]		[0.022]		[0.022]	
	-0.046	0.001	-0.049	-0.004	-0.031	0.058
	[0.032]	[0.047]	[0.036]	[0.045]	[0.034]	[0.044]

Notes: Standard errors are in brackets. The "main coefficient" is the coefficient on the change in the particular socio-emotional skill (i.e. anger, anxiety, or self-confidence, as indicated by the column) between age 12/13 to 13/14, i.e. prior versus post Reunification for the young cohort. The "female interaction" is the coefficient on the previously described variable (change in SED) interacted with a dummy for "female". All regressions include as controls the level of the relevant socio-emotional skill at age 12/13 (i.e. prior to Reunification for the young cohort), a "treatment" dummy, which is a dummy for being part of the young cohort, and a "female" dummy. Columns (2), (4), and (6) include further interactions between the "Pre-"level of the socio-emotional skill and "female" and between "treatment" and "female". The full set of coefficients, including all included controls for the relevant outcomes in this Table, are displayed in Online Appendix Tables B1 to B7.

1999, for a survey on the returns to education in the labor market and Kaufmann et al., 2015 on the returns to education in the marriage market).

In Table 2.6, rows (3) and (4), we display the effect of a change in socio-emotional skills on German and math grades in grade 10, which is the last grade of compulsory education so that we have data on the performance for all individuals.[9] Changes in anger and in anxiety

[9]The full set of coefficients on long-run academic outcomes can be found in Online Appendix Tables B10 to B12.

are negatively related to individuals' GPA. A one-standard-deviation increase in anger (anxiety) decreases the grade in German by 9 (10) percent of a standard deviation.The effects run in the same direction for math but are not statistically significant. Changes in self-confidence are not significantly related to German or math grades for the pooled sample.

These effects are relatively similar for female and male youths (only one of the six gender interactions is significantly different from zero). One notable difference is that a reduction in self-confidence is linked to a worse German grade, but only for female youths. In particular, a one-standard-deviation decrease in self-confidence reduces the German grade of female adolescents by 21 percent of a standard deviation, but has no effect on male youths. Increases in anger, on the other hand, appear more strongly linked to worse math grades for male youths (a one-standard-deviation increase in anger reduces the math grade by 13 percent of a standard deviation), while the female interaction is +11 percent (albeit not significant), so that there is no significant effect for females.

Lastly, we investigate the longer-run effects of the change in SED on individuals' likelihood of obtaining the "Abitur", which is the school-leaving certificate for the highest educational track, namely, the academic track, and a requirement for university entry. For the likelihood of Abitur completion, we find that changes in anger and anxiety have substantial and significant effects on the likelihood of Abitur completion (see Table 2.6, row (5)). A one-standard-deviation increase in anger (anxiety) decreases the likelihood of obtaining the Abitur by 4.4 (5) percentage points, which is equivalent to a decrease of 18 (22) percent. The effects of changes in anger and anxiety on Abitur completion are very similar for male and female youths.

2.7 Conclusion

In this paper, we identify the long-run impacts of a macro shock on young adults' behaviors as well as health and educational outcomes, propagated via causal changes induced by the shock on their socio-emotional development as adolescents. We document that short-run effects on socio-emotional development, as well as longer-run effects on health, well-being and educational success are similar for both, girls and boys, despite the common perception that males are more strongly impacted by (negative) circumstances or changes in their environment. While our results support the "fragile male" hypothesis if attention is restricted to certain behaviors/outcomes, by broadening our focus, we show that negative effects on

socio-emotional skills *manifest* themselves in very different ways by gender. In particular, adverse shocks and circumstances negatively affect externalizing and self-control (risky) behaviors, but only (or mostly) for boys, as predicted by the "fragile male" hypothesis. However, it is important to take into account that for girls (and only for them), internalizing behaviors related to mental health problems are instead strongly impacted. Ultimately, in the longer run, (adverse) changes in socio-emotional development have similarly negative impacts on subjective health measures and life satisfaction as well as educational success.

From a policy perspective, our study highlights a number of important results. First, our study provides evidence for a causal link between uncertainty and youths' socio-emotional development. We show that, among early-adolescent East Germans, anger, anxiety and self-confidence changed substantially within a relatively short time span from before to after Reunification (using as a counterfactual trend, the development of a slightly older cohort between the same ages). Second, these changes had a lasting impact on these adolescents, impacting their outcomes as young adults. These findings highlight the importance of studying and promoting socio-emotional development at early ages. Third, focusing on gender differences, we show that similar shocks to socio-emotional development affect the behavior of boys and girls very differently. This is also important from the point of view of policy, as it suggests that careful targeting is needed. While a great deal of attention has been paid to particular problems related to the externalizing behavior of boys, especially in the classroom, less attention has been given to severe problems in internalizing behavior (related to mental-health problems) in girls. However, as we highlight, both externalizing behaviors and self-control problems, as well as internalizing behaviors related to mental-health problems, are detrimental in the short run and appear similarly relevant for longer-run health, well-being and (educational) success.

Chapter 3

Fertility Peer Effects

joint with Katja Maria Kaufmann[*]

3.1 Introduction

Decisions of family formation, such as entering a committed relationship or parenthood, are among the most important and long-lasting decisions of an individual. Their consequences range from labor market outcomes (in particular for women, see e.g. Kleven et al., 2019) to well-being (see e.g. Bertrand, 2013). The effects of childbirth on different areas of life can be influenced by the social environment of an individual. For example, a parent's labor supply decision could depend on whether extended family members such as grandparents or siblings can provide support in terms of time and resources (see e.g. Kaptijn et al., 2010; Thomese and Liefbroer, 2013). Further, the social environment can directly affect preferences for children and the timing of childbirth due to different mechanisms like social learning, pressure, or emotional contagion (see e.g. Bernardi and Klaerner, 2014).

In this paper, we answer the question of whether there are family spillovers in fertility decisions. In particular, we are interested in whether an individual's decision about when to have the first child is influenced by her sibling, and what the underlying mechanisms for this relationship are.

There is a large literature on the existence of peer effects, in the context of classmates or friends, in a number of areas (e.g. for smoking behavior among youth see Powell et al., 2005; for academic achievement see Lin, 2010; for household consumption see De Giorgi et al., 2019; for residential choices see Patacchini and Arduini, 2016). Relationships between family members, such as siblings or cousins, differ from relationships among friends or colleagues. Since, in contrast to other peers, an individual cannot self-select into the own

[*]Department of Economics, Johannes Gutenberg University Mainz, briq, CESifo, HCEO and IZA

family, family peers compose a special peer group. The literature on the existence of family and in particular sibling spillovers is more limited (recent exceptions are in the areas of education see e.g. Nicoletti and Rabe, 2019; or labor supply, see e.g. Nicoletti et al., 2018).

The main challenge in peer effect analyses is to distinguish between different sources leading to similar outcomes of individuals within the considered reference group (Manski, 1993). In the recent literature peer effects are well-identified using randomized peer groups (e.g. Sacerdote, 2001), quasi-random cohort variation (e.g. Hoxby, 2000), or via partially overlapping peer groups (see e.g. De Giorgi et al., 2019). However, well-identified literature on peer effects in the fertility decision is limited, with only a few papers focusing on teen fertility. In the context of teenage siblings, Monstad et al. (2011) exploit an educational reform affecting only one sibling to provide evidence on contagion effects from the older sisters' teenage pregnancy on the younger sister. Using the age of menarche and miscarriages as instruments, Yakusheva and Fletcher (2015) and Fletcher and Yakusheva (2016) document spillovers in the likelihood of teenage pregnancy among high-school friends.

Spillovers in the context of adult fertility have been so far mainly investigated by sociologists. Balbo and Barban (2014) use a series of discrete-time event history models to show that a friend's childbearing increases the own risk of entering parenthood, peaking around two years after the friend gives birth and declining afterward. Similarly, but in the context of family peers, Lyngstad and Prskawetz (2010) use continuous-time hazard models to describe woman's births' depending on their siblings' fertility history. They find that within the first 12 months after a sibling gives birth, the own hazard of conception increases every month and turns negative in the second and third year. While these two papers don't explicitly tackle the identification problem analytically, but rather argue why in their context identification assumptions hold, Buyukkececi et al. (2020) exploit information on different peer groups to reach identification. They use Dutch data to show that fertility peer effects accumulate across different interaction groups. Comparing siblings' and co-workers' influence, they show that women are influenced more by their sibling (irrespective of the gender) as opposed to their female co-workers.

The economics literature on fertility peer effects is scarce.[1] Modeling fertility decision in a game theory context where women strategically interact with their coworkers, Ciliberto et al. (2016) show that the workplace composition of a woman is an important factor of fertility. In particular, they document positive effects across worker types as defined by

[1]For an overview on how to introduce social interactions into standard economic models of fertility see Kohler et al. (2001)

age or education, and find negative peer effects within age types and among low educated coworkers. Focusing on neighborhoods Morales (2015) provides evidence for positive peer effects on the age of entering motherhood. Instead of peer effects itself, Mishra and Parasnis (2017) focus on the mechanism behind fertility spillovers and show that the preference to conform as well as education are important mediators. Observing higher fertility among immediate peers, both in terms of geography and religion, increases the preference for more children. The importance of family peers as defined by siblings is considered by Kuziemko (2006), who distinguishes between information and cost-sharing motives and shows that within the first two years of a sibling giving birth, fertility patterns are contagious. Nicoletti et al. (2018) extend the family peer definition to include cousins, to document positive spillovers in the context of labor supply decisions of women after entering motherhood.

With this paper, we contribute to this literature by providing well-identified causal evidence on the existence of family peer effects in adult fertility decisions. Rich administrative data allow us to look beyond teen fertility, which makes up a small fraction of pregnancies and where the social environment is likely to play a different role. We shed light on peer effects among siblings, who compose a particularly close peer group and thus are likely to affect each other in important decisions such as fertility.

One prominent mechanism of social interactions is information sharing/ learning from peers. This channel is more pronounced when individuals are uninformed or uncertain about the exact consequences of a decision. Therefore, we focus only on first births, that is, the decision on when to enter parenthood. We document positive spillovers for women starting one year after a sibling gives birth, with effects persisting at least up to two-and-a-half years after sibling's birth. For men, spillovers take more time to realize, in particular at least two-and-a-half years. Overall, a sibling's birth within the last two years can almost quadruple the probability of becoming and mother, and triple the likelihood of becoming a father in any given quarter.

There are different reasons why a sibling's fertility could lead to spillovers. Social effects driven by fertility preferences can lead to two opposing effects. First, positive spillovers will occur if the underlying mechanism is the desire to conform with the sibling. Second, it will lead to negative spillovers if an individual prefers to be different from the sibling. Our results indicate that the desire to conform is more likely since spillovers are in general positive, and even stronger in case of same gender (men with brothers) and small age difference (women with siblings up to one year age difference). Another mechanism can work via parents pressuring for grandparents so that a sibling giving birth would lead to

two possible effects. Either positive spillovers via increased pressure to conform can occur, or negative spillovers due to decreased pressure occur when grandparents are satisfied after the arrival of the first grandchild. In our main results, we document positive spillovers, so that the increased pressure (or desire) to conform as an underlying mechanism seems to dominate.

By analyzing how effects depend on help by the extended family, we find that spillovers are stronger for both men and women, in the case support by the grandmother in terms of time and geography is available. Also, tight connections to the labor market as measured by being the main breadwinner of the household leads to weaker and in some cases even negative spillovers.

The remainder of the paper is structured as follows. In Section 3.2, we describe the data, the sample used throughout the analysis, and variables. We continue with a detailed description of the identification and estimation strategy in Section 3.3. Main results are discussed in Section 3.4, and extended by heterogeneous results in Section 3.5. Section 3.7 concludes.

3.2 Data

3.2.1 Data and Sample Description

In the following analysis, we use dutch administrative data maintained by Statistics Netherlands (Centraal Bureau voor de Statistiek, CBS). The municipal register data (Gemeentelijke Basis Administratie, GBA), which records every person living in the Netherlands, contains information that allows us to follow families across generations and over time. In 1994, the register data was digitized and provide information, including among other things, on birth records, marriage histories, education, labor market status, and neighborhood of residence.

Linking individuals to their parents, we define siblings based on having the same mother.[2] In the analysis, we focus on sibships of two, that is individuals with only one brother or sister. Including sibships of more than two requires a more complex setup, including potential snowball effects between multiple siblings' births. Using birth records, we link individuals to their children, in case they have any. Restricting the age between

[2]Conditioning sibship on both, having the same mother and father only slightly decreases the sample size. The main reason why we do not condition additionally on having the same father is, this leads in some cases to very large age differences between siblings.

20 and 40, we create a rolling panel over the calendar quarters of the years 1999 to 2017.[3] We set the minimum age to 20 to avoid capturing teenage fertility and exclude those over 40 since by then entry into parenthood is likely to be realized (in Appendix in Figure C.1 we show that dutch men and women enter parenthood on average when they are 29 to 31 years old). In addition, for identification purposes, observations in which siblings report to live in the same neighborhood in a given quarter are excluded from the analysis (for details see 3.3.1).

Our main sample thus includes all individuals born between 1975 and 1985 who can be linked to their mother and have only one sibling. Doing so, by construction, the maximum age difference between siblings cannot exceed ten years. Both birth records and household register, are translated such that for each quarter between 1999 and 2017, we know whether a birth occurred, the individual is married or cohabiting, and the neighborhood in which the individual is residing. The first panel-year (1999) includes only individuals born in 1975-1979. Until 2005, every year, an additional cohort enters the sample and starting in 2016, every year, the birth cohort exceeding the age of 40 exits the sample. This setup gives us overall 117,618 sibling pairs, of which approximately 36% are sister-sister pairs, 36% are brother-brother pairs, and 28% are mixed gender sibling pairs.

3.2.2 Variable Description

The main outcome of interest indicates whether a birth occurred in a given quarter of a year, wherein we only consider the first birth to an individual. Hereby our main individual of interest is the sibling who gave birth as second within her sibship. To investigate potential spillovers from the sibling giving birth first on the main individual, we include the sibling's fertility history over the past two years. In particular, we include indicators taking the value of one in case the sibling entered parenthood in half-year intervals from current up to two-and-a-half years ago (i.e.up to half a year ago, half to one year ago, etc.).

Additional controls include current marriage and cohabitation status, age and its squared, and years of completed education. We include these controls for the main individual as well as the sibling. Further, in addition to neighborhood fertility, we include neighborhood averages for all control variables. Hereby only relevant neighbors, as defined by women (or men) between the age of 20 and 40 living in the same neighborhood at a

[3]Data is available starting in 1995, however, information on the level of education is only available starting in 1999 so that we exclude the first four years available to us.

given time, are considered. Neighborhood fertility is defined as the fraction of relevant neighbors giving birth to their first child in a given quarter.

3.2.3 Summary Statistics

In Table 3.1, we report summary statistics of birth outcomes belonging to the main individual, her sibling, and her neighborhood. The first column reports summary statistics for the female sample, and the second column reports statistics for the male sample.

In total, around 48% of the women and 39% of men in our sample enter into parenthood within the observed time. Over the sample period, on average 1% of women enter motherhood in any quarter, and 0.8% of men become a father in any given quarter. With 1.4%, quarterly sibling fertility is slightly higher than individual fertility, which is mainly driven by construction, i.e. defining the main individual as the sibling giving birth second (if at all). Overall, sibling fertility histories over the past two years are quite constant around 3% in each half-year and comparable for women and men.

The Netherlands is divided into twelve provinces, which are further sub-divided into more than 350 municipalities ("gemeenten"). Each municipality consists of up to a hundred districts ("wijk"), which is an aggregation of neighborhoods ("buurt"). These neighborhoods are slightly more aggregate than postcodes[4] and are the regional level on which we define neighborhoods. Each individual in our sample has on average around 560 relevant neighbors in a given quarter. In each quarter, around 41% of women's neighbors give birth to their first child, while only around 30% of men's relevant neighbors enter fatherhood.

In Table 3.2, we report summary statistics of individual characteristics, and variables used for heterogeneity analyses. Of the main individuals considered, that is, the sibling who gives birth second, around 60% of both women and men, are the younger sibling in the family. The majority of the sample has a sister so that the female sample consists of more sister-sister pairs, while for men opposite gender pairs are more common. In terms of an age difference, 11% of both women and men have a sibling that is close in age (i.e. up to one year difference), while 21% have siblings who are at least four years older or younger.

Since almost all individuals between the ages of 20 and 40 actively participate in the labor market, we focus on being the main breadwinner of the household to differentiate

[4]In 2017, a neighborhood summarized on average seven five-digit postcodes, and includes on average 1,500 individuals.

Table 3.1: Descriptive Statistics: Entry into Parenthood

	Enter Parenthood	
	Women	Men
Quarterly likelihood of		
Main Individual	0.0097	0.0082
	[0.0982]	[0.0904]
Sibling	0.0143	0.0145
	[0.1187]	[0.1195]
Sibling's likelihood		
up to half-year ago	0.0288	0.0292
	[0.1671]	[0.1684]
half to 1 year ago	0.0294	0.0299
	[0.1689]	[0.1702]
1 to 1.5 years ago	0.0299	0.0303
	[0.1702]	[0.1715]
1.5 to 2 years ago	0.0301	0.0306
	[0.1709]	[0.1721]
Average Neighborhood entry		
up to half-year ago	0.4132	0.2995
	[0.1342]	[0.1089]
half to 1 year ago	0.4134	0.3004
	[0.1352]	[0.1093]
1 to 1.5 years ago	0.4137	0.3015
	[0.1362]	[0.1098]
1.5 to 2 years ago	0.4141	0.3026
	[0.1373]	[0.1103]
N Individual	77,372	100,246

effects by labor market attachment. Around half of the women in our sample and 75% of men are the main breadwinners of their household at some point over the observed period. For both women and men, 41% have a mother (grandmother to child born) that is not active in the labor market. The majority of individuals (75% of women and 70 % of men) live in a neighborhood other than the grandmother. Approximately 20% of women and men have a sibling living in the same neighborhood as the grandmother. After excluding sibling pairs living in the same neighborhood, we find that less than 10% of women and men live in the same district as their sibling.

Table 3.2: Variable Description - Characteristics

	Women	Men
Individual Characteristics		
Sibling is male	0.4556	0.4182
	[0.4980]	[0.4933]
Individual is younger sibling	0.6362	0.5890
	[0.4811]	[0.4920]
Age difference of siblings up to 1 year	0.1101	0.1110
	[0.3131]	[0.3142]
Age difference of siblings at least 4 year	0.2152	0.2082
	[0.4109]	[0.4060]
Individual lives in sibling's district	0.0839	0.0912
	[0.2772]	[0.2879]
N Individual	77,372	100,246
Individual is main breadwinner	0.5261	0.7419
	[0.4993]	[0.4376]
N Individual	74,085	95,678
Grandmother		
is retired	0.4137	0.4161
	[0.4925]	[0.4929]
N Individual	72,226	92,882
lives in same neighborhood	0.2435	0.2912
	[0.4292]	[0.4543]
lives in sibling's neighborhood	0.1992	0.1819
	[0.3994]	[0.3858]
N Individual	76,935	99,642

3.3 Empirical Implementation

An individual's decision to enter parenthood can be modeled, using a utility-based choice model as introduced by McFadden (1974). Let the latent utility of an individual i at time t be denoted by U_{it}^*. Assuming this utility is an additively separable function of individual, family and neighborhood characteristics, and siblings' fertility choice, individual i decides to enter parenthood, $y_{it} = 1$, whenever her utility from doing so is positive, i.e. $U_{it}^*(X_{it}, y_{st}) > 0$. We exploit the order in which siblings give birth so that the sibling's

decision is already made and known by the individual.[5] Also, by ordering siblings according to their fertility history rather than age, we are not restricting the direction of the effect, meaning a younger sibling can influence the older one, but the reverse is possible as well.

In our reduced-form application, we use a linear-in-means approximation frequently used in the peer effects literature, and allow individual i's fertility decision to depend on different timings of the siblings' outcome:

$$y_{it} = \beta_1 y_{s,\overrightarrow{t-1}} + \sum_{k \in K} \beta_k y_{s,\overrightarrow{t-k}} + \gamma_0 \bar{y}_{-it} + X'_{it}\alpha + X'_{st}\alpha^{\mathbf{s}} + \bar{X}'_{-it}\alpha^{\mathbf{n}} + \eta_i + \delta_t + u_{it} \qquad (3.1)$$

where $y_{it} = \mathbb{1}\{\ birth_{it} = 1\}$ indicates i becoming a parent in quarter t; $y_{s,\overrightarrow{t-1}}$ indicates that sibling s entered parenthood at some point up to and including quarter $t-1$, so that $y_{s,\overrightarrow{t-k}}$ with $k \in K = \{3, 5, 7\}$ captures the siblings fertility over the past two years; $\bar{y}_{-it} = \frac{1}{N_{it}} \sum_{j \in N_{it}} y_{jt}$ measures the fraction of i's relevant peers entering parenthood in quarter t (excluding individual i); X includes marriage and cohabitation status, age and age squared, and years of education so that X_s and $\bar{X}$ refer to sibling and average neighborhood characteristics, respectively; δ_t captures separately year and seasonality trends; η_i are time-constant individual level unobservables; u_{it} is an error term.

The main challenge in estimating peer effects is to isolate the direct influence of the considered peers' outcome, here sibling, on the individual (Manski, 1993). A correlation in siblings' outcomes could be due to the direct influence (*endogenous effect*), but could also be due to peer characteristics or unobserved shocks affecting both the individual and her peers. In our context, siblings not only share genetics but also usually grow up together facing the same parenting and norms, which could be leading to similar fertility preferences and outcomes (*exogenous effect*). Similar sibling outcomes could also arise due to unobserved shocks affecting both siblings, such as sorting into similar (family-friendly) neighborhoods (*correlated effect*).

To overcome the *reflection problem* (isolate the different effects) between individual i and sibling s, in addition to exploiting the natural timing of births, we use an instrumental variable strategy that exploits partially overlapping peer groups. Assuming that each individual interacts with her sibling and neighbors, but not with the neighbors of her sibling, the latter can be used to instrument the siblings' fertility. This approach is a common way of solving the endogeneity problem in the context of peer effects proposed

[5] Alternatively, one could model a strategic game allowing siblings to simultaneously decide when to enter parenthood as Ciliberto et al. (2016) do it in the context of co-workers.

and employed, among others, by Bramoullé et al. (2009), De Giorgi et al. (2010), and Blume et al. (2015).[6] The instrument exploits that an individual is more likely to enter parenthood, with more neighbors becoming parents (for neighborhood peer effects on fertility outcomes see e.g. Morales, 2015; Nicoletti et al., 2018). Which means, the first stage estimates how the sibling's neighbors affect the sibling's entry into parenthood. In each regression, we instrument four endogenous variables (sibling's fertility history for the last two years) and report under- and weak identification statistics (see Kleibergen and Paap, 2006, for details). The first tests the relevance of instruments, by testing the matrix rank, and the second, given that the instruments are relevant, tests whether the instruments are weak.

We control for time-constant individual (and family) level unobservables using first-differences. In all regressions, standard errors are clustered on individual level.[7] The main parameters of interest are the β's in equation 3.1 capturing the direct effect of the sibling's outcome (*endogenous effect*). Correlated effects would confound results if u_{it} includes unobserved shocks on family or neighborhood level, we discuss this concern in the next section.

3.3.1 Threats to Identification

There are four potential threats to the identification strategy used. First, if siblings have similar residential preferences leading them to sort into similar neighborhoods, this would lead to an overestimation of any sibling spillover effect. In this case, observed spillovers would be due to selection rather than endogenous behavior contagion. Controlling for characteristics of the own neighborhood ($\bar{X}'_{-it}$) makes sure that effects are net of similarities in residential areas.

Second, if individuals know the neighbors of their sibling, our instruments lose their exogeneity. This would occur, for instance, if both siblings live in the same neighborhood and thus interact with the same people. To make sure that this does not happen, we exclude all observations in which siblings report to live in the same neighborhood at a given time. Another concern might be that one sibling still lives in the neighborhood both siblings grew up in, wherein the other moved away. Since they don't live in the same neighborhood they

[6] Alternatively, exogenous peer group variations could be used. In the context of siblings, this would require quasi-random variation in the entry into parenthood of one sibling. Monstad et al. (2011), for instance, exploit an educational reform which affected only the older sibling to provide evidence on within families spillovers in teen births.

[7] The results are robust to using two-way clustering on individual and neighborhood level.

are included in the sample. However, if the sibling that moved away still is in contact with some past neighbors (e.g. old school or cohort mates), the exogeneity of the instruments would be threatened, and it would also lead to an overestimation of any sibling spillover. However, this would only occur if both the sibling and the childhood neighbors the main individual was in contact with, stayed in the same neighborhood until adulthood.[8]

Third, potential feedback or reversed causality effects could lead siblings to influence their neighbors. This would lead to a correlation of the error term of the main equation with the instruments. We circumvent this by exploiting the timing of births, for both siblings and the relevant neighbors of the sibling, we consider the first child. Given this, the natural time between fertility decision and actual realization of birth solves reversed causality concerns.

Last, there could be correlated shocks affecting both siblings and some of their neighbors. Imagine a situation in which a big firm, employing a large group of individuals, introduces a change in their maternity/ paternity leave regulations. If siblings live in the same district or municipality and the firm is covering a large fraction of this area, these firm-level changes would confound results by affecting the instruments and individuals at the same time. We test for this by including regional fixed effects and can show that our findings are robust to aggregate level shocks on municipal, district, and neighborhood levels.

3.4 Main Results

In Table 3.3, we report our main estimation results based on a linear in means model with individual, year, and quarter fixed effects (as described by equation (3.1)). In particular, we present separately for women (columns [1]-[3]) and men (columns [4]-[6]) three specifications estimating sibling spillovers in the entry into parenthood. Column [1] and [3] report results based on ordinary least squares (OLS) estimations for the sample of women and men, respectively. Results in columns [2], [3], [5], and [6] are based on two different specifications estimated via two-stage least squares (2SLS).

In columns [1], [2], [4], and [5] sibling's entry into fertility is considered within the past

[8]The register data is available starting from 1995 so that we are only able to link the younger part of our sample to their childhood neighborhoods. In particular, suppose the relevant childhood neighborhood refers to when the individual was 12 to 13, this would allow us to link less than half of our sample since the oldest cohort would be those born in 1983.

two years, and columns [3] and [6] include an additional lag allowing spillovers also up to two-and-a-half years after entry into parenthood. In all specifications, we control for marital and cohabitation status, age, and years of education of the main individual, the sibling, and average levels in the neighborhood of the individual (for the full set of results, see Table C1).

Table 3.3: Sibling Spillover - Main Results

Outcome:	**Become Mother**			**Become Father**		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	[1]	[2]	[3]	[4]	[5]	[6]
Sibling gave birth						
up to half year ago	0.014***	-0.014	-0.015	0.008***	0.007	0.007
	[0.000]	[0.009]	[0.009]	[0.000]	[0.008]	[0.008]
half to 1 year ago	0.019***	0.005	0.003	0.012***	0.005	0.003
	[0.001]	[0.009]	[0.010]	[0.000]	[0.008]	[0.008]
1 to 1.5 years ago	0.018***	0.021**	0.018*	0.012***	0.001	0.001
	[0.001]	[0.009]	[0.010]	[0.000]	[0.008]	[0.008]
1.5 to 2 years ago	0.017***	0.027***	0.024**	0.011***	-0.005	-0.006
	[0.001]	[0.010]	[0.010]	[0.000]	[0.008]	[0.008]
2 to 2.5 years ago			0.024**			0.016*
			[0.011]			[0.008]
N Observations	3,017,119	3,015,409	2,892,002	3,741,811	3,739,450	3,582,263
N Individuals	77,382	77,372	76,987	100,256	100,246	99,640
Statistics						
Under-identification		884.32	811.07		776.06	709.45
p-value		0.0000	0.0000		0.0000	0.0000
Weak-identification		232.37	170.10		199.20	144.98

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Standard errors are clustered on the individual level. Dependent variable: columns [1]-[3] enter motherhood, columns [4]-[6] enter fatherhood. Individual controls: marriage and cohabitation status, age, age squared, and years of education. Contextual controls for sibling: an analog of individual controls. Contextual controls for neighbors: entry into parenthood, become a parent, marriage and cohabitation status, age, and years of education. IV's used in columns [2], [3], [5], and [6]: average neighborhood entry into parenthood in sibling's neighborhood in each half-year within two years ([2] and [5]), and within two-and-a-half years ([3] and [6]). In each regression, we control for year and quarter fixed effects. For the full results including controls see Table C1.

The OLS results show that entry into parenthood is by 1-2 percentage points more likely in case a sibling became a parent in any half-year up to and including the past two years. These effects prevail for both women and men, albeit slightly stronger for women. These results, in particular, the coefficient of up to half a year ago, give the impression that siblings plan their entry into parenthood jointly. However, these results are likely to

be upward biased due to the reflection problem (see Manski, 1993). To correct for the endogeneity between siblings' decisions and obtain causal effects, we instrument lagged outcomes of the sibling using their neighborhood fertility. In particular, we instrument the sibling's fertility outcome in a given half year by the fraction of the sibling's relevant neighbors entering parenthood. The reported under-identification statistics are significant on at least 1% for all 2SLS specifications confirming the relevance of the instruments used in the first stage. The weak identification statistics are all above 100 so that we are not concerned about a big bias due to weak instruments.

The 2SLS estimates for a woman's sibling giving birth up to one year ago turn insignificant. Starting from the past one year, in any half-year that a woman's sibling gives birth, the likelihood of becoming a mother increases by 2-2.7 percentage points. Given the baseline probability of becoming a mother in any quarter of 1 percent, these effects are quite sizable. This longer response time suggests that women exploit the sibling's experience to ease their uncertainty about entering parenthood. That effects are zero up to and including the first year after a sibling's birth, reduces the chances that the underlying mechanism is a joint decision to enter parenthood. In the sense that siblings could plan to enter parenthood at the same time, but not be successful at the same time.

For men, in contrast to correlations presented in column [4], we do not find sibling spillovers within the first two years after a sibling enters parenthood. However, two to two-and-a-half years after a sibling becomes a parent, the likelihood of becoming a father increases by 1.6 percentage points, tripling the initial likelihood of 0.8% in any given quarter (though only on 10%).

Comparing OLS to 2SLS results, it seems that, especially for men, similar fertility behavior among siblings within one year from each other is mainly driven by similar background and preferences. Men are not only less prone to direct spillovers but also take more time to respond to their sibling's fertility as compared to women. To understand these patterns and investigate potential mechanisms underlying these contagion effects, we provide a heterogeneity analysis in the next section.

3.5 Heterogeneous Results

In this section, we study how the effect of a sibling giving birth within the last two years differs by the gender composition of siblings, the age and age difference, and the availability of the grandmother (i.e. the mother of the individual). For this, we estimate the 2SLS

specification in column [2] of Table 3.3 for women and column [5] of Table 3.3 for men, allowing each sibling birth outcome to differ by the considered characteristic.

Heterogeneous results by gender and age for the female sample can be found in columns [1]-[4] of Table 3.4, and for the male sample results by gender and age are reported in columns [5]-[8]. Columns [1] and [5] of Table 3.5, document differences by labor market attachment for women and men, respectively. In columns [2]-[4] and [6]-[8] of Table 3.5, we allow spillovers to differ by the availability of the grandmother for women and men, respectively.

3.5.1 Results by Gender

The main results show that women are generally more prone to sibling spillover in fertility decisions as opposed to men. Hereby, column [1] of Table 3.4 shows irrespective of having a brother or a sister, one-and-a-half to two years after the sibling becomes a mother/ father women are on average 3.6 percentage points more likely to become a mother. For men, on the other hand, in general, there are no spillovers within the first two years of a sibling entering parenthood. However, allowing this effect to differ by the sibling's gender, we find that having a brother, as opposed to having a sister, entering parenthood within the last half-year, increases the likelihood of becoming a father by 3.4 percentage points (column [5] of Table 3.4). Note that given the quarterly likelihood of becoming a mother of 1% and becoming a father of 0.8%, the average spillover among brother is stronger than the average spillover on a woman (irrespective of her sibling's gender) reported in Table 3.3.

This difference between men and women could indicate different underlying channels leading to spillovers. For women irrespective of the gender, it takes around one to two years to respond to sibling fertility. This could indicate that observing and learning for the sibling's (or the sibling's partner's) experience is important. For men, on the other hand, having a brother become a father leads to a spillover within the first half-year, which could, for instance, indicate a preference to have a child grow up with his/ her cousins, or sharing resources with the sibling (such as child care).

3.5.2 Results by Age

Since fertility decreases with age (in particular for women), the age difference between siblings could be of importance. Siblings that have a high age difference are unlikely to influence each other if the main driving channel is a homophily argument, in the sense

Table 3.4: Heterogeneous Results: Gender and Age

Outcome:	**Become Mother**				**Become Father**			
	Individual		Age difference		Individual		Age difference	
het. Var.:	has a brother	is at least 35	up to 1 year	more than 4 years	has a brother	is at least 35	up to 1 year	more than 4 years
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Sibling gave birth								
up to half year ago	-0.018	-0.014	-0.014	-0.011	-0.006	0.008	0.007	0.007
	[0.012]	[0.009]	[0.009]	[0.009]	[0.010]	[0.008]	[0.008]	[0.008]
x het. var.	0.011	0.001	-0.009	-0.017	0.034**	0.003***	0.004	-0.002
	[0.018]	[0.000]	[0.018]	[0.014]	[0.016]	[0.000]	[0.015]	[0.011]
half to 1 year ago	-0.006	0.006	0.008	0.007	0.003	0.006	0.002	0.008
	[0.012]	[0.009]	[0.009]	[0.010]	[0.010]	[0.008]	[0.008]	[0.008]
x het. var.	0.028	-0.001	-0.021	-0.013	0.006	0.002***	0.024	-0.011
	[0.018]	[0.000]	[0.024]	[0.016]	[0.016]	[0.000]	[0.019]	[0.014]
1 to 1.5 years ago	0.013	0.020**	0.018*	0.029***	0.004	0.001	-0.002	0.007
	[0.012]	[0.009]	[0.010]	[0.010]	[0.010]	[0.008]	[0.008]	[0.008]
x het. var.	0.019	-0.002***	0.036	-0.039**	-0.005	0.000	0.035	-0.028**
	[0.019]	[0.000]	[0.026]	[0.016]	[0.016]	[0.000]	[0.021]	[0.014]
1.5 to 2 years ago	0.036***	0.026***	0.021**	0.036***	-0.010	-0.005	-0.006	-0.001
	[0.013]	[0.010]	[0.010]	[0.011]	[0.010]	[0.008]	[0.008]	[0.008]
x het. var.	-0.022	-0.003***	0.052**	-0.046***	0.013	0.001**	0.014	-0.018
	[0.020]	[0.000]	[0.022]	[0.014]	[0.015]	[0.000]	[0.017]	[0.012]
N Observations	3,015,409	3,015,356	3,015,409	3,015,409	3,739,450	3,738,803	3,739,450	3,739,450
N Individuals	77,372	77,365	77,372	77,372	100,246	100,200	100,246	100,246
Statistics								
Under-identification	344.84	888.26	94.72	533.08	458.30	776.12	211.33	607.62
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Weak-identification	44.54	116.74	12.18	69.09	58.73	99.61	27.16	78.08

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Standard errors are clustered on the individual level. Dependent variable: columns [1]-[4] enter motherhood, columns [5]-[8] enter fatherhood. Individual controls: marriage and cohabitation status, age, age squared, and years of education. Contextual controls for sibling: an analog of individual controls. Contextual controls for neighbors: entry into parenthood, become a parent, marriage and cohabitation status, age, and years of education. IV's used: average neighborhood entry into parenthood in sibling's neighborhood in each half-year within two years and their interaction with the het. Var. reported on the header. In each regression, we control for year and quarter fixed effects.

that being similar to and taking the same decisions as the sibling gives a high utility. It is possible that siblings that are close in age compare themselves stronger to each other as opposed to siblings with a high age difference. If this kind of "competition" drives the behavioral spillover, then effects should decline with the age difference between siblings. We test this hypothesis in columns [2]-[4] and [6]-[8] of Table 3.4 for women and men

separately.

First, we confirm that the rising age of women leads to a significantly weaker spillover of sibling fertility. In particular, having a sibling enter parenthood one to two years ago has a 0.2-0.3 percentage point weaker influence on women that are 35 years and older compared to women who are between the ages 20 and 34. Doing the same exercise for men, we find the opposite effect, with men who are between 35 and 40 responding around 0.1-0.3 percentage points stronger to sibling fertility as compared to men aged 20 to 34.

Second, we study how the effect differs for siblings that have an age difference of up to one year (columns [3] and[7] in Table 3.4), and siblings that have an age difference of at least four years (columns [4] and [8] in Table 3.4). While for men, we find no significant difference in the average spillover of siblings that have an age difference of up to one year as opposed to more, for women, having a closed aged sibling entering parenthood one-and-a-half to two years ago, leads to significantly stronger spillovers. In particular, the effect increases by additional 5.2 percentage points, which almost triples the main effect. Columns [4] and [8] of Table 3.4 show that for both men and women, having a sibling who is at least four years older or younger enter parenthood leads to significantly weaker spillovers as compared to siblings with an age difference up to three years. In sum, these results indicate that, especially for women, either the "competition" between siblings, or homophily is a particularly strong driver of spillovers.

3.5.3 Results by Labor Market Attachment

Labor market participation is an important factor regarding family formation, especially for women, who are found to face a "child penalty" (see e.g. Kleven et al., 2019). Given this, women strongly connected to the labor market should be less affected by their sibling's fertility in terms of timing of birth. Specifically, due to higher opportunity costs, they should be more strategic in terms of the best timing concerning their career. To validate this, we show in column [1] of Table 3.5 how effects differ between women who are the main breadwinner of their household, and those who are not (i.e. active but earning less or not active). We find that strong labor market attachment leads in every half-year of the past two years to a 1 percentage point weaker spillover from sibling's fertility.

For men, we document a slightly different pattern, up to half a year after a sibling gives birth, men who are main breadwinners are 0.4 percentage points more likely to become a father compared to those who are not the main earner of the household. Interestingly,

Table 3.5: Heterogeneous Results: Labor Market and Grandmother

Outcome:	**Become Mother**				**Become Father**			
		Grandmother				Grandmother		
het. Var.:	main bread-winner	is retired	in same neigh.	in siblings neigh.	main bread-winner	is retired	in same neigh.	in siblings neigh.
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Sibling gave birth								
up to half year ago	-0.004	-0.011	-0.014	-0.012	-0.003	-0.004	0.007	0.010
	[0.010]	[0.010]	[0.009]	[0.009]	[0.008]	[0.008]	[0.008]	[0.008]
x het. var.	-0.011***	0.002***	0.002	0.011***	0.004***	0.002***	0.002**	0.005***
	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]
half to 1 year ago	0.012	0.011	0.005	0.007	0.005	0.005	0.004	0.006
	[0.010]	[0.010]	[0.009]	[0.009]	[0.008]	[0.008]	[0.008]	[0.008]
x het. var.	-0.009***	0.001	0.002	0.010***	-0.002***	0.004***	0.001	0.011***
	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]
1 to 1.5 years ago	0.024**	0.015	0.021**	0.022**	-0.007	-0.013	0.002	0.002
	[0.010]	[0.010]	[0.010]	[0.010]	[0.008]	[0.008]	[0.008]	[0.008]
x het. var.	-0.010***	0.002**	0.000	0.011***	-0.001**	0.000	0.001	0.014***
	[0.001]	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]
1.5 to 2 years ago	0.028**	0.020*	0.026**	0.027***	-0.001	-0.001	-0.004	-0.004
	[0.011]	[0.011]	[0.010]	[0.010]	[0.008]	[0.008]	[0.008]	[0.008]
x het. var.	-0.010***	-0.000	0.001	0.009***	-0.004***	0.003***	0.000	0.013***
	[0.001]	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.002]
N Observations	2,196,618	2,192,211	2,974,677	2,974,677	2,697,502	2,707,062	3,689,929	3,689,929
N Individuals	73,619	71,980	76,866	76,866	94,993	92,590	99,557	99,557
Statistics								
Under-identification	779.98	787.18	847.28	857.00	710.62	692.24	781.31	772.90
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Weak-identification	103.08	102.87	110.59	111.91	90.80	88.82	100.40	99.29

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Standard errors are clustered on the individual level. Dependent variable: columns [1]-[4] enter motherhood, columns [5]-[8] enter fatherhood. Individual controls: marriage and cohabitation status, age, age squared, and years of education. Contextual controls for sibling: an analog of individual controls. Contextual controls for neighbors: entry into parenthood, become a parent, marriage and cohabitation status, age, and years of education. IV's used: average neighborhood entry into parenthood in sibling's neighborhood in each half-year within two years and their interaction with the het. Var. reported on the header. In each regression, we control for year and quarter fixed effects.

this effect turns negative in case the sibling's birth occurred more than half a year ago. This could indicate that with more time observing sibling's parenthood also men who are strongly attached to the labor market, plan parenthood more strategically with respect to their career.

3.5.4 Results by Availability of Grandmother

The focus here is on the first child of an individual, meaning that there is no direct experience in child care. Thus, support by the extended family such as the grandmother (i.e. the own mother), can be considered as an important source of support, especially if the grandmother is available, i.e. already retired/ not active in the labor market or lives close by.[9] We focus here on the grandmother because the literature shows that grandmothers are more likely to provide child care support as compared to grandfathers (e.g. see Thomese and Liefbroer, 2013). If siblings compete for grand-maternal resources, then effects should be more pronounced in cases where the grandmother is available, and even more so if the grandmother is not equally available to both siblings. We study these potential differences in columns [2]-[4] and [6]-[8] of Table 3.5 for women and men, respectively.

First, we look at how effects differ if the grandmother has time, in the sense that she is not actively participating in the labor market. For both women and men, having a mother that is not active in the labor market leads to significantly stronger fertility spillovers. Most striking, in the case of women, grandmother availability even leads to a 0.2 percentage point increase in immediate spillovers within the first half-year of the sibling entering parenthood. While this increased effect by the grandmother decreases for women over time, for men, it consistently increases spillovers within the first two years of a sibling entering parenthood.

Second, we allow effects to differ by grandmothers' geographical availability. In columns [3] and [7] of Table 3.5 we check for differences in case the grandmother lives in the same neighborhood as the individual, and in columns [4] and [8] of Table 3.5 we allow effects to differ in case the grandmother lives in the sibling's neighborhood. For women, the effect does not differ if the grandmother lives in the same neighborhood as opposed to having the grandmother live further away. For men, however, having the grandmother living in the same neighborhood leads to a 0.2 percentage point increase in the likelihood of becoming a father up to half a year after a sibling entered parenthood in a given quarter.

In contrast to that, having a mother that lives closer to the sibling leads for both, women and men, to stronger spillovers in any half-year after the sibling gave birth to the first child within the last two years. In particular, the effects increase by 1 percentage point, which is as much as the baseline likelihood of becoming a parent in any given quarter. These

[9] This has been shown in the context of many European countries, e.g. see Kaptijn et al. (2010) for the Netherlands; Hank and Kreyenfeld (2003) for Germany; and Del Boca (2002)for Italy.

results on geographical availability suggest that there is no need for competition in case the mother is already close, but if she is closer to the sibling, the mother might be less available in the future so that the effects are stronger. Also, observing the willingness of grand-maternal support might reduce the uncertainty and reassure an individual's decision to enter parenthood. Given that this pattern is comparable between women and men, both maternal and paternal grandmothers seem to be a resource, siblings compete for, and individuals rely on.

3.6 Robustness

As discussed in section 3.3.1, a concern could be that our results are biased due to unobserved correlated shock, for instance, due to siblings working in the same firm, or because individuals have contact to their sibling's neighbors. We test the first by employing in addition separately municipality, district, and neighborhood fixed effects and can show that our results are robust with respect to all three additions. The second is tested by checking whether results differ if individuals live closer and are thus more likely to be in contact with neighbors. Results in Table C2 show that effects do not differ between individuals that live in the same district as opposed to those who live further apart.

In all regressions, standard errors are clustered on the individual level, but results are robust to using two-way clustering on individual and neighborhood level. In terms of alternative specifications, including lags of controls (for the individual, her sibling, the neighborhood averages) does not lead to additional information and does not change the results. Also, we estimate spillovers separately, including always only one of the sibling fertility outcomes in equation 3.1. This exercise leads to the same spillover pattern, with only minor changes in coefficient size.

3.7 Conclusion

With this paper, we provide well-identified causal evidence on the existence of peer effects in adult fertility decisions. We document positive spillovers for women starting one year after a sibling gives birth, with effects persisting at least up to two-and-a-half years after the sibling enters into parenthood. A sibling entering parenthood within the last two years can almost quadruple the average likelihood of becoming a mother in any given quarter.

For men, spillovers take more time to realize, in particular around two-and-a-half years and lead to a tripled likelihood of becoming a father in any given quarter.

There are different reasons why fertility could lead to spillovers between siblings. First, social effects driven by fertility preferences will lead on the one hand, to positive spillovers if the underlying mechanism is the desire to conform with the sibling, on the other hand, it will lead to negative spillovers if an individual prefers to be different from the sibling. Our results indicate that the desire to conform is more likely since spillovers are in general positive, and even stronger in case of the same gender (men with brothers) or close age differences (women with siblings up to one year age difference). Second, parents could pressure for grandchildren, so that a sibling becoming a parent would lead to two possible effects. On the one hand, positive spillovers via increased pressure to conform with the sibling and exceptions of the family could prevail. On the other hand, it could lead to negative spillovers if the pressure decreases in case grandparents are satisfied after the first grandchild. In our main results, we document positive spillovers, so that the increased pressure (or desire) to conform as an underlying mechanism seems more likely.

Family peers can have a significant influence on long-lasting decisions in life. Our results highlight that such social influences within the family are not negligible in the fertility context and could be an influential mediator of policy changes. An interesting extension would be to see the width of the contagion by including the extended family to test for effects between cousins, or how effects change when an individual is allowed to have more than one sibling.

Appendix A

Addendum to Chapter 1

A.1 Details on Measures

Table A1a reports summary statistics of the variables used to create cognitive and non-cognitive skill measures. The top panel reports the four school subject grades on which the cognitive measure is based. The grades are coded to range between 0 (fail) up to 5 (A). The bottom panel lists six questions on which the self-esteem measure is based. Answers range from 1 (strongly disagree) to 5 (strongly agree).

Table A1b reports summary statistics of the set of questions used to create verbal investment, activity investment, and monitoring measures. The first panel reports statistics on questions used to create a verbal investment measure separately for mothers and fathers. The second panel reports summary statistics on questions used to create an activity investment measure separately for mothers and fathers. The third panel reports the set of questions, on which the monitoring measure is based. These questions are answered by the child so that no distinction between mothers and fathers is made.

Table A2 reports summary statistics on the ten questions on which the health measure is based. Hereby, answers range from 1 (everyday) to 5 (never).

Table A1: Description: Main Variables

(a) Variables measuring skills

	Question	Mean	Std.Dev.	Answers	N.Ind.
	Cognitive Skill Measures				
Grades in School-Subjects					
Math	Math-grade in the most recent grading period.	2.622	1.209	0 4	3424
English	English-grade in the most recent grading period.	2.857	1.044	0 4	3424
Science	Science-grade in the most recent grading period.	2.593	1.310	0 4	3424
History	History-grade in the most recent grading period.	2.617	1.359	0 4	3424
	Joint measure	Mean	Std. Dev.	Min. Max.	
	Cognitive	0.089	0.931	-3 2	
	Peer Cognitive	0.038	0.982	-4 2	
	Non-Cognitive Skill Measures				
Self-Esteem					
Item 1	You have a lot of good qualities.	4.285	0.713	1 5	3424
Item 2	You have a lot to be proud of.	4.309	0.772	1 5	3424
Item 3	You like yourself as you are.	3.998	0.988	1 5	3424
Item 4	You do everything just about right.	3.688	0.947	1 5	3424
Item 5	You feel socially accepted.	4.075	0.819	1 5	3424
Item 6	You feel loved and wanted.	4.253	0.812	1 5	3424
	Joint measure	Mean	Std. Dev.	Min. Max.	
	Self-Esteem	0.018	0.996	-6 1	
	Peer Self-Esteem	0.011	0.988	-6 2	

Table A1: Description: Main Variables continued

(b) Variables measuring parental investment

	Question	Mean	Std.Dev.	Answers	N.Ind.
	Verbal Investment				
Mother					
Item 1	Talked about someone you are dating.	0.508	0.500	0 1	3424
Item 2	Talked about your school work or grades.	0.682	0.466	0 1	3424
Item 3	Talked about other things you have done at school.	0.593	0.491	0 1	3424
Item 4	Talked about personal problems you are having.	0.408	0.492	0 1	3424
Item 5	Had a serious argument on your behavior.	0.335	0.472	0 1	3424
Father					
Item 1	Talked about someone you are dating.	0.290	0.454	0 1	2750
Item 2	Talked about your school work or grades.	0.564	0.496	0 1	2750
Item 3	Talked about other things you have done at school.	0.493	0.500	0 1	2750
Item 4	Talked about personal problems you are having.	0.182	0.386	0 1	2750
Item 5	Had a serious argument on your behavior.	0.252	0.434	0 1	2750
	Joint measures	Mean	Std. Dev.	Min. Max.	
	Maternal Investment	0.156	0.630	-1 1	
	Paternal Investment	0.528	0.358	-0 1	
	Activity Investment				
Mother					
Item 6	Worked on a project for school together.	0.142	0.349	0 1	3424
Item 7	Went together to a movie, play, museum, concert, or sports event.	0.268	0.443	0 1	3424
Item 8	Played sports together.	0.096	0.295	0 1	3424
Item 9	Went shopping togther.	0.730	0.444	0 1	3424
Item 10	Attended a church related event together.	0.428	0.495	0 1	3424
Item 11	Have done nothing of the above mentioned.	0.016	0.125	0 1	3424
Father					
Item 6	Worked on a project for school together.	0.118	0.322	0 1	2750
Item 7	Went together to a movie, play, museum, concert, or sports event.	0.249	0.432	0 1	2750
Item 8	Played sports together.	0.316	0.465	0 1	2750
Item 9	Went shopping togther.	0.237	0.425	0 1	2750
Item 10	Attended a church related event together.	0.340	0.474	0 1	2750
Item 11	Have done nothing of the above mentioned.	0.082	0.274	0 1	2750
	Joint measures	Mean	Std. Dev.	Min. Max.	
	Maternal Investment	0.182	0.551	-1 2	
	Paternal Investment	0.542	0.343	0 2	
	Parental Monitoring				
Item 1	Not own decision when to be home on weekend nights	0.683	0.465	0 1	3424
Item 2	Not own decision with whom to hang out	0.125	0.331	0 1	3424
Item 3	Not own decision when to go to bed on week nights	0.328	0.470	0 1	3424
Item 4	Not own decision what to eat	0.165	0.372	0 1	3424
Item 5	Not own decision what to wear	0.086	0.280	0 1	3424
Item 6	Not own decision how much TV to watch	0.156	0.363	0 1	3424
Item 7	Not own decision what to watch on TV	0.213	0.410	0 1	3424
	Joint measure	Mean	Std. Dev.	Min. Max.	
	Monitoring	0.082	0.871	-1 4	

Table A2: Description: Variables Measuring Health

Health					
	In the last month, how often...				
Item 1	...did you feel really sick?	4.243	0.747	1 5	3424
Item 2	...did you wake up feeling tired?	3.139	1.221	1 5	3424
Item 3	...did you have skin problems, such as itching or pimples?	3.576	1.129	1 5	3424
Item 4	...were you dizzy?	4.400	0.823	1 5	3424
Item 5	...did you have chest pain?	4.604	0.693	1 5	3424
Item 6	...did you have a headache?	3.584	0.870	1 5	3424
Item 7	...did you have aches, pains, or soreness in your muscles or joints?	3.630	0.958	1 5	3424
Item 8	...did you have a stomachache?	3.880	0.747	1 5	3424
Item 9	...did you have trouble eating, or a poor appetite?	4.324	0.876	1 5	3424
Item 10	...did you have trouble falling asleep or staying asleep?	4.014	1.041	1 5	3424
	Joint measures	Mean	Std. Dev.	Min. Max.	
	Health	0.003	0.996	-6 2	
	Peer Health	0.002	1.000	-8 3	

A.2 Full Set of Results

In Table A3 I report the full set of results, i.e. including all controls, from the main regression analysis. Hereby The *Main Equation* estimated is the investment equation, while the cognitive and non-cognitive equation are reported under *Supplementary Equation*. Each column reports results on separate estimation of the system described by equations 1.5, 1.6a, and 1.6b. In each row, a different investment measure is used, which is indicated in the first row of the table.

Table A3: Parental Investment and Child Skills - full results

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
			Main Equation		
Dep.Var.: Parental Investment					
Cognitive Skill	0.026	0.011	0.118	0.173*	-0.035
	[0.124]	[0.126]	[0.102]	[0.104]	[0.136]
Self-Esteem	0.042	0.233**	0.054	0.065	-0.087
	[0.117]	[0.118]	[0.050]	[0.049]	[0.128]
Health	-0.055**	-0.013	-0.027	-0.016	0.031
	[0.024]	[0.022]	[0.017]	[0.017]	[0.026]
Peer Cognitive Skill	-0.138**	-0.025	0.002	0.055	-0.146*
	[0.069]	[0.067]	[0.069]	[0.076]	[0.079]
Peer Self-Esteem	0.009	-0.002	0.051	0.133*	0.000
	[0.097]	[0.102]	[0.077]	[0.080]	[0.106]
Family Atmosphere	-0.012	-0.004	-0.024	-0.022	-0.040
	[0.022]	[0.022]	[0.016]	[0.016]	[0.025]
Household Size	0.242***	0.187***	0.196***	0.170***	0.187***
	[0.037]	[0.038]	[0.033]	[0.033]	[0.041]
Living Conditions	0.015	0.014	0.024	0.014	0.011
	[0.019]	[0.018]	[0.015]	[0.016]	[0.021]
Free Time Activities	0.026	0.023	-0.003	0.002	0.019
	[0.019]	[0.018]	[0.015]	[0.015]	[0.021]
Peer Health	-0.050	-0.024	-0.014	-0.021	0.001
	[0.032]	[0.031]	[0.028]	[0.029]	[0.039]
			Supplementary Equations		

Continued on next page

Table A3: Parental Investment and Child Skills - full results - continued

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
Dep. Var.: Cognitive Skill					
Lag-Cognitive Skill	0.332***	0.336***	0.294***	0.289***	0.321***
	[0.042]	[0.042]	[0.048]	[0.048]	[0.042]
Lag-Self-Esteem	0.039	0.041	0.062	0.070*	0.039
	[0.039]	[0.039]	[0.042]	[0.042]	[0.039]
Lag-Health	0.040	0.046	0.076*	0.077*	0.047
	[0.037]	[0.037]	[0.045]	[0.045]	[0.037]
Lag-Investment	0.039**	0.039**	0.042*	0.042*	0.035*
	[0.019]	[0.019]	[0.022]	[0.023]	[0.019]
Lag-Peer Cognitive Skill	0.113*	0.107	0.136*	0.131*	0.119*
	[0.066]	[0.066]	[0.073]	[0.073]	[0.067]
Lag-Peer Self-Esteem	0.028	0.029	0.020	0.020	0.023
	[0.061]	[0.062]	[0.069]	[0.069]	[0.060]
Problems in School	-0.072***	-0.074***	-0.045*	-0.049**	-0.069***
	[0.019]	[0.019]	[0.023]	[0.023]	[0.019]
Peer Problems in School	0.020	0.020	-0.014	-0.015	0.018
	[0.021]	[0.021]	[0.024]	[0.024]	[0.021]
Free Time Activities	0.035**	0.033**	0.034*	0.032*	0.037**
	[0.016]	[0.016]	[0.019]	[0.019]	[0.016]
Peer Free Time Activities	0.019	0.018	-0.007	-0.007	0.020
	[0.019]	[0.019]	[0.022]	[0.022]	[0.019]
Dep. Var.: Non-Cognitive Skill					
Lag-Cognitive Skill	-0.025	-0.026	-0.037	-0.037	-0.030
	[0.038]	[0.038]	[0.046]	[0.046]	[0.038]
Lag-Self-Esteem	0.135***	0.137***	0.088*	0.091**	0.122***
	[0.039]	[0.039]	[0.046]	[0.046]	[0.039]
Lag-Health	-0.010	-0.006	-0.033	-0.032	-0.003
	[0.037]	[0.036]	[0.045]	[0.045]	[0.037]
Lag-Investment	0.020	0.019	0.009	0.009	0.018
	[0.018]	[0.019]	[0.022]	[0.022]	[0.018]
Lag-Peer Cognitive Skill	-0.015	-0.014	0.024	0.020	-0.019
	[0.064]	[0.064]	[0.072]	[0.072]	[0.064]
Lag-Peer Self-Esteem	0.064	0.063	0.064	0.066	0.056
	[0.057]	[0.057]	[0.065]	[0.065]	[0.056]

Continued on next page

Table A3: Parental Investment and Child Skills - full results - continued

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
Emotions about School	0.139***	0.139***	0.135***	0.135***	0.146***
	[0.018]	[0.018]	[0.022]	[0.022]	[0.018]
Peer Emotions about School	0.002	0.002	-0.003	0.000	0.004
	[0.019]	[0.019]	[0.023]	[0.023]	[0.019]
Free Time Activities	0.072***	0.070***	0.064***	0.064***	0.069***
	[0.016]	[0.016]	[0.021]	[0.021]	[0.017]
Peer Free Time Activities	0.036**	0.035**	0.035*	0.035*	0.033*
	[0.018]	[0.018]	[0.021]	[0.021]	[0.018]
Observations	3424	3424	2299	2299	3332
Test of Overidentifying	9.3560	7.3964	14.1539	15.1552	14.1515
Restrictions p-value	(0.8980)	(0.9648)	(0.3631)	(0.2978)	(0.5874)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Robust standard errors are in brackets.

A.3 Details on Peers' Parents

One concern of the analysis could be, whether parents know the parents. In case parents do not know the peers of their children, it is very unlikely that the response captured in the main results is driven by the actual peers the child is in contact with. Table A4 reports in part (a) overall averages on how many parents in the sample have met their child's best friend, the parent of the best friends, and with how many parents they talked to in the past four weeks. Only 4% have not met the best friend of their child, and up to 87% report to have met the best friend's parents. In part (b) it can be seen that the fraction of parents who met the best friend and/ or the best friends' parents do not differ between parents of children aged up to 15 and those with older children. The only difference is that parents of relatively older children talked on average with slightly more parents over the past four weeks.

Table A4: Contact to Peers and Peers' Parents

(a) Main Sample

	Mean	Std.Dev.	Min.& Max.	N.Ind.
Met child's best friend	0.9610	0.1937	0 1	3383
Met best friend's parents	0.8658	0.3409	0 1	3383
Number of parents talked to	2.1746	1.4778	0 4	3379

(b) Differences by age of child

	Age 15 or younger	Above Age 15	Difference
Met child's best friend	0.9606	0.9614	0.00
	[0.1946]	[0.1927]	[0.90]
Met best friend's parents	0.8615	0.8707	0.01
	[0.3455]	[0.3356]	[0.43]
Number of parents talked to	2.0892	2.2726	0.18***
	[1.4682]	[1.4831]	[0.00]

A.4 Full Set of Results on Dynamic Peer Groups

In Table A6 and A5 I report the full set of results, i.e. including all controls, from the regression analysis using dynamic peer groups. Hereby The *Main Equation* estimated is the investment equation, while the cognitive and non-cognitive equation are reported under *Supplementary Equation*. In each column, a different investment measure is used, which is indicated in the first row of the table.

Each column in Table A5 reports results on separate estimation of the system described by equations:

$$\begin{aligned}
\Delta JI_{it} &= \beta_1 + \Delta J\theta'_{i,t}\boldsymbol{\beta_2} + \Delta JX'_{it}\boldsymbol{\gamma} + \Delta JGX'_{it}\boldsymbol{\beta_3} + \Delta J\epsilon_{it} \\
\Delta J\theta^C_{it} &= \delta^C_1 + \Delta J\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}^C_2 + \Delta JI_{i,t-1}\delta^C_3 + \Delta JX^C_{i,t-1}\delta^C_5 + \Delta JGX^C_{i,t-1}\delta^C_6 + \Delta\eta^C_{i,t} \\
\Delta J\theta^N_{it} &= \delta^N_1 + \Delta J\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}^N_2 + \Delta JI_{i,t-1}\delta^N_3 + \Delta JX^N_{i,t-1}\delta^N_5 + \Delta JGX^N_{i,t-1}\delta^N_6 + \Delta\eta^N_{it}
\end{aligned}$$

Each column in Table A6 reports results on separate estimation of the system described by equations:

$$\begin{aligned}
\Delta JI_{it} &= \beta_1 + \Delta J\theta'_{i,t}\boldsymbol{\beta_2} + \Delta JG\theta'_{it}\boldsymbol{\alpha} + \Delta JX'_{it}\boldsymbol{\gamma} + \Delta JGX'_{it}\boldsymbol{\beta_3} + \Delta J\epsilon_{it} \\
\Delta J\theta^C_{it} &= \delta^C_1 + \Delta J\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}^C_2 + \Delta JI_{i,t-1}\delta^C_3 + \Delta JG\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}^C_4 + \Delta JX^C_{i,t-1}\delta^C_5 + \Delta JGX^C_{i,t-1}\delta^C_6 + \Delta\eta^C_{i,t} \\
\Delta J\theta^N_{it} &= \delta^N_1 + \Delta J\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}^N_2 + \Delta JI_{i,t-1}\delta^N_3 + \Delta JG\boldsymbol{\theta}'_{i,t-1}\boldsymbol{\delta}^N_4 + \Delta JX^N_{i,t-1}\delta^N_5 + \Delta JGX^N_{i,t-1}\delta^N_6 + \Delta\eta^N_{it}
\end{aligned}$$

This is the main system of equations described by 1.5, 1.6a, and 1.6b, extended by the changes in average peer characteristics in each equation.

Table A5: Parental Investment and Child Skills - Changing friendship networks with exogenous effects only - full results

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
			Main Equation		
Dep.Var.: Parental Investment					
Cognitive Skill	0.015	0.068	0.011	0.169***	-0.030
	[0.071]	[0.070]	[0.067]	[0.063]	[0.099]
Self-Esteem	0.035	0.207*	0.095	0.024	-0.095
	[0.063]	[0.123]	[0.058]	[0.057]	[0.083]
Health	-0.158	-0.195	-0.086	0.053	-0.040
	[0.130]	[0.145]	[0.095]	[0.097]	[0.183]
Peers: Female	0.007	-0.038**	-0.016	-0.040**	-0.049*
	[0.020]	[0.019]	[0.018]	[0.017]	[0.026]
Peers: Maternal HS degree	0.061*	0.036	0.001	-0.003	-0.052
	[0.031]	[0.031]	[0.032]	[0.028]	[0.043]
Peers: White	-0.071*	0.068*	0.007	0.023	0.067
	[0.042]	[0.041]	[0.041]	[0.036]	[0.056]
Peers: Minority	-0.016	0.031	-0.017	0.006	0.104**
	[0.033]	[0.033]	[0.036]	[0.036]	[0.047]
Peers: Father Professional	0.021	-0.005	0.000	0.043***	-0.024
	[0.017]	[0.017]	[0.015]	[0.014]	[0.024]
Peer Health	0.005	-0.004	0.022	0.002	0.043
	[0.026]	[0.026]	[0.027]	[0.025]	[0.036]
Family Atmosphere	0.024	0.043*	0.020	0.046***	0.040
	[0.019]	[0.022]	[0.018]	[0.017]	[0.026]
Household Size	0.015	-0.020	0.124***	0.096***	-0.034
	[0.027]	[0.025]	[0.032]	[0.032]	[0.046]
Living Conditions	0.001	0.009	0.032*	0.015	-0.026
	[0.017]	[0.016]	[0.017]	[0.018]	[0.023]
Free Time Activities	-0.014	0.016	0.030*	0.044**	0.020
	[0.022]	[0.025]	[0.017]	[0.018]	[0.029]
			Supplementary Equations		
Dep.Var.: Cognitive Skill					
Lag-Cognitive Skill	0.471***	0.470***	0.438***	0.435***	0.426***
	[0.050]	[0.050]	[0.057]	[0.057]	[0.050]

Continued on next page

Table A5: Parental Investment and Child Skills - Changing friendship networks with exogenous effects only - full results - continued

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
Lag-Self-Esteem	0.098**	0.095**	0.093	0.117**	0.085*
	[0.045]	[0.045]	[0.057]	[0.056]	[0.045]
Lag-Health	0.055	0.069	0.048	0.053	0.089**
	[0.043]	[0.043]	[0.051]	[0.052]	[0.043]
Lag-Investment	0.072***	0.072***	0.077***	0.079***	0.069***
	[0.024]	[0.024]	[0.027]	[0.028]	[0.024]
Lag-Peer Cognitive Skill	0.029	0.035	0.046	0.039	0.022
	[0.056]	[0.057]	[0.061]	[0.061]	[0.056]
Lag-Peer Self-Esteem	0.020	0.021	-0.030	-0.042	0.015
	[0.047]	[0.047]	[0.056]	[0.056]	[0.047]
Peers: Female	-0.005	-0.001	0.013	0.011	-0.005
	[0.027]	[0.027]	[0.031]	[0.031]	[0.028]
Peers: Maternal HS degree	0.064	0.067	0.174***	0.162***	0.072
	[0.044]	[0.044]	[0.055]	[0.057]	[0.046]
Peers: White	-0.021	-0.020	-0.172**	-0.164**	-0.037
	[0.059]	[0.058]	[0.070]	[0.071]	[0.061]
Peers: Minority	-0.042	-0.041	-0.221***	-0.220***	-0.069
	[0.049]	[0.049]	[0.056]	[0.057]	[0.049]
Peers: Father Professional	-0.030	-0.035	-0.051*	-0.048*	-0.035
	[0.025]	[0.025]	[0.027]	[0.027]	[0.025]
Problems in School	-0.112***	-0.112***	-0.101***	-0.104***	-0.112***
	[0.026]	[0.026]	[0.031]	[0.031]	[0.027]
Peer Problems in School	-0.005	-0.003	-0.009	-0.010	-0.012
	[0.021]	[0.021]	[0.027]	[0.027]	[0.021]
Free Time Activities	0.044**	0.043*	0.065**	0.063**	0.056**
	[0.022]	[0.022]	[0.026]	[0.026]	[0.023]
Peer Free Time Activities	0.023	0.019	0.027	0.035	0.014
	[0.021]	[0.021]	[0.024]	[0.024]	[0.021]
Dep. Var.: Non-Cognitive Skill					
Lag-Cognitive Skill	0.001	-0.004	-0.055	-0.054	0.002
	[0.046]	[0.045]	[0.056]	[0.057]	[0.046]
Lag-Self-Esteem	0.144***	0.146***	0.175***	0.172***	0.157***
	[0.049]	[0.048]	[0.065]	[0.065]	[0.051]

Continued on next page

Table A5: Parental Investment and Child Skills - Changing friendship networks with exogenous effects only - full results - continued

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
Lag-Health	-0.009	-0.013	-0.005	-0.018	-0.010
	[0.044]	[0.043]	[0.053]	[0.053]	[0.045]
Lag-Investment	0.001	0.003	-0.013	-0.018	0.007
	[0.023]	[0.023]	[0.029]	[0.030]	[0.024]
Lag-Peer Cognitive Skill	0.018	0.009	-0.013	-0.011	0.008
	[0.051]	[0.051]	[0.056]	[0.056]	[0.052]
Lag-Peer Self-Esteem	0.078*	0.084*	0.070	0.079	0.057
	[0.043]	[0.043]	[0.053]	[0.053]	[0.044]
Peers: Female	0.021	0.025	0.018	0.020	0.027
	[0.026]	[0.026]	[0.031]	[0.031]	[0.027]
Peers: Maternal HS degree	-0.061	-0.055	-0.071	-0.072	-0.041
	[0.043]	[0.042]	[0.055]	[0.055]	[0.044]
Peers: White	0.042	0.029	0.045	0.049	0.031
	[0.057]	[0.056]	[0.069]	[0.069]	[0.059]
Peers: Minority	0.069	0.062	0.026	0.030	0.044
	[0.044]	[0.044]	[0.057]	[0.057]	[0.045]
Peers: Father Professional	-0.013	-0.008	0.050*	0.050*	-0.009
	[0.025]	[0.025]	[0.029]	[0.029]	[0.025]
Emotions about School	0.159***	0.156***	0.173***	0.172***	0.158***
	[0.025]	[0.024]	[0.029]	[0.030]	[0.026]
Peer Emotions about School	-0.022	-0.021	-0.020	-0.023	-0.020
	[0.021]	[0.021]	[0.026]	[0.026]	[0.021]
Free Time Activities	0.077***	0.075***	0.064**	0.063**	0.084***
	[0.022]	[0.022]	[0.027]	[0.027]	[0.023]
Peer Free Time Activities	0.028	0.026	0.012	0.013	0.029
	[0.021]	[0.021]	[0.025]	[0.025]	[0.022]
Observations	1818	1818	1156	1156	1745
Test of Overidentifying Restrictions p-value	27.9191 (0.3625)	35.4492 (0.1902)	31.4379 (0.2124)	29.4473 (0.2457)	27.4869 (0.2823)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table A6: Parental Investment and Child Skills - Changing friendship networks - full results

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
			Main Equation		
Dep.Var.: Parental Investment					
Cognitive Skill	0.064	0.077	0.017	0.157**	-0.041
	[0.074]	[0.073]	[0.069]	[0.067]	[0.106]
Self-Esteem	0.030	0.177*	0.075	0.022	-0.093
	[0.063]	[0.104]	[0.057]	[0.058]	[0.080]
Health	-0.070	-0.189	-0.049	0.072	-0.061
	[0.126]	[0.135]	[0.100]	[0.102]	[0.180]
Peer Cognitive Skill	-0.113**	-0.007	-0.043	0.020	0.021
	[0.054]	[0.052]	[0.051]	[0.053]	[0.070]
Peer Self-Esteem	-0.013	0.042	0.042	-0.004	0.087
	[0.047]	[0.041]	[0.044]	[0.046]	[0.057]
Peers: Female	0.028	-0.034	-0.004	-0.043**	-0.044
	[0.026]	[0.024]	[0.021]	[0.021]	[0.031]
Peers: Maternal HS degree	0.077**	0.025	0.005	-0.008	-0.081*
	[0.033]	[0.032]	[0.032]	[0.029]	[0.045]
Peers: White	-0.085**	0.070*	-0.010	0.022	0.070
	[0.043]	[0.042]	[0.041]	[0.038]	[0.057]
Peers: Minority	-0.045	0.034	-0.034	0.013	0.111**
	[0.035]	[0.036]	[0.036]	[0.036]	[0.050]
Peers: Father Professional	0.035*	-0.001	0.011	0.043***	-0.019
	[0.018]	[0.018]	[0.006]	[0.016]	[0.025]
Peer Health	0.016	-0.015	0.008	0.001	0.033
	[0.027]	[0.027]	[0.028]	[0.027]	[0.038]
Family Atmosphere	0.015	0.049**	0.018	0.047***	0.043*
	[0.020]	[0.021]	[0.018]	[0.017]	[0.026]
Household Size	0.012	-0.022	0.124***	0.103***	-0.033
	[0.027]	[0.025]	[0.033]	[0.032]	[0.046]
Living Conditions	-0.002	0.010	0.037**	0.018	-0.030
	[0.017]	[0.016]	[0.018]	[0.017]	[0.023]
Free Time Activities	-0.004	0.016	0.029	0.043**	0.013
	[0.021]	[0.023]	[0.018]	[0.018]	[0.029]
			Supplementary Equations		

Continued on next page

Table A6: Parental Investment and Child Skills - Changing friendship networks - full results - continued

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
Dep. Var.: Cognitive Skill					
Lag-Cognitive Skill	0.473***	0.472***	0.440***	0.441***	0.424***
	[0.050]	[0.050]	[0.057]	[0.057]	[0.050]
Lag-Self-Esteem	0.096**	0.097**	0.094*	0.118**	0.089**
	[0.045]	[0.045]	[0.057]	[0.056]	[0.045]
Lag-Health	0.053	0.066	0.050	0.050	0.083*
	[0.043]	[0.043]	[0.051]	[0.052]	[0.043]
Lag-Investment	0.074***	0.071***	0.076***	0.082***	0.071***
	[0.024]	[0.024]	[0.027]	[0.028]	[0.024]
Lag-Peer Cognitive Skill	0.030	0.033	0.052	0.049	0.026
	[0.056]	[0.057]	[0.061]	[0.061]	[0.056]
Lag-Peer Self-Esteem	0.019	0.021	-0.038	-0.040	0.015
	[0.048]	[0.047]	[0.056]	[0.056]	[0.047]
Peers: Female	-0.004	-0.001	0.007	0.008	-0.003
	[0.027]	[0.027]	[0.031]	[0.031]	[0.028]
Peers: Maternal HS degree	0.063	0.068	0.162***	0.167***	0.077*
	[0.044]	[0.044]	[0.056]	[0.056]	[0.046]
Peers: White	-0.020	-0.024	-0.155**	-0.169**	-0.045
	[0.059]	[0.058]	[0.071]	[0.071]	[0.060]
Peers: Minority	-0.045	-0.045	-0.210***	-0.226***	-0.072
	[0.049]	[0.049]	[0.056]	[0.057]	[0.049]
Peers: Father Professional	-0.030	-0.035	-0.053*	-0.048*	-0.036
	[0.025]	[0.025]	[0.027]	[0.027]	[0.025]
Problems in School	-0.113***	-0.112***	-0.104***	-0.103***	-0.111***
	[0.026]	[0.026]	[0.031]	[0.031]	[0.027]
Peer Problems in School	-0.004	-0.004	-0.007	-0.008	-0.010
	[0.021]	[0.021]	[0.027]	[0.027]	[0.021]
Free Time Activities	0.045**	0.043*	0.063**	0.064**	0.055**
	[0.022]	[0.022]	[0.026]	[0.026]	[0.023]
Peer Free Time Activities	0.023	0.019	0.029	0.034	0.015
	[0.021]	[0.021]	[0.024]	[0.025]	[0.021]
Dep. Var.: Non-Cognitive Skill					
Lag-Cognitive Skill	0.006	-0.006	-0.056	-0.055	-0.002
	[0.046]	[0.045]	[0.056]	[0.056]	[0.046]

Continued on next page

Table A6: Parental Investment and Child Skills - Changing friendship networks - full results - continued

	Parental Investment				
	Mother		Father		
	Verbal	Activity	Verbal	Activity	Monitoring
	[1]	[2]	[3]	[4]	[5]
Lag-Self-Esteem	0.145***	0.142***	0.173***	0.172***	0.154***
	[0.049]	[0.049]	[0.065]	[0.065]	[0.051]
Lag-Health	-0.009	-0.012	-0.007	-0.019	-0.012
	[0.044]	[0.043]	[0.053]	[0.053]	[0.045]
Lag-Investment	0.002	0.001	-0.014	-0.021	0.006
	[0.023]	[0.023]	[0.029]	[0.030]	[0.024]
Lag-Peer Cognitive Skill	0.015	0.017	-0.008	-0.009	0.005
	[0.051]	[0.050]	[0.056]	[0.056]	[0.052]
Lag-Peer Self-Esteem	0.085**	0.083*	0.074	0.082	0.064
	[0.043]	[0.043]	[0.053]	[0.053]	[0.044]
Peers: Female	0.024	0.024	0.015	0.020	0.029
	[0.026]	[0.026]	[0.031]	[0.031]	[0.027]
Peers: Maternal HS degree	-0.058	-0.055	-0.083	-0.076	-0.036
	[0.043]	[0.042]	[0.055]	[0.054]	[0.044]
Peers: White	0.037	0.028	0.054	0.045	0.025
	[0.057]	[0.056]	[0.070]	[0.069]	[0.059]
Peers: Minority	0.065	0.063	0.040	0.030	0.039
	[0.044]	[0.043]	[0.057]	[0.057]	[0.045]
Peers: Father Professional	-0.012	-0.010	0.051*	0.051*	-0.008
	[0.025]	[0.025]	[0.029]	[0.029]	[0.025]
Emotions about School	0.158***	0.157***	0.173***	0.171***	0.156***
	[0.025]	[0.024]	[0.030]	[0.030]	[0.025]
Peer Emotions about School	-0.023	-0.021	-0.022	-0.025	-0.021
	[0.021]	[0.021]	[0.026]	[0.026]	[0.021]
Free Time Activities	0.079***	0.076***	0.063**	0.063**	0.082***
	[0.022]	[0.022]	[0.027]	[0.027]	[0.023]
Peer Free Time Activities	0.027	0.026	0.012	0.015	0.028
	[0.021]	[0.021]	[0.025]	[0.025]	[0.022]
Observations	1818	1818	1156	1156	1745
Test of Overidentifying Restrictions p-value	38.1680 (0.1455)	34.5425 (0.2200)	33.1427 (0.2720)	34.9175 (0.2073)	32.6385 (0.2493)

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

In Table A7 I report the full set of results, i.e. including all controls, from the regression analysis using dynamic peer groups separately for girls (column [1]) and boys (column [2]). Hereby the equations and estimation is the same as the results presented in Tbale A6 .

Table A7: Parental Investment and Child Skills - Changing friendship networks by gender

	Parental Investment	
	Monitoring	
	Girls	Boys
	[1]	[2]
	Main Equation	
Dep.Var.: Parental Investment		
Cognitive Skill	-0.116	0.181
	[0.119]	[0.166]
Self-Esteem	-0.174*	0.029
	[0.094]	[0.117]
Health	-0.106	-0.212
	[0.157]	[0.252]
Peer Cognitive Skill	0.067	-0.203*
	[0.088]	[0.121]
Peer Self-Esteem	0.038	0.173
	[0.059]	[0.140]
Peers: Female	-0.072*	0.037
	[0.039]	[0.054]
Peers: Maternal HS degree	-0.076	-0.042
	[0.058]	[0.067]
Peers: White	0.117	-0.027
	[0.075]	[0.083]
Peers: Minority	0.125*	0.009
	[0.071]	[0.070]
Peers: Father Professional	-0.002	0.022
	[0.031]	[0.041]
Peer Health	0.045	0.035
	[0.046]	[0.073]
Family Atmosphere	0.069**	0.045
	[0.035]	[0.041]
Household Size	-0.008	-0.029
	[0.059]	[0.062]

Continued on next page

Table A7: Parental Investment and Child Skills - Changing friendship networks by gender - continued

	Parental Investment	
	Monitoring	
	Girls	Boys
	[1]	[2]
Living Conditions	0.042	-0.081**
	[0.027]	[0.040]
Free Time Activities	0.021	-0.001
	[0.034]	[0.044]
	Supplementary Equations	
Dep.Var.: Cognitive Skill		
Lag-Cognitive Skill	0.455***	0.400***
	[0.066]	[0.069]
Lag-Self-Esteem	0.204***	-0.009
	[0.064]	[0.059]
Lag-Health	0.095*	0.078
	[0.058]	[0.063]
Lag-Investment	0.074**	0.084**
	[0.032]	[0.033]
Lag-Peer Cognitive Skill	-0.007	0.026
	[0.076]	[0.068]
Lag-Peer Self-Esteem	-0.023	0.031
	[0.060]	[0.071]
Peers: Female	-0.003	-0.019
	[0.040]	[0.038]
Peers: Maternal HS degree	0.094*	0.037
	[0.052]	[0.074]
Peers: White	-0.023	-0.038
	[0.077]	[0.089]
Peers: Minority	-0.098	-0.002
	[0.066]	[0.070]
Peers: Father Professional	-0.033	-0.007
	[0.032]	[0.037]
Problems in School	-0.158***	-0.107***
	[0.033]	[0.038]
Peer Problems in School	-0.016	-0.006
	[0.030]	[0.028]
Free Time Activities	0.063**	0.035
	[0.029]	[0.032]

Continued on next page

Table A7: Parental Investment and Child Skills - Changing friendship networks by gender - continued

	Parental Investment	
	Monitoring	
	Girls	Boys
	[1]	[2]
Peer Free Time Activities	0.013	0.050
	[0.026]	[0.032]
Dep.Var.: Non-Cognitive Skill		
Lag-Cognitive Skill	0.093	-0.101*
	[0.064]	[0.059]
Lag-Self-Esteem	0.212***	0.066
	[0.068]	[0.069]
Lag-Health	-0.034	-0.036
	[0.064]	[0.057]
Lag-Investment	0.021	-0.009
	[0.032]	[0.032]
Lag-Peer Cognitive Skill	0.069	0.001
	[0.070]	[0.065]
Lag-Peer Self-Esteem	0.051	0.034
	[0.059]	[0.059]
Peers: Female	0.038	-0.026
	[0.038]	[0.036]
Peers: Maternal HS degree	-0.057	-0.025
	[0.053]	[0.069]
Peers: White	0.085	-0.009
	[0.075]	[0.084]
Peers: Minority	0.018	0.090
	[0.058]	[0.063]
Peers: Father Professional	-0.025	0.003
	[0.036]	[0.032]
Emotions about School	0.138***	0.170***
	[0.033]	[0.036]
Peer Emotions about School	-0.066**	0.029
	[0.030]	[0.027]
Free Time Activities	0.108***	0.044
	[0.031]	[0.032]
Peer Free Time Activities	0.058**	-0.005
	[0.029]	[0.030]

Continued on next page

Table A7: Parental Investment and Child Skills - Changing friendship networks by gender - continued

	Parental Investment	
	Monitoring	
	Girls	Boys
	[1]	[2]
Observations	977	841
Test of Overidentifying Restrictions	37.8983	35.7997
p-value	0.1246	0.1478

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table A8: Correlations of Skills and Background Characteristics

	Cognitive Skill	Δ Cognitive Skill	Self-Esteem	Δ Self-Esteem	Female	Maternal HS degree	White	Minority
Δ Cognitive Skill	0.450***	1.000						
Self-Esteem	0.149***	0.014	1.000					
Δ Self-Esteem	-0.005	0.015	0.459***	1.000				
Female	0.100***	-0.012	-0.122***	0.034**	1.000			
Maternal HS degree	0.142***	-0.009	0.068***	-0.006	-0.019	1.000		
White	0.111***	-0.021	0.001	0.018	-0.019	0.158***	1.000	
Minority	-0.111***	0.021	-0.001	-0.018	0.019	-0.158***	-1.000	1.000
Father Professional	0.160***	-0.014	0.021	-0.015	-0.030*	0.127***	0.107***	-0.107***

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table A9: Correlations of Friends' Skill Changes and Composition Changes

	Δ Peer Cognitive Skill	Δ Peer Self-Esteem	Δ Peers: Female	Δ Peers: Maternal HS degree	Δ Peers: White	Δ Peers: Minority
Δ Peer Self-Esteem	0.154***	1.000				
Δ Peers: Female	0.160***	0.032**	1.000			
Δ Peers: Maternal HS degree	0.143***	0.191***	0.559***	1.000		
Δ Peers: White	0.154***	0.116***	0.483***	0.674***	1.000	
Δ Peers: Minority	-0.033**	0.137***	0.380***	0.460***	-0.125***	1.000
Δ Peers: Father Professional	0.147***	0.075***	0.244***	0.376***	0.349***	0.148***

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Appendix B

Addendum to Chapter 2

B.1 Comparison with other Datasets

To supplement our analysis, we compare our measures on risky and disruptive behavior with German and US surveys aiming the surveillance of risky behavior among children and adolescents. We report comparable measures in Table B13.

KiGGS and SEYLE (Germany)

The Robert Koch Institute (RKI), which is a federal institute and part of the Federal Ministry of Health, is running the "German Health Interview and Examination Survey for Children and Adolescents" (KiGGS) since 2003. The aim of the study is to collect comprehensive health data on children and adolescents that are representative for the whole country[1]. We use information collected in the baseline study in 2003 that covers the core topics of health status, health related behavior, and take-up of health services. The KiGGS sample focuses on 14 to 17-year-old high school students, which is slightly younger than our sample of 18 to 21 year olds in 1995.

In terms of suicidal tendencies, unfortunately the RKI did not include an explicit question. However, we supplement the KiGGS for this topic with the Saving and Empowering Young Lives in Europe (SEYLE) Survey, which is a longitudinal research project based on randomly selected 11 European countries. One of the key objectives of this study is to collect data on the mental health and well-being, lifestyles, values, and risk behaviors of adolescents aged 14 to 16 in Europe. The study also conducts a suicide-preventative RCT, however we will only exploit information from the baseline survey reported for German

[1]For more details about the survey and how it was conducted, see here

students.[2] The baseline survey of Germany was conducted in 2010 at several schools in Heidelberg and in the Rheine-Neckar-Area, with students that are 14 to 16-year-old.

Youth Risk Behavior Surveillance (US)

The Youth Risk Behavior Surveillance System (YRBSS) aims to monitor six categories of priority health-risk behaviors among adolescents and is conducted jointly by the Centers for Disease Control and Prevention (CDC) and state and local education agencies. National surveys started in 1990 and are still conducted today, however we use results reported from the 1995 to keep the year comparable to our sample. The survey targets a nationally representative sample of students attending grades 9 through 12.[3] In Table B13 we report YRBSS statistics that refer to 12th graders only.

B.2 Full Set of Long-run Results

In the following we present the full set of results, i.e. including all controls, of the results reported in Tables 2.5 and 2.6. Hereby each table considers a different outcome which is indicated in the head of the table. Columns [1] and [2] link the long-run outcome with changes in anger, columns [3] and [4] link long-run outcomes to changes in anxiety, and columns [5] and [6] link changes in self-confidence to long-run outcomes.

[2]For more details on the setup and results of the RCT see Wasserman et al. (2010)
[3]For a detailed discussion on sampling, survey questions, and implementation see Kann et al. (1996).

Table B1: Longer-Run Outcome: Physical Fighting

	Physical Fighting					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**0.041*** **	**0.068*** **				
	[0.012]	**[0.021]**				
Δ Anger x Female		**-0.053** **				
		[0.025]				
Δ Anxiety (Post-Pre)			**0.000**	**-0.002**		
			[0.010]	**[0.019]**		
Δ Anxiety x Female				**0.006**		
				[0.022]		
Δ Self-Confidence (Post-Pre)					**-0.003**	**0.012**
					[0.010]	**[0.020]**
Δ Self-Confidence x Female						**-0.025**
						[0.022]
Anger (Pre)	0.046***	0.088***				
	[0.011]	[0.020]				
Anger (Pre) x Female		-0.082***				
		[0.021]				
Anxiety (Pre)			0.017	0.026		
			[0.013]	[0.025]		
Anxiety (Pre) x Female				-0.015		
				[0.028]		
Self-Confidence (Pre)					-0.002	0.013
					[0.010]	[0.018]
Self-Confidence (Pre) x Female						-0.026
						[0.021]
Treated	0.022	0.034	0.032*	0.041	0.031*	0.039
	[0.016]	[0.029]	[0.017]	[0.031]	[0.016]	[0.031]
Treated x Female		-0.012		-0.016		-0.019
		[0.033]		[0.034]		[0.033]
Female	-0.063***	-0.060***	-0.075***	-0.069***	-0.072***	-0.064***
	[0.015]	[0.019]	[0.016]	[0.020]	[0.016]	[0.019]
Constant	0.083***	0.075***	0.084***	0.082***	0.082***	0.077***
	[0.015]	[0.017]	[0.016]	[0.019]	[0.015]	[0.017]
N Observations	863	863	863	863	863	863
N Individuals	863	863	863	863	863	863
R-squared	0.054	0.073	0.032	0.034	0.028	0.031

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B2: Longer-Run Outcome: Destroy Property

	Destroy Property					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**0.041*** **	**0.071*** **				
	[0.013]	**[0.023]**				
Δ Anger x Female		**-0.056** **				
		[0.026]				
Δ Anxiety (Post-Pre)			**-0.001**	**0.028**		
			[0.010]	**[0.021]**		
Δ Anxiety x Female				**-0.047** **		
				[0.023]		
Δ Self-Confidence (Post-Pre)					**-0.007**	**-0.008**
					[0.009]	**[0.020]**
Δ Self-Confidence x Female						**-0.003**
						[0.021]
Anger (Pre)	0.041***	0.063***				
	[0.012]	[0.019]				
Anger (Pre) x Female		-0.037				
		[0.023]				
Anxiety (Pre)			-0.003	0.028		
			[0.011]	[0.022]		
Anxiety (Pre) x Female				-0.050**		
				[0.024]		
Self-Confidence (Pre)					-0.009	-0.023
					[0.010]	[0.021]
Self-Confidence (Pre) x Female						0.023
						[0.023]
Treated	0.063***	0.106***	0.073***	0.110***	0.071***	0.114***
	[0.018]	[0.032]	[0.019]	[0.034]	[0.018]	[0.034]
Treated x Female		-0.074**		-0.064		-0.083**
		[0.037]		[0.039]		[0.038]
Female	-0.076***	-0.044**	-0.083***	-0.058***	-0.086***	-0.050***
	[0.018]	[0.019]	[0.018]	[0.019]	[0.018]	[0.018]
Constant	0.085***	0.066***	0.083***	0.071***	0.085***	0.068***
	[0.015]	[0.016]	[0.016]	[0.017]	[0.015]	[0.017]
N Observations	863	863	863	863	863	863
N Individuals	863	863	863	863	863	863
R-squared	0.064	0.078	0.046	0.058	0.047	0.055

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B3: Longer-Run Outcome: Suicidal Thoughts

	Suicidal Thoughts					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**0.070*** **	**0.040**				
	[0.019]	**[0.026]**				
Δ Anger x Female		**0.053**				
		[0.039]				
Δ Anxiety (Post-Pre)			**0.040** **	**-0.006**		
			[0.020]	**[0.027]**		
Δ Anxiety x Female				**0.071***		
				[0.039]		
Δ Self-Confidence (Post-Pre)					**-0.050** **	**0.022**
					[0.019]	**[0.026]**
Δ Self-Confidence x Female						**-0.110*** **
						[0.037]
Anger (Pre)	0.083***	0.063**				
	[0.020]	[0.027]				
Anger (Pre) x Female		0.031				
		[0.040]				
Anxiety (Pre)			0.052**	0.009		
			[0.021]	[0.031]		
Anxiety (Pre) x Female				0.065		
				[0.042]		
Self-Confidence (Pre)					-0.084***	-0.021
					[0.019]	[0.026]
Self-Confidence (Pre) x Female						-0.096***
						[0.037]
Treated	0.053*	-0.019	0.058*	-0.015	0.053*	-0.013
	[0.031]	[0.041]	[0.032]	[0.042]	[0.031]	[0.041]
Treated x Female		0.128**		0.128**		0.106*
		[0.061]		[0.063]		[0.062]
Female	0.164***	0.108***	0.141***	0.087**	0.133***	0.086**
	[0.030]	[0.041]	[0.030]	[0.041]	[0.030]	[0.040]
Constant	0.170***	0.202***	0.179***	0.206***	0.182***	0.206***
	[0.025]	[0.028]	[0.025]	[0.028]	[0.025]	[0.028]
N Observations	833	833	833	833	833	833
N Individuals	833	833	833	833	833	833
R-squared	0.055	0.063	0.042	0.052	0.056	0.072

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B4: Longer-Run Outcome: Repeated Suicidal Thoughts

	Repeated Suicidal Thoughts					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**0.021***	**0.012**				
	[0.011]	**[0.010]**				
Δ Anger x Female		**0.016**				
		[0.022]				
Δ Anxiety (Post-Pre)			**0.021***	**-0.017**		
			[0.012]	**[0.010]**		
Δ Anxiety x Female				**0.063*****		
				[0.021]		
Δ Self-Confidence (Post-Pre)					**-0.017**	**0.014**
					[0.012]	**[0.010]**
Δ Self-Confidence x Female						**-0.046****
						[0.020]
Anger (Pre)	0.031***	0.016				
	[0.012]	[0.011]				
Anger (Pre) x Female		0.025				
		[0.023]				
Anxiety (Pre)			0.010	-0.012		
			[0.011]	[0.010]		
Anxiety (Pre) x Female				0.032		
				[0.020]		
Self-Confidence (Pre)					-0.022*	0.010
					[0.012]	[0.008]
Self-Confidence (Pre) x Female						-0.050**
						[0.021]
Treated	0.035**	-0.005	0.033**	-0.001	0.034**	-0.002
	[0.017]	[0.016]	[0.017]	[0.017]	[0.016]	[0.017]
Treated x Female		0.070**		0.058*		0.060*
		[0.032]		[0.032]		[0.032]
Female	0.065***	0.034*	0.057***	0.032*	0.055***	0.029
	[0.016]	[0.019]	[0.015]	[0.018]	[0.015]	[0.018]
Constant	0.009	0.027**	0.012	0.026**	0.013	0.027**
	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]	[0.011]
N Observations	833	833	833	833	833	833
N Individuals	833	833	833	833	833	833
R-squared	0.033	0.040	0.028	0.044	0.029	0.043

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B5: Longer-Run Outcome: Alcohol Consumption: Regular

	Alcohol Consumption: Regular					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**0.016**	**0.054***				
	[0.021]	**[0.029]**				
Δ Anger x Female		**-0.073***				
		[0.042]				
Δ Anxiety (Post-Pre)			**0.005**	**0.012**		
			[0.021]	**[0.029]**		
Δ Anxiety x Female				**-0.013**		
				[0.041]		
Δ Self-Confidence (Post-Pre)					**-0.005**	**0.000**
					[0.020]	**[0.030]**
Δ Self-Confidence x Female						**-0.007**
						[0.040]
Anger (Pre)	0.015	0.022				
	[0.020]	[0.028]				
Anger (Pre) x Female		-0.012				
		[0.041]				
Anxiety (Pre)			-0.005	-0.012		
			[0.021]	[0.031]		
Anxiety (Pre) x Female				0.013		
				[0.042]		
Self-Confidence (Pre)					-0.024	-0.007
					[0.019]	[0.030]
Self-Confidence (Pre) x Female						-0.028
						[0.039]
Treated	0.006	-0.007	0.008	0.001	0.009	0.006
	[0.032]	[0.045]	[0.032]	[0.045]	[0.032]	[0.045]
Treated x Female		0.026		0.013		0.004
		[0.065]		[0.065]		[0.065]
Female	-0.078**	-0.090**	-0.080**	-0.084**	-0.085***	-0.086**
	[0.032]	[0.043]	[0.031]	[0.042]	[0.032]	[0.042]
Constant	0.751***	0.758***	0.750***	0.752***	0.753***	0.753***
	[0.026]	[0.030]	[0.027]	[0.030]	[0.026]	[0.030]
N Observations	833	833	833	833	833	833
N Individuals	833	833	833	833	833	833
R-squared	0.009	0.013	0.008	0.009	0.010	0.011

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B6: Longer-Run Outcome: Alcohol Consumption: Heavy

	Alcohol Consumption: Heavy					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**0.037***	**0.066****				
	[0.022]	**[0.032]**				
Δ Anger x Female		**-0.055**				
		[0.045]				
Δ Anxiety (Post-Pre)			**0.026**	**0.056***		
			[0.022]	**[0.033]**		
Δ Anxiety x Female				**-0.053**		
				[0.044]		
Δ Self-Confidence (Post-Pre)					**0.020**	**0.040**
					[0.022]	**[0.035]**
Δ Self-Confidence x Female						**-0.031**
						[0.045]
Anger (Pre)	0.046**	0.060*				
	[0.023]	[0.033]				
Anger (Pre) x Female		-0.027				
		[0.045]				
Anxiety (Pre)			-0.005	-0.002		
			[0.023]	[0.035]		
Anxiety (Pre) x Female				-0.003		
				[0.046]		
Self-Confidence (Pre)					0.003	0.014
					[0.022]	[0.034]
Self-Confidence (Pre) x Female						-0.016
						[0.044]
Treated	-0.130***	-0.141***	-0.130***	-0.147***	-0.114***	-0.126**
	[0.035]	[0.052]	[0.035]	[0.051]	[0.035]	[0.052]
Treated x Female		0.024		0.033		0.018
		[0.070]		[0.070]		[0.071]
Female	-0.144***	-0.155***	-0.152***	-0.164***	-0.151***	-0.160***
	[0.035]	[0.047]	[0.034]	[0.046]	[0.034]	[0.046]
Constant	0.614***	0.618***	0.614***	0.620***	0.609***	0.614***
	[0.029]	[0.034]	[0.029]	[0.034]	[0.029]	[0.034]
N Observations	833	833	833	833	833	833
N Individuals	833	833	833	833	833	833
R-squared	0.043	0.045	0.041	0.043	0.040	0.040

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B7: Longer-Run Outcome: Cigarette Smoking

	Cigarette Smoking					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**0.058*** **	**0.085*** **				
	[0.022]	**[0.032]**				
Δ Anger x Female		**-0.052**				
		[0.045]				
Δ Anxiety (Post-Pre)			**0.015**	**-0.011**		
			[0.022]	**[0.034]**		
Δ Anxiety x Female				**0.042**		
				[0.045]		
Δ Self-Confidence (Post-Pre)					**0.017**	**0.061***
					[0.021]	**[0.033]**
Δ Self-Confidence x Female						**-0.067**
						[0.043]
Anger (Pre)	0.098***	0.117***				
	[0.022]	[0.032]				
Anger (Pre) x Female		-0.038				
		[0.045]				
Anxiety (Pre)			0.030	0.026		
			[0.023]	[0.035]		
Anxiety (Pre) x Female				0.002		
				[0.046]		
Self-Confidence (Pre)					0.001	0.025
					[0.021]	[0.034]
Self-Confidence (Pre) x Female						-0.033
						[0.043]
Treated	0.016	-0.023	0.024	-0.012	0.035	-0.008
	[0.034]	[0.049]	[0.035]	[0.051]	[0.035]	[0.050]
Treated x Female		0.076		0.064		0.071
		[0.068]		[0.069]		[0.070]
Female	0.043	0.008	0.019	-0.011	0.024	-0.008
	[0.034]	[0.045]	[0.034]	[0.046]	[0.034]	[0.046]
Constant	0.348***	0.364***	0.355***	0.371***	0.347***	0.364***
	[0.029]	[0.033]	[0.029]	[0.034]	[0.029]	[0.034]
N Observations	833	833	833	833	833	833
N Individuals	833	833	833	833	833	833
R-squared	0.025	0.027	0.004	0.007	0.003	0.008

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B8: Longer-Run Outcome: Subjective Health

	Subjective Health					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**-0.115****	**-0.138****				
	[0.045]	**[0.064]**				
Δ Anger x Female		**0.057**				
		[0.089]				
Δ Anxiety (Post-Pre)			**-0.084***	**0.014**		
			[0.044]	**[0.061]**		
Δ Anxiety x Female				**-0.162***		
				[0.088]		
Δ Self-Confidence (Post-Pre)					**0.085***	**0.082**
					[0.045]	**[0.068]**
Δ Self-Confidence x Female						**-0.013**
						[0.092]
Anger (Pre)	-0.180***	-0.175**				
	[0.045]	[0.068]				
Anger (Pre) x Female		0.003				
		[0.090]				
Anxiety (Pre)			-0.189***	-0.142**		
			[0.044]	[0.062]		
Anxiety (Pre) x Female				-0.066		
				[0.087]		
Self-Confidence (Pre)					0.160***	0.130*
					[0.042]	[0.067]
Self-Confidence (Pre) x Female						0.042
						[0.086]
Treated	-0.157**	-0.022	-0.157**	-0.048	-0.154**	-0.022
	[0.068]	[0.091]	[0.068]	[0.091]	[0.069]	[0.092]
Treated x Female		-0.258*		-0.196		-0.254*
		[0.134]		[0.135]		[0.138]
Female	-0.258***	-0.144	-0.190***	-0.102	-0.191***	-0.083
	[0.067]	[0.091]	[0.066]	[0.091]	[0.067]	[0.091]
Constant	0.278***	0.219***	0.240***	0.195***	0.251***	0.196***
	[0.055]	[0.062]	[0.057]	[0.065]	[0.057]	[0.065]
N Observations	859	859	859	859	859	859
N Individuals	859	859	859	859	859	859
R-squared	0.040	0.045	0.042	0.049	0.038	0.043

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B9: Longer-Run Outcome: Life Satisfaction

	Life Satisfaction					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**-0.103****	**-0.100***				
	[0.044]	**[0.059]**				
Δ Anger x Female		**-0.001**				
		[0.088]				
Δ Anxiety (Post-Pre)			**-0.118*****	**-0.093**		
			[0.043]	**[0.067]**		
Δ Anxiety x Female				**-0.043**		
				[0.088]		
Δ Self-Confidence (Post-Pre)					**0.083***	**-0.014**
					[0.043]	**[0.062]**
Δ Self-Confidence x Female						**0.158***
						[0.086]
Anger (Pre)	-0.137***	-0.097				
	[0.042]	[0.060]				
Anger (Pre) x Female		-0.072				
		[0.083]				
Anxiety (Pre)			-0.114**	-0.134**		
			[0.047]	[0.067]		
Anxiety (Pre) x Female				0.041		
				[0.093]		
Self-Confidence (Pre)					0.118**	0.084
					[0.046]	[0.061]
Self-Confidence (Pre) x Female						0.048
						[0.091]
Treated	-0.052	0.012	-0.039	0.011	-0.048	-0.007
	[0.066]	[0.090]	[0.068]	[0.092]	[0.066]	[0.088]
Treated x Female		-0.114		-0.097		-0.057
		[0.132]		[0.136]		[0.133]
Female	-0.078	-0.029	-0.032	0.016	-0.027	0.001
	[0.066]	[0.088]	[0.066]	[0.089]	[0.066]	[0.086]
Constant	0.075	0.044	0.049	0.023	0.054	0.038
	[0.054]	[0.060]	[0.055]	[0.061]	[0.054]	[0.060]
N Observations	859	859	859	859	859	859
N Individuals	859	859	859	859	859	859
R-squared	0.014	0.016	0.013	0.015	0.012	0.017

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B10: Longer-Run Outcome: German Grade (in grade 10)

	German Grade (in grade 10)					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**-0.086***	**-0.111***				
	[0.046]	**[0.065]**				
Δ Anger x Female		**0.058**				
		[0.092]				
Δ Anxiety (Post-Pre)			**-0.101****	**-0.047**		
			[0.044]	**[0.069]**		
Δ Anxiety x Female				**-0.084**		
				[0.090]		
Δ Self-Confidence (Post-Pre)					**0.053**	**-0.079**
					[0.041]	**[0.064]**
Δ Self-Confidence x Female						**0.205****
						[0.083]
Anger (Pre)	-0.070	-0.091				
	[0.045]	[0.066]				
Anger (Pre) x Female		0.043				
		[0.090]				
Anxiety (Pre)			-0.222***	-0.172**		
			[0.046]	[0.077]		
Anxiety (Pre) x Female				-0.075		
				[0.096]		
Self-Confidence (Pre)					0.062	-0.037
					[0.043]	[0.071]
Self-Confidence (Pre) x Female						0.140
						[0.089]
Treated	-0.302***	-0.230**	-0.285***	-0.238**	-0.303***	-0.252**
	[0.068]	[0.100]	[0.067]	[0.100]	[0.068]	[0.100]
Treated x Female		-0.140		-0.084		-0.063
		[0.138]		[0.135]		[0.136]
Female	0.446***	0.510***	0.499***	0.532***	0.467***	0.492***
	[0.068]	[0.097]	[0.067]	[0.096]	[0.068]	[0.095]
Constant	0.161***	0.130*	0.118*	0.105	0.154**	0.144**
	[0.062]	[0.073]	[0.063]	[0.075]	[0.062]	[0.072]
N Observations	723	723	723	723	723	723
N Individuals	723	723	723	723	723	723
R-squared	0.090	0.091	0.116	0.118	0.088	0.096

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B11: Longer-Run Outcome: Math Grade (in grade 10)

	Math Grade (in grade 10)					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**-0.072**	**-0.128****				
	[0.048]	**[0.065]**				
Δ Anger x Female		**0.110**				
		[0.097]				
Δ Anxiety (Post-Pre)			**-0.066**	**-0.084**		
			[0.044]	**[0.073]**		
Δ Anxiety x Female				**0.028**		
				[0.092]		
Δ Self-Confidence (Post-Pre)					**0.023**	**0.034**
					[0.043]	**[0.071]**
Δ Self-Confidence x Female						**-0.017**
						[0.090]
Anger (Pre)	-0.099**	-0.166**				
	[0.046]	[0.070]				
Anger (Pre) x Female		0.122				
		[0.094]				
Anxiety (Pre)			-0.203***	-0.224***		
			[0.043]	[0.072]		
Anxiety (Pre) x Female				0.035		
				[0.090]		
Self-Confidence (Pre)					0.051	0.075
					[0.045]	[0.076]
Self-Confidence (Pre) x Female						-0.039
						[0.095]
Treated	-0.377***	-0.356***	-0.367***	-0.350***	-0.383***	-0.361***
	[0.070]	[0.105]	[0.070]	[0.106]	[0.071]	[0.107]
Treated x Female		-0.055		-0.032		-0.044
		[0.142]		[0.141]		[0.143]
Female	-0.041	-0.012	0.011	0.028	-0.021	0.000
	[0.071]	[0.099]	[0.070]	[0.098]	[0.071]	[0.098]
Constant	0.468***	0.459***	0.428***	0.418***	0.462***	0.450***
	[0.061]	[0.070]	[0.061]	[0.072]	[0.062]	[0.071]
N Observations	723	723	723	723	723	723
N Individuals	723	723	723	723	723	723
R-squared	0.048	0.050	0.068	0.069	0.043	0.044

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B12: Longer-Run Outcome: Abitur Degree

	Abitur Degree					
	[1]	[2]	[3]	[4]	[5]	[6]
Δ Anger (Post-Pre)	**-0.044***	**-0.046**				
	[0.023]	**[0.032]**				
Δ Anger x Female		**0.001**				
		[0.047]				
Δ Anxiety (Post-Pre)			**-0.050****	**-0.049**		
			[0.022]	**[0.036]**		
Δ Anxiety x Female				**-0.004**		
				[0.045]		
Δ Self-Confidence (Post-Pre)					**0.003**	**-0.031**
					[0.022]	**[0.034]**
Δ Self-Confidence x Female						**0.058**
						[0.044]
Anger (Pre)	-0.027	-0.038				
	[0.023]	[0.035]				
Anger (Pre) x Female		0.018				
		[0.047]				
Anxiety (Pre)			-0.122***	-0.133***		
			[0.022]	[0.034]		
Anxiety (Pre) x Female				0.018		
				[0.045]		
Self-Confidence (Pre)					0.031	0.016
					[0.022]	[0.035]
Self-Confidence (Pre) x Female						0.022
						[0.044]
Treated	0.372***	0.359***	0.379***	0.362***	0.361***	0.349***
	[0.035]	[0.052]	[0.035]	[0.052]	[0.036]	[0.052]
Treated x Female		0.023		0.031		0.032
		[0.071]		[0.070]		[0.072]
Female	0.052	0.042	0.080**	0.068	0.059*	0.046
	[0.035]	[0.045]	[0.034]	[0.045]	[0.035]	[0.045]
Constant	0.246***	0.252***	0.224***	0.229***	0.247***	0.254***
	[0.029]	[0.032]	[0.029]	[0.033]	[0.029]	[0.033]
N Observations	723	723	723	723	723	723
N Individuals	723	723	723	723	723	723
R-squared	0.138	0.138	0.168	0.169	0.137	0.139

Notes: Standard errors are in brackets. "Treatment" takes value one (zero) if in the younger (older) cohort. "Post-Pre" measures changes in Anger (or Anxiety, Self-Confidence, respectively) between ages 12/13 and 13/14 (i.e., before versus after Reunification for the treated (younger) cohort). The outcome variable is measured in 1995 for both cohorts.

Table B13: Comparison of Measures

	Longitudinal Study of Students (our sample, Germany			KiGGS (Germany)			Youth Risk Behavior Surveillance (US)		
sample age	18-21 year olds			14-17 year olds			12th graders		
survey year	1995			2003			1995		
	definition	girls	boys	definition	girls	boys	definition	girls	boys
physical fight	have been or started a physical fight at least once in past 12 months	2.38%	9.32%	experienced physical violence as offender during past 12 months (at least once)	9.9%	21.0%	at lest once in past 30 in physical fight on school property	5.6% (+-1.6)	15.5% (+-2.8)
suicidal thoughts	thought about committing suicide at least once	34.88%	19.95%	had suicidal thoughts in the past 14 days[1]	17%	8.3%	thought seriously about attempting suicide during past 12 months	23.9% (+-3.9)	16.3% (+-3.5)
smoking behavior	currently smoking (regularly/ occasionally)	38.55%	36.15%	currently smoking (irrespective of intensity)	31.9%	31.1%	smoked at least on 1 of the past 30 days	34.4% (+-4.1)	42.0% (+-5.2)
drinking behavior	drank alcohol at least 1-2 times per month during past year[2]	63.04%	74.35%				drank alcohol on at least 1 day out of the past 30 days	53.6% (+-5.0)	59.5% (+-3.8)
	drank alcohol at least once per week during the past 3 months[3]	37.77%	57.72%	drink alcohol at least once per week	23.1%	40.7%	episodic heavy drinking (drank at least 5 drinks in one occasion in 1 out of past 30 days)	31.6% (+-4.6)	46.5% (+-4.0)

1 This question comes from the European SEYLE Survey that was conducted in 2010 and surveyed 14-16 year olds.

2 Corresponds to the variable *Alcohol Consumption: Regular* used in the analysis.

3 Corresponds to the variable *Alcohol Consumption: Heavy* used in the analysis.

Appendix C

Addendum to Chapter 3

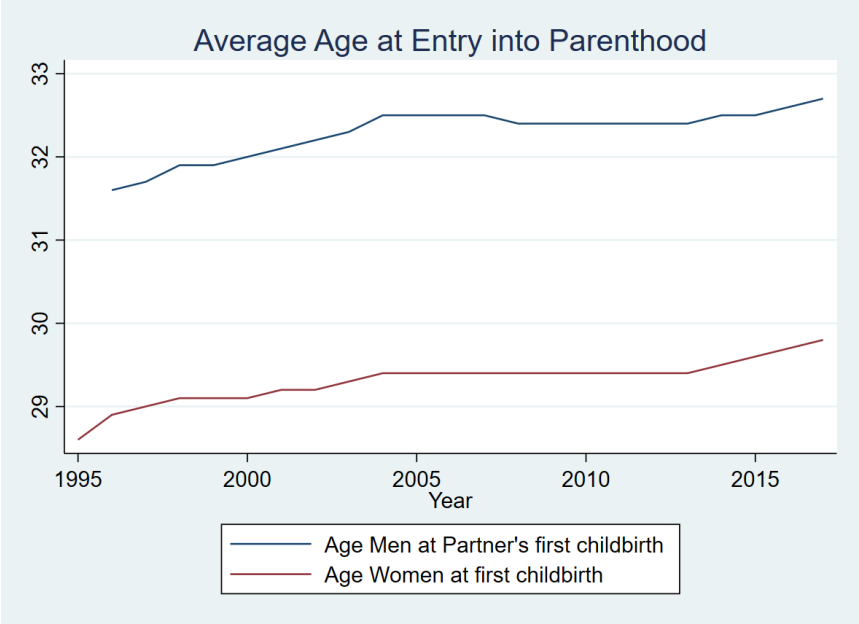
C.1 Dutch Fertility: Average Age at First Child

Figure C.1 plots the average of entry into parenthood between 1995 and 2017 for the whole Dutch population. Hereby, the red line plots the average of the mother when she gives birth for the first time. The blue line plots the average age of the father when the mother gives birth for the first time. We restrict our sample to the ages 20 to 40, which might seem restrictive given the delay in fertility in Europe over the last years. For the dutch population, a slight increase in the age of entry into parenthood can be seen. The averages are clearly under 40, which means, with our restriction, we are likely to capture the fertility decision of the majority of our sample.

C.2 Full Set of Results

Table C1 reports the full set of results, i.e. including all control variables, of the main results discussed in section 3.4. The dependent variable in columns [1]-[3] is entry into motherhood, and for columns [4]-[6] it is entry into fatherhood. In columns [2], [3], [5], and [6] sibling outcomes are instrumented by average neighborhood entry into parenthood in sibling's neighborhood in each half-year within two years. In each regression, we control for year and quarter fixed effects.

Figure C.1: Average Age of Parenthood Entry in the Netherlands (1995 - 2017)



Source: CBS, Birth - key figures

Table C1: Sibling Spillover - Main Results - Full Set of Covariates

Outcome:	Become Mother			Become Father		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	[1]	[2]	[3]	[4]	[5]	[6]
Sibling gave birth						
up to half year ago	0.014***	-0.014	-0.015	0.008***	0.007	0.007
	[0.000]	[0.009]	[0.009]	[0.000]	[0.008]	[0.008]
half to 1 year ago	0.019***	0.005	0.003	0.012***	0.005	0.003
	[0.001]	[0.009]	[0.010]	[0.000]	[0.008]	[0.008]
1 to 1.5 years ago	0.018***	0.021**	0.018*	0.012***	0.001	0.001
	[0.001]	[0.009]	[0.010]	[0.000]	[0.008]	[0.008]
1.5 to 2 years ago	0.017***	0.027***	0.024**	0.011***	-0.005	-0.006
	[0.001]	[0.010]	[0.010]	[0.000]	[0.008]	[0.008]
2 to 2.5 years ago			0.024**			0.016*
			[0.011]			[0.008]
Individual Characteristics						
Married	0.027***	0.028***	0.028***	0.027***	0.027***	0.027***

Continued on next page

Table C1: Sibling Spillover - Main Results - Full Set of Covariates continued

Outcome:	**Become Mother**			**Become Father**		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	[1]	[2]	[3]	[4]	[5]	[6]
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Cohabiting	0.002***	0.002***	0.002***	0.001***	0.002***	0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Age	-0.008***	-0.007***	-0.005***	-0.014***	-0.014***	-0.013***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Age Squared	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Years of Education	-0.001***	-0.001***	-0.001***	-0.000	-0.000	-0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Siblings' Characteristics						
Married	-0.005***	-0.004***	-0.004***	-0.004***	-0.004***	-0.004***
	[0.001]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
Cohabiting	-0.002***	-0.002***	-0.002***	-0.001***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Age	-0.015***	-0.014***	-0.013***	-0.018***	-0.017***	-0.017***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Age Squared	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Years of Education	0.000	-0.000	-0.000	-0.000***	-0.000***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Neighborhood Averages						
Entry Parenthood	0.349***	0.350***	0.360***	0.430***	0.431***	0.440***
	[0.008]	[0.008]	[0.008]	[0.008]	[0.008]	[0.009]
Become Parent in general	-0.080***	-0.080***	-0.083***	-0.121***	-0.121***	-0.124***
	[0.003]	[0.003]	[0.003]	[0.004]	[0.004]	[0.004]
Married	-0.087***	-0.087***	-0.088***	-0.128***	-0.127***	-0.130***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Cohabiting	-0.027***	-0.026***	-0.028***	-0.044***	-0.044***	-0.045***
	[0.003]	[0.003]	[0.003]	[0.002]	[0.002]	[0.002]
Age	-0.006***	-0.006***	-0.006***	-0.004***	-0.004***	-0.004***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Years of Education	0.004***	0.004***	0.004***	0.002***	0.002***	0.002***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
N Observations	3,017,119	3,015,409	2,892,002	3,741,811	3,739,450	3,582,263
N Individuals	77,382	77,372	76,987	100,256	100,246	99,640
Statistics						

Continued on next page

Table C1: Sibling Spillover - Main Results - Full Set of Covariates continued

Outcome:	**Become Mother**			**Become Father**		
	OLS	2SLS	2SLS	OLS	2SLS	2SLS
	[1]	[2]	[3]	[4]	[5]	[6]
Under-identification		884.32	811.07		776.06	709.45
p-value		0.0000	0.0000		0.0000	0.0000
Weak-identification		232.37	170.10		199.20	144.98

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Standard errors are clustered on the individual level.

C.3 Additional Results

In Table C2 the dependent variable of column [1] is to enter motherhood, and in column [2] it is to enter fatherhood. In each regression, we control for year and quarter fixed effects. Further, we include individual level controls for marriage and cohabitation status, age, age squared, and years of education. As contextual controls for siblings we include the analog of all individual controls. Contextual controls of neighbors include entry into parenthood, become a parent, marriage and cohabitation status, age, and years of education. In both regressions, sibling outcomes and their interactions are instrumented by average neighborhood entry into parenthood in sibling's neighborhood in each half-year within two years and their interaction with the dummy indicating whether the individual and sibling live in the same district.

Table C2: Additional Heterogeneous Results

het. Var.:	live in Sibling's district	
Outcome:	**Become Mother**	**Become Father**
	[1]	[2]
Sibling gave birth		
up to half-year ago	-0.014	0.007
	[0.009]	[0.008]
x het. Var.	0.002	0.001
	[0.002]	[0.001]
half to 1 year ago	0.005	0.005
	[0.009]	[0.008]
x het. Var.	-0.000	-0.001
	[0.002]	[0.001]
1 to 1.5 years ago	0.021**	0.001
	[0.009]	[0.008]
x het. Var.	-0.002	0.000
	[0.002]	[0.001]
1.5 to 2 years ago	0.027***	-0.005
	[0.010]	[0.008]
x het. Var.	-0.002	-0.001
	[0.002]	[0.002]
N Observations	3,015,409	3,739,450
N Individuals	77,372	100,246
Statistics		
Under-Identification	884.93	775.38
p-value	0.0000	0.0000
Weak-Identification	116.27	99.51

Notes: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Standard errors are clustered on the individual level.

Bibliography

Agostinelli, F. (2018). Investing in children's skill: An equilibrium analysis of social interactions and parental investments. *PhD thesis, W.P. Carey School of Business, Arizona State University*.

Almlund, M., Duckworth, A. L., Heckman, J., and Kautz, T. (2011). Personality psychology and economics. In *Handbook of The Economics of Education*, pages 1–181. Elsevier.

Almond, D., Currie, J., and Duque, V. (2018). Childhood circumstances and adult outcomes: Act ii. *Journal of Economic Literature*, 56(4):1360–1446.

Autor, D., Figlio, D., Karbownik, K., Roth, J., and Wasserman, M. (2019). Family disadvantage and the gender gap in behavioral and educational outcomes. *American Economic Journal: Applied Economics*, 11(3):338–381.

Balbo, N. and Barban, N. (2014). Does fertility behavior spread among friends? *American Sociological Review*, 79(3):412–431.

Banerjee, A., Chandrasekhar, A. G., Duflo, E., and Jackson, M. O. (2013). The diffusion of microfinance. *Science*, 341(6144):1236498.

Bernardi, L. and Klaerner, A. (2014). Social networks and fertility. *Demographic Research*, 30:641–670.

Bertrand, M. (2013). Career, family, and the well-being of college-educated women. *American Economic Review*, 103(3):244–250.

Bertrand, M. and Pan, J. (2013). The trouble with boys: Social influences and the gender gap in disruptive behavior. *American Economic Journal: Applied Economics*, 5(1):32–64.

Bhaumik, S. K. and Nugent, J. B. (2011). Real options and demographic decisions: empirical evidence from east and west germany. *Applied Economics*, 43(21):2739–2749.

Blume, L. E., Brock, W. A., Durlauf, S. N., and Jayaraman, R. (2015). Linear social interactoins models. *Journal of Political Economy*, 123(2):444–496.

Borghans, L., Duckworth, A. L., Heckman, J. J., and ter Weel, B. (2008). The economics and psychology of personality traits. *Journal of Human Resources*, 43(4):972–1059.

Bramoullé, Y., Djebbari, H., and Fortin, B. (2009). Identification of peer effects through social networks. *Journal of econometrics*, 150(1):41–55.

Brenøe, A. A. and Lundberg, S. (2018). Gender gaps in the effects of childhood family environment: Do they persist into adulthood? *European Economic Review*, 109:42–62.

Butikofer, A., Løken, K., and Salvanes, K. G. (2019). Infant health care and long-term outcomes. *Review of Economics and Statistics*, 101(2):341–354.

Buyukkececi, Z., Leopold, T., van Gaalen, R., and Engelhardt, H. (2020). Family, firms, and fertility: A study of social interaction effects. *Demography*, 57:243–266.

Cai, J., De Janvry, A., and Sadoulet, E. (2015). Social networks and the decision to insure. *American Economic Journal: Applied Economics*, 7(2):81–108.

Calvó-Armengol, A., Patacchini, E., and Zenou, Y. (2009). Peer effects and social networks in education. *The Review of Economic Studies*, 76(4):1239–1267.

Card, D. (1999). The causal effect of education on earnings. In Card, O. C. A. a. D., editor, *Handbook of Labor Economics*, volume 3, Part A, chapter 30, pages 1801–1863. Elsevier. DOI: 10.1016/S1573-4463(99)03011-4.

Carneiro, P., Lopez-Garcia, I., Tominey, E., and Salvanes, K. G. (2015). Intergenerational transmission, human capital formation and the timing of parental income. *IZA DP No. 9479*.

Carrell, S. E., Hoekstra, M., and Kuka, E. (2018). The long-run effects of disruptive peers. *American Economic Review*, 108(11):3377–3415.

Carrell, S. E., Sacerdote, B. I., and West, J. E. (2013). From natural variation to optimal policy? the importance of endogenous peer group formation. *Econometrica*, 81(3):855–882.

Ciliberto, F., Miller, A. R., Nielsen, H. S., and Simonsen, M. (2016). Playing the fertility game at work: An equilibirum model of peer effects. *International Economic Review*, 57(3):827–856.

Cobb-Clark, D. A., Salamanca, N., and Zhu, A. (2019). Parenting style as an investment in human deelopment. *Journal of Population Economics*, 32:1315–1352.

Conti, G., Heckman, J. J., and Pinto, R. (2016). The effects of two influential early childhood interventions on health and healthy behaviour. *The Economic Journal*, 126(596):F28–F65.

Cunha, F. and Heckman, J. (2007). The technology of skill formation. DOI: 10.3386/w12840.

Cunha, F. and Heckman, J. J. (2008). Formulating, identifying and estimating the technology of cognitive and noncognitive skill formation. *Journal of Human Resources*, 43(4):738–782.

Cunha, F., Heckman, J. J., and Schennach, S. M. (2010). Estimating the technology of cognitive and noncognitive skill formation. *Econometrica*, 78(3):883–931.

Currie, J. (2009). Healthy, wealthy, and wise: Socioeconomic status, poor health in childhood, and human capital development. *Journal of economic Literature*, 47(1):87–122.

De Giorgi, G., Frederiksen, A., and Pistaferri, L. (2019). Consumption network effects. *The Review of Economic Studies*, 87(1):130–163.

De Giorgi, G., Pellizzari, M., and Redaelli, S. (2010). Identification of social interactions through partially overlapping peer groups. *American Economic Journal: Applied Economics*, 2(2):241–275.

Del Boca, D. (2002). The effect of child care and part time opportunities on participation and fertility decisions in italy. *Journal of Population Economics*, 15(3):549–573.

Del Boca, D., Flinn, C., and Wiswall, M. (2014). Household choices and child development. *Review of Economic Studies*, 81(1):137–185.

Del Boca, D., Monfardini, C., and Nicoletti, C. (2017). Parental and child time investments and the cognitive development of adolescents. *Journal of Labor Economics*, 35(2):565–608.

Del Bono, E., Francesconi, M., Kelly, Y., and Sacker, A. (2016). Early maternal time investment and early child outcomes. *The Economic Journal*, 126(596):96–135.

Deming, D. J. (2017). The growing importance of social skills in the labor market. *The Quarterly Journal of Economics*, 132(4):1593–1640.

Doepke, M. and Zilibotti, F. (2017). Parenting with style: Altruism and paternalism in intergenerational preference transmission. *Econometrica*, 85(5):1331–1371.

Fafchamps, M. and Gubert, F. (2007). Risk sharing and network formation. *American Economic Review*, 97(2):75–79.

Feld, J. and Zölitz, U. (2017). Understanding peer effects: On the nature, estimation and channels of peer effects. *Journal of Labor Economics*, 35(2):387–428.

Fletcher, J. M. and Yakusheva, O. (2016). Peer effects on teenage fertility: Social transmission mechanisms and policy recommendations. *American Journal of Health Economics*, 2(3):300–317.

Fort, M., Ichino, A., and Zanella, G. (2019). Cognitive and non-cognitive costs of daycare 0–2 for children in advantaged families. *The Journal of Political Economy*, forthcoming.

Fortin, N. M., Oreopoulos, P., and Phipps, S. (2015). Leaving boys behind gender disparities in high academic achievement. *Journal of Human Resources*, 50(3):549–579.

Fredriksson, P., Öckert, B., and Oosterbeek, H. (2016). Parental responses to public investments in children - evidence from a miximum class size rule. *Journal of Human Resources*, 51(4).

Gaviria, A. and Raphael, S. (2001). School-based peer effects and juvenile behavior. *The Review of Economics and Statistics*, 83(2):257–268.

Goldsmith-Pinkham, P. and Imbens, G. W. (2013). Social networks and the identification of peer effects. *Journal of Business & Economic Statistics*, 31(3):253–264.

Golsteyn, B., Non, A., and Zölitz, U. (2017). The impact of peer personality on academic achievement. Technical Report Working Paper No.269. SSRN, University of Zurich, Department of Economics.

Graham, B. S. (2017). An econometric model of network formation with degree heterogeneity. *Econometrica*, 85(4):1033–1063.

Greaves, E., Hussain, I., Rabe, B., and Rasul, I. (2019). Parental responses to information about school quality: Evidence from linked survey and administrative data. Technical report.

Hank, K. and Kreyenfeld, M. (2003). A multilevel analysis of child care and women's fertility decisions in western germany. *Journal of Marriage and Family*, 65(3):584–596.

Hanushek, E. A., Kain, J. F., Markman, J. M., and Rivkin, S. G. (2003). Does peer ability affect student achievement? *Journal of applied econometrics*, 18(5):527–544.

Harris, K., Halpern, C., Whitsel, E., Hussey, J., Tabor, J., Entzel, P., and Udry, J. (2009). The national longitudinal study of adolescent to adult health: Research design. url: http://www.cpc.unc.edu/projects/addhealth/design.

Heckman, J., Pinto, R., and Savelyev, P. (2013). Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *American Economic Review*, 103(6):2052–2086.

Heckman, J., Stixrud, J., and Urzua, S. (2006). The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior. *Journal of Labor Economics*, 24(3):411–482.

Hoxby, C. (2000). Peer effects in the classroom: Learning fro gender and race variation. *National Bureau of Economic Research*, No. w7867.

Hoxby, C. M. (2002). The power of peers: How does the makeup of a classroom influence achievement. *Education Next*, 2(2):57–63.

Hoxby, C. M. and Weingarth, G. (2005). Taking race out of the equation: School reassignment and the structure of peer effects. Technical report, Working paper.

Hunt, J. (2002). The transition in east germany: When is a ten-point fall in the gender wage gap bad news? *Journal of Labor Economics*, 20(1):148–169.

Hunt, J. (2008). German reunification, economics of. In *The New Palgrave Dictionary of Economics*, pages 1–10. Palgrave Macmillan UK.

Jackson, C. K., Porter, S., Easton, J., Blanchard, A., and Kiguel, S. (2020). School effects on socio-emotional development, school-based arrests, and educational attainment. Technical report, CALDER.

Juutilainen, A., Kortelainen, S., Lehto, S., Ronnemaa, T., Pyorala, K., and Laakso, M. (2004). Gender difference in the impact of type 2 diabetes on coronary heart disease risk. *Diabetes Care*, 27(12):2898–2904.

Kann, L., Warren, C. W., Harris, W. A., Collins, J. L., Williams, B. I., Ross, J. G., and Kolbe, L. J. (1996). Youth risk behavior surveillance-united states, 1995. *Journal of School Health*, 66(10):365–377.

Kaptijn, R., Thomese, F., van Tilburg, T. G., and Liefbroer, A. C. (2010). How grandparents matter. *Human Nature*, 21(4):393–405.

Kaufmann, K. M., Messner, M., and Solis, A. (2015). Elite higher education, the marriage market and theintergenerational transmission of human capital.

Kirkcaldy, B., Trimpop, R., and Furnham, A. (1999). German unification: persistent differences between those from east and west. *Journal of Managerial Psychology*, 14(2):121–133.

Kleibergen, F. and Paap, R. (2006). Generalized reduced rank tests using the singular value decomposition. *Journal of Econometrics*, 133(1):97–126.

Kleven, H., Landais, C., and Søgaard, J. E. (2019). Children and gender inequality: Evidence from denmark. *American Economic Journal: Applied Economics*, 11(4):181–209.

Kohler, H.-P., Behrman, J. R., and Watkins, S. C. (2001). The density of social networks and fertility decisions: Evidence from south nyanza district, kenya. *Demography*, 38(1):43–58.

Kraemer, S. (2000). The fragile male. *BMJ*, 321(7276):1609–1612.

Krauss, T. and Faas, A. (1994). The wall: On the psychology of the reunification of germany. *Contemporary Family Therapy*, 16(3):199–213.

Krueger, A. B. and Pischke, J.-S. (1995). *A Comparative Analysis of East and West German Labor Markets: Before and After Unification*, pages 405–446. University of Chicago Press.

Kuziemko, I. (2006). Is having babies contagious? estimating fertility peer effects between siblings.

Lavy, V., Paserman, M. D., and Schlosser, A. (2012a). Inside the black box of ability peer effects: Evidence from variation in the proportion of low achievers in the classroom*. *The Economic Journal*, 122(559):208–237.

Lavy, V. and Schlosser, A. (2011). Mechanisms and impacts of gender peer effects at school. *American Economic Journal: Applied Economics*, 3(2):1–33.

Lavy, V., Silva, O., and Weinhardt, F. (2012b). The good, the bad, and the average: evidence on ability peer effects in schools. *Journal of Labor Economics*, 30(2):367–414.

Lee, L.-f. (2007). Identification and estimation of econometric models with group interactions, contextual factors and fixed effects. *Journal of Econometrics*, 140(2):333–374.

Lee, L.-f., Liu, X., and Lin, X. (2010). Specification and estimation of social interaction models with network structures. *Econometrics Journal*, 13(2):145–176.

Lin, X. (2010). Identifying peer effects in student academic achievement by spatial autoregressive models with group unobservables. *Journal of Labor Economics*, 28(4):825–860.

Lin, X. (2015). Utilizing spatial autoregressive models to identify peer effects among adolescents. *Empirical economics*, 49(3):929–960.

Lyngstad, T. H. and Prskawetz, A. (2010). Do siblings' fertility decisions influence each other? *Demography*, 47(4):923–934.

Manski, C. F. (1993). Identification of endogenous social effects: The reflection problem. *The review of economic studies*, 60(3):531–542.

McFadden, D. (1974). The measurement of urban travel demand. *Journal of Public Economics*, 3(4):303–328.

Mishra, A. and Parasnis, J. (2017). Peers and fertility preferences: An empirical investigation of the role of neighbours, religion and education. *Social Indicators Research*, 134(1):339–357.

Monstad, K., Propper, C., and Salvanes, K. G. (2011). Is teenage motherhood contagious? evidence from a natural experiment. Technical report, CEPR.

Morales, L. F. (2015). Peer effects on a fertility decision: an application for medellín, colombia. *Economía*, 15(2):119–159.

Neidell, M. and Waldfogel, J. (2010). Cognitive and noncognitive peer effects in early education. *The Review of Economics and Statistics*, 92(3):562–576.

Nicoletti, C. and Rabe, B. (2019). sibling spillover effects in school achievement. *Journal of Applied Econometrics*, 34(4):482–501.

Nicoletti, C., Salvanes, K. G., and Tominey, E. (2018). The family peer effect on mothers' labour supply. *American Economic Journal: Applied Economics*, 10(3):206–234.

Nicoletti, C. and Tonei, V. (2017). The response of parental time investments to the child's abilities and health. IZA DP No. 10993.

Oreopoulos, P., Stabile, M., Walld, R., and Roos, L. L. (2008). Short-, medium-, and long-term consequences of poor infant health - an analysis uinf siblings and twins. *Journal of Human Resources*, 43(1):88–138.

Patacchini, E. and Arduini, T. (2016). Residential choices of young americans. *Journal of Housing Economics*, 34:69–81.

Patacchini, E. and Zenou, Y. (2016). Social networks and parental behavior in the intergenerational transmission of religion. *Quantitative Economics*, 7:969–995.

Plug, E. and Vijverberg, W. (2005). Does family income matter for schooling outcomes? using adoption as a natural experiment. *Economic Journal*, 115(506):880–907.

Pomerantz, E. M., Altermatt, E. R., and Saxon, J. L. (2002). Making the grade but feeling distressed: Gender differences in academic performance and internal distress. *Journal of Educational Psychology*, 94(2):396–404.

Pop-Eleches, C. and Urquiola, M. (2013). Going to a better school: Effects and behavioral responses. *American Economic Review*, 103(4):1289–1324.

Powell, L. M., Tauras, J. A., and Ross, H. (2005). The importance of peer effects, cigarette prices and tobacco control policies for youth smoking behavior. *Journal of Health Economics*, 24(5):950–968.

Sacerdote, B. (2001). Peer effects with random assignment: Results for dartmouth roommates. *The Quarterly Journal of Economics*, 116(2):681–704.

Schmitt, M. and Maes, J. (1998). Perceived injustice in unified germany and mental health. *Social Justice Research*, 11(1):59–78.

Slomski, A. (2012). Chronic mental health issues in children now loom larger than physical problems. *JAMA: The Journal of the American Medical Association*, 308(3):223.

Thomese, F. and Liefbroer, A. C. (2013). Child care and child births: The role of grandparents in the netherlands. *Journal of Marriage and Family*, 75(2):403–421.

Wasserman, D., Carli, V., Wasserman, C., Apter, A., Balazs, J., Bobes, J., Bracale, R., Brunner, R., Bursztein-Lipsicas, C., Corcoran, P., Cosman, D., Durkee, T., Feldman, D., Gadoros, J., Guillemin, F., Haring, C., Kahn, J.-P., Kaess, M., Keeley, H., Marusic, D., Nemes, B., Postuvan, V., Reiter-Theil, S., Resch, F., Sáiz, P., Sarchiapone, M., Sisask, M., Varnik, A., and Hoven, C. W. (2010). Saving and empowering young lives in europe (SEYLE): a randomized controlled trial. *BMC Public Health*, 10(1).

Yakusheva, O. and Fletcher, J. (2013). Learning from teen childbearing experiences of close friends: Evidence using miscarriages as a natural experiment. *The Review of Economics and Statistics*, 97(1):29–43.

Yakusheva, O. and Fletcher, J. (2015). Learning from teen childbering experiences of close friends: evidence using miscarriages as a natural experiment. *Review of Economics and Statistics*, 97(1):29–43.

Yi, J., Heckman, J. J., Zhang, J., and Conti, G. (2015). Early health shocks, intra-household resource allocation and child outcomes. *The Economic Journal*, 125(588):F347–F371.

Young, J. K. and Beaujean, A. A. (2011). Measuring personality in wave i of the national longitudinal study of adolescent health. *Frontiers in Psychology*, 2.

Zahn-Waxler, C., Shirtcliff, E. A., and Marceau, K. (2008). Disorders of childhood and adolescence: Gender and psychopathology. *Annual Review of Clinical Psychology*, 4(1):275–303.

Curriculum Vitae

September 2014 – August 2020	Ph.D. Studies in Economics Center for Doctoral Studies in Economics, University of Mannheim, Germany
September 2014 – August 2016	M.Sc. in Economics University of Mannheim, Germany
September 2011 – July 2014	B.Sc. in Economics and Business Administration University of Mainz, Germany
June 2011	Abitur Gymnasium an der Stenner Iserlohn, Germany

Eidesstattliche Erklärung

Hiermit erkläre ich, die vorliegende Dissertation selbstständig angefertigt und mich keiner anderen als der in ihr angegebenen Hilfsmittel bedient zu haben. Insbesondere sind sämtliche Zitate aus anderen Quellen als solche gekennzeichnet und mit Quellenangaben versehen.

Mannheim, 13. August 2020 Yasemin Özdemir