The Interaction between Parents and Children

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Three Essays on Family Economics

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Contents

Chapter 1

1. Introduction

Parents play an important role in a variety of children's outcomes. Parents' influence on children occurs over the children's life cycle, from the in utero stage (Currie et al., 2018; Scholte et al., 2015) to the infant stage (Alessie et al., 2018), the education stage (Grönqvist et al., 2017), the adulthood stage (Carneiro et al., 2021; Almond et al., 2018), and up to older ages (Li and An, 2015). Besides, children will also affect their parents' wellbeing. For example, children could provide financial support, emotional and functional support to their parents later in life. Therefore, it is critical to analyze parent-child interactions over the life cycle, particularly at the beginning of the life cycle, when parents are motivated to care for and invest in their children; and at the end of the life cycle, when children's support and care can influence parents' wellbeing. It is noteworthy that parent-child interactions are important across cultures and economies, although with different features.

Extensive research has focused on the parent-child interactions early in the life cycle (Baker et al., 2019; van Huizen and Plantenga, 2018) and at the end of the life cycle (Ma, 2019; Oliveira, 2016), while less attention has been paid to the early stage of adulthood. First, parental care and investment in the early stages is documented to be a key determinant of child development. In particular, the quality of parenting is critical in children's human capital accumulation, as it lays the foundation for children's development. In addition to the role of parents, external interventions that occur in early childhood can have long-term and substantial impacts on children (Almond et al., 2018). Despite the beneficial impact of early childhood interventions on disadvantaged children, some recent evidence implies that replacing high-quality parental care with fair or even poor-quality center-based child care may have an undesirable effect on the children of better-educated parents (Fort et al., 2020). As more countries have introduced child care (OECD, 2020), it is important to investigate the effect of child care, especially how it varies by the characteristics of parents.

Second, as the global population is ageing, many countries have invested heavily in the wellbeing of older people, including investment in health care and long-term care. However, family support remains one of the primary sources of care for older people. Closer interactions between parents and children and greater support from children are essential factors for older

people. Hence, investigating the impact of children on parents can provide insights to deal with the global ageing trends.

Third, despite less research focusing on parent-child interactions during an individual's early adulthood, the interactions at this stage are vital in some settings, such as China. One reason for this is the deeply rooted culture of filial piety, which influences children's interaction with their parents in terms of living arrangements, financial support, and time transfers (Chen and Fang, 2018). For example, adult children in China have a larger chance of coresidence with their parents. Therefore, it is interesting to investigate the effect of parent-child interaction in the early adulthood stages on child outcomes in China.

In addition to the impact of parent-child interactions on family wellbeing, understanding parent-child interactions is important from an inequality perspective. Even in the early stages, children's skills gaps have already opened up. These gaps result from genes and are reinforced by different family environments, such as parent-child interactions and parental investment (Francesconi and Heckman, 2016). This highlights the vital role of parents in human capital accumulation and the potential for parent-child interactions to lead to inequality in child development across socioeconomic groups. This is related to the recent concerns that school closures during the Covid -19 pandemic would enlarge inequalities, as children from relatively disadvantaged families may have less access to educational resources at home (Engzell et al., 2021; Haelermans et al., 2022). Besides the impacts of parent investment and resources on inequality, it is also noted that losing a child has negative impacts on parents' wellbeing. The deterioration of economic status due to the loss of a child may contribute to inequality among the bereaved parents. Overall, investigating parent-child interactions can help us understand social inequality.

This thesis focuses on two aspects of parent-child interactions. First, I look at the impact of parents on their children's development at the infant stage and the adulthood stage. In Chapter 2, I study the effect of attending daycare at age 0-2 on children's cognitive development at age 8 in the Netherlands. With the increasing labour force participation in many OECD countries (OECD, 2017), parents highly rely on child care. Despite the expanding evidence on the desirable effects of using child care at age 3-6 on various child outcomes (see, e.g., Havnes and Mogstad, 2015; Felfe et al., 2015), there is less evidence on the effect of child care at very young ages. For Dutch policy makers, it is important to have a proper understanding of the effect of daycare on child development, as the Netherlands has very high enrollment rates in early childhood care and education (OECD, 2017). In the last two decades, the Dutch child care system has been subject to several reforms.

After establishing the relationship between parents and children at a very young age, in Chapter 3 this thesis turns to the adulthood stage. In particular, Chapter 3 explores the impact of parents' housing wealth on children's marriage prospects at marriageable ages in China. The hypothesis is that in an economy with an excess supply of males in the marriage market, such as China, parental housing wealth acts as a signal in the marriage market: higher parental housing wealth will enhance males' marriage prospects.

Finally, I explore the impact of children on their parents' wellbeing at older ages. Specifically, in Chapter 4, I investigate the effect of the death of a child on parents' physical and mental wellbeing in China. The death of a child in China may have extended impacts on parents, as children are the primary source of support for older individuals (Oliveira, 2016). With the rapid aging of the population and the lack of a developed social security system in China, it is very important to understand the effect of losing a child on older people's wellbeing.

The next subsections describe the three main chapters of the thesis and the main results. Section 1.4 discusses the policy recommendations.

1.1 Does Child Care Affect Children's Ability? Evidence from the Netherlands

In Chapter 2, I examine the effect of daycare use at age 0-2 on children's cognitive abilities and self-assessed qualities at age 8 in the Netherlands. The last decade has witnessed increased child care use in many OECD countries (OECD, 2017). As for the effect of child care on children, a large literature shows positive impacts of child care at age 3-6 on various child outcomes, particularly among disadvantaged children (Heckman et al., 2013; Havnes and Mogstad, 2015; Felfe et al., 2015). In contrast, less attention has been paid to child care at age 0-2. It is suggested that very early ages are crucial for individual development, as the child's brain at these stages is the most receptive, and the experiences at this stage could lay the basis of cognitive and non-cognitive development in the future (Knudsen et al., 2006).

According to the OECD Family Database (OECD, 2020), the Netherlands is among the OECD countries with the highest enrollment rates in early childhood care and education for children aged 0-3. Therefore, it is very important to understand the effect of child care attendance on child development in the Netherlands. Consequently, Chapter 2 answers the following research question:

What is the effect of daycare use at very young ages on children's school outcomes at age 8?

To answer this research question, I use data from the Dutch Longitudinal Cohort Survey School Careers (COOL). One issue is that daycare use indicators may suffer from endogeneity

caused by omitted variable bias (e.g., family background). Therefore, I estimate the effects by exploiting a Dutch policy reform of increasing child care subsidies in 2005 as an instrument. To measure children's school outcomes, I consider children's 1) self-assessed skills, including cognitive self-confidence and task orientation), and 2) test scores, including vocabulary, mathematics, reading comprehension, word decoding, and non-school capability test scores.

I find that using daycare at age 0-2 reduces children's scores on task orientation by 0.820 standard deviations and reading comprehension by 1.289 standard deviations, while it has a beneficial impact on children's word decoding scores (0.807 standard deviations). The negative effect is driven by children with high-educated fathers, consistent with the extant evidence of child care's adverse impact on affluent children (see, e.g., Fort et al., 2020). Fort et al. (2020) suggest that children usually get fewer one-to-one interactions with adults at daycare centers than at home, leading to a negative effect on children's development. This negative effect is more pronounced for children from affluent families, as these families are more likely to provide care with better quality.

This chapter contributes to the existing literature mainly in two ways. First, it focuses on the effect of daycare use at age 0-2, which lays the foundation of individual development. Second, despite the extensive evidence on the positive impacts of child care on child development (see, e.g., Havnes and Mogstad, 2015; Felfe et al., 2015), I empirically study the effect using Dutch cohort data and find that using daycare has an undesirable impact on children's task orientation and reading comprehension scores, driven by relatively more affluent children.

1.2 Parental Housing Wealth and Children's Marriage Prospects in China

In Chapter 3, we examine the effect of parental housing wealth on children's marriage prospects, focusing on the context of China. Individuals' marital status is believed to be associated with housing wealth (see, for example, Chu et al., 2020; Lafortune and Low, 2017b; Wei and Zhang, 2011), especially in some developing countries such as China, where housing wealth is likely to be treated as a status good (Wei et al., 2017) or a positional good (Chu et al., 2020). As housing wealth is more visible than non-housing financial wealth (e.g., stocks and savings), it plays a more crucial role in the marriage market than other forms of wealth (Wei et al., 2017). In particular, due to the rising sex ratios in China (the excess supply of males in the marriage market), housing wealth is more likely to act as a signal for males in the marriage market than for females. The hypothesis is that young males with higher housing wealth have a better chance to find a partner and get married. This hypothesis is supported by some evidence

from China, suggesting that housing wealth enhances males' marriage chances (e.g., Hu and Wang, 2020; Fang and Tian, 2018; Wei et al., 2017; Wei and Zhang, 2011).

The extant literature exploring the association between housing wealth and marriage outcomes in China focuses on the effect of individual housing wealth on marriage outcomes (see, e.g., Hu and Wang, 2018). However, parental housing wealth could play a non-trivial role in children's marriage prospects. It is difficult for young individuals to purchase houses when they get married due to their low wealth holdings and the rising housing prices in many cities (Wrenn et al., 2019). Thus, they are very likely to need help from their parents to purchase a home (Sun and Zhang, 2020; Wei et al., 2017). In practice, it is more likely that rich parents with high housing wealth could provide such help. In other words, parental housing wealth could serve as a signal in the marriage market as housing wealth is more visible than non-housing wealth.

Understanding the effect of housing wealth –particularly parental housing wealth- is very important for policy makers for several reasons. First, China is experiencing decreasing marriage rates (Wrenn et al., 2019). Second, as housing is normally the largest and most visible form of wealth for most households in China, the recent China's housing market boom has had a pronounced influence on households (Sun and Zhang, 2020). Chapter 3 answers the following research questions:

What is the effect of parental housing wealth on young individuals' marriage prospects, and how does this effect differ between genders?

To empirically examine the impact of parental housing wealth on children's marriage outcomes, we draw data from the 2011, 2013, and 2015 waves of the China Health and Retirement Longitudinal Survey (CHARLS). The CHARLS data set has rich information on household housing and financial wealth, allowing us to construct different measures for housing wealth, including housing value, a dummy for high-value houses, and a dummy for homeownership. Moreover, to mitigate the potential effect of marital status on parental housing wealth holdings, we make use of the panel structure of the CHARLS data. Specifically, we focus on the children who were 16-35 years old and unmarried in the 2011 survey and track their marriage prospects in 2015. Hence, we are less concerned about potential reverse causality issues.

The results show that parental housing wealth plays a crucial role in children's transitions into marriage. This is particularly pronounced for males with rural *hukou*, whereas this effect is insignificant for females. For example, if parents own high-value houses, rural men's probability of getting married will increase by 10.77 percentage points. In contrast to housing

wealth, non-housing wealth does not affect young people's marriage transitions. This is in line with the hypothesis that housing wealth plays a more critical role in the marriage market than non-housing wealth as it is essentially the most visible form of wealth, while non-housing wealth is more difficult to verify (Wei et al. 2017).

This chapter contributes to the literature in mainly three ways. First, by using the panel structure of the CHARLS data, we can rule out potential reverse causality issues resulting from coresidence between the newlyweds and their parents. This is different from the existing studies in China, which only use cross-sectional data (Fang and Tian 2018; Wei and Zhang 2011). Second, different from other studies that only have information on homeownership (Hu and Wang 2020) or the size of the house (Fang and Tian 2018), the detailed wealth information provided by CHARLS allows us to use a measure of the financial value of the parental house. Furthermore, we find no evidence that non-housing wealth affects young people's marriage transitions, implying that housing wealth is more likely to act as a signal in the marriage market than non-housing wealth.

1.3 Parental Bereavement and Health: Evidence from China

In Chapter 4, we investigate the effect of losing a child on parents' physical health, mental health, and wellbeing later in life. Adverse life events play an important role in explaining the deteriorated wellbeing of older individuals. The death of a child, among all the adverse life events, has a considerable impact on older people's wellbeing, including their physical health status (Rogers et al., 2008), their mental health status (Li et al., 2005; Galatzer-Levy and Bonanno, 2012), and their socioeconomic status (Bucciol and Zarri, 2015; Van den Berg et al., 2017).

The negative effect of losing a child on parental wellbeing has been well-documented in many developed countries. However, there is limited evidence on China, where the negative effects could be amplified (e.g., due to the social custom and the lack of a developed social security system). The extant literature in China focuses either on a limited sample such as a city (Wei et al., 2016) or only on parents' mental health (Ren and Ye, 2017; Lei et al., 2014). In addition, it does not distinguish between the effect of losing a son and losing a daughter. This distinction is essential in China, owing to the prevalence of traditional son preferences. In other words, losing a son may have a more pronounced impact on parents. Therefore, Chapter 4 answers the following research question:

What is the effect of losing a child on parents' wellbeing later in life? And does the effect exhibit gender-specific patterns?

To study this research question, we draw data from the 2011 and 2013 waves of the China Health and Retirement Longitudinal Survey (CHARLS). To measure parents' wellbeing, we construct different measures of both physical and mental health, including subjective survival expectations, depression symptoms, poor health indicators, and subjective wellbeing.

We find that, compared to parents who never experienced the death of a child, bereaved parents are more pessimistic about their survival expectations, have more depression symptoms and lower subjective wellbeing, and have a higher probability of reporting being in poor health. Importantly, for mothers, losing a son has a more substantial negative effect on their mental health and self-rated health than losing a daughter.

This chapter contributes to the discussion on the wellbeing of the parents who lost their children. First, we draw data from a nationally representative data set and provide evidence that losing a child influences various parental wellbeing in China. Importantly, we find that the effect of losing a child exhibits strong gender-specific patterns. In particular, for mothers, losing a son has a stronger negative effect on their mental and physical health than losing a daughter. Second, this chapter sheds light on the effect of a child's death on parental survival expectations, which remains understudied. Finally, different from the extant research in China, we only consider characteristics as control variables that are predetermined to avoid endogeneity. The covariates are less likely to be affected by the child's death, such as age, gender, *hukou* at birth, education level, education level of respondent's parents, and childhood health status. This helps us capture the effects of parental bereavement on parental wellbeing better.

Chapter 2

2. Does Child Care Affect Children's Ability? Evidence from the Netherlands[1]

2.1 Introduction

Early childhood investment is crucial in determining children's well-being and shaping child development over the life cycle (Knudsen et al., 2006). Many countries have invested heavily in child care programs in recent years. With the increasing total public expenditure on early childhood education and care and the labour market development in OECD countries (e.g., the increase in female labour force participation),[2] child care enrollment has increased substantially, especially among children at a very young age. For example, the average child care enrollment rates for children under the age of three have risen from 26% in 2005 to 34% in 2014 (OECD, 2017). Despite the importance of this issue, there is no consensus on the extent to which children would benefit from child care. The extant literature examines the effect of exposure to child care on various child outcomes, and the results vary across studies (see negative results, e.g., Baker et al., 2008; Bernal and Keane, 2011 and positive effects, e.g., Havnes and Mogstad 2011; Black et al., 2014; Van den Berg and Siflinger, 2020). Most existing studies emphasize the impact of exposure at age 3-6 to child care. It is arguably more important to investigate the period of exposure just after births because of the vital role of the first three years for child development (Currie and Almond, 2011) and children's vulnerability at that period (Drange and Havnes, 2019).

In this chapter, we estimate the effect of exposure at age 0-2 to formal daycare on children's abilities at age 8-9 in the Netherlands. A major challenge in estimating the effect of daycare use on child outcomes is that the usual OLS estimator might suffer from endogeneity problems caused by the omitted variable bias. In particular, family background could influence both children's outcomes and parental decisions on daycare use. To address this issue, in addition to controlling for parents' characteristics, we employ an Instrumental Variable (IV) approach

[1] This chapter is based on Gao (2021).

[2] Source: OECD Family database.

by exploiting the introduction of a Dutch child care reform in 2005 (*Wet kinderopvang*), which increased the generosity of childcare benefits.

We use data from the 2007, 2010, and 2013 waves of the Dutch Cohort Study Education Careers among pupils aged 5–18 (*CohortOnderzoek OnderwijsLoopbanen van 5-18 jaar*, COOL hereinafter). Children's outcomes we study in this chapter contain 1) children's self-assessed qualities, including cognitive self-confidence and task orientation, and 2) test scores, including the test for vocabulary, mathematics, reading comprehension, word decoding, and the Non-school cognitive capacities test (NSCCT hereinafter).[3]

We find that daycare use at age 0-2 reduces children's abilities. Specifically, the IV estimates show that using daycare under the age of two reduces children's task orientation scores by 0.820 standard deviations and reading comprehension scores by 1.289 standard deviations. However, children benefit from using daycare at age 0-2 in their word decoding skills. Our findings are robust to alternative measures of daycare use and using a subsample dropping the children using daycare less than two years.

The interpretation of the negative effect is worthwhile. One potential explanation is that the effect is driven mainly by children from relatively advantaged families. This chapter explores the heterogeneous effect and finds that the negative effect is driven by children with high-educated fathers, consistent with the idea that attending daycare harms advantaged children (Fort et al., 2020). Given that children of affluent households and high-educated parents are more likely to use formal daycare in the Netherlands, [4-5] the undesirable effect of daycare use on advantaged children becomes more dominant than the desirable effect on disadvantaged children. Moreover, the negative effect may relate to Dutch daycare's deteriorating quality after the child care reform in 2005 (de Kruif et al., 2009; Helmerhorst et al., 2015). In fact, using internationally comparable indicators for the quality of child care,[6] researchers have shown a steady decrease in the average quality of Dutch child care centers from 1995 to 2005 (Deynoot-Schaub and Riksen-Walraven, 2005; Vermeer et al., 2008). Using the 2008 Dutch quality assessment of child care centers, de Kruif et al. (2009) and Helmerhorst et al. (2015) report a further decline in Dutch average child care quality in 2008 compared to 2005. For example, the average quality score decreased from 4.8 (on a 7-point scale ranging from 1 (bad) to 7

[3] The non-school cognitive capacities test (Niet-Schoolse Cognitieve Capaciteiten Test) is similar to IQ test.

[4] Lage en middeninkomens maken vooral gebruik van onbetaalde kinderopvang, CBS, 2011, https://www.cbs.nl/nl-nl/achtergrond/2011/48/lage-en-middeninkomens-maken-vooral-gebruik-van-onbetaalde-kinderopvang

[5] Childcare more important for working parents, CBS, 2010, https://www.cbs.nl/en-gb/news/2010/42/childcare-more-important-for-working-parents.

[6] ITERS-R (Infant/Toddler Environment Rating Scale-Revised) for 0-2 year olds, and the ECERS-R (Early Childhood Environment Rating Scale- Revised) for 2-4 year olds.

(excellent)) in 1995, to 4.3 in 2001, to 3.2 in 2005, and to 2.8 in 2008. Finally, the negative effect could be attributed to the Dutch daycare institutional background. It is typical of the Dutch society in which children only go to daycare some days a week, and therefore there is less structure than in other countries where children use full-time daycare. For instance, after the 2005 reform, the teacher-child ratio in daycare centers was around 1:4 to 1:8, depending on children's age. The ratio was lower than in some countries and regions with high-quality daycare (e.g., West Germany and Oslo). Therefore, the different daycare institutional contexts and the different daycare quality and structure may hinder child development.

This chapter makes three contributions to the existing literature. First, we estimate the impact of daycare attendance at younger ages (age 0-2) on child outcomes, which differs from the many existing studies focusing on child care at age 3-6 (e.g., Havnes and Mogstad, 2011; Black et al., 2014; Havnes and Mogstad, 2015; Felfe et al., 2015; Cornelissen et al., 2018). Moreover, existing literature on child care at age 0-2 only relies on data from a specific city or region (Felfe and Lalive, 2018; Drange and Havnes, 2019; Fort et al., 2020); we use a nationally representative cohort study and therefore focus on the representative Dutch population. Second, we address the endogeneity issue using an IV approach. Since unobservable heterogeneity, such as family background, is likely to correlate with daycare use and children's outcomes, OLS estimates may be biased. We exploit a Dutch child care policy change to identify the effect of daycare attendance on child outcomes. Third, this chapter focuses more on the effect of relatively advantaged children. Most studies emphasize either universal child care programs or child care programs targeting children of disadvantaged families, whereas less aim at children of advantaged households.[7] The Dutch context, in which advantaged households (e.g., high-income households and well-educated parents) make the most use of daycare,[8] allows us to study the effect of daycare use on children from the more advantaged background.

The remainder of the chapter is organized as follows: Section 2.2 reviews relevant literature. Section 2.3 introduces the institutional background of child care in the Netherlands. Section 2.4 discusses the data and empirical strategy. Section 2.5 shows the main results, and Section 2.6 concludes.

[7] One exception is recent research by Fort et al., (2020), which examines the effect of child care use on children with advantaged backgrounds. They find a negative effect of child care on children's cognitive and noncognitive abilities.

[8] See Merens et al. (2014) and Lage en middeninkomens maken vooral gebruik van onbetaalde kinderopvang, CBS, 2011, https://www.cbs.nl/nl-nl/achtergrond/2011/48/lage-en-middeninkomens-maken-vooral-gebruik-van-onbetaalde-kinderopvang

2.2 Relevant Literature

Several studies have investigated the effect of early child care on child development. Most papers focus on child care at age 3-6 and show positive impacts on a wide range of child outcomes (see, e.g., Heckman et al., 2010; Heckman et al., 2013; Havnes and Mogstad, 2015; Felfe et al., 2015; Conti et al., 2016), especially among disadvantaged children (Currie and Almond, 2011). For child care at a younger age (e.g., at age 0-2 in our study), however, the evidence is limited in the economic literature. From a neurobiological and behavioral perspective, there is a consensus that the very early stages are crucial, as child's brain at these stages is the most receptive, and the experiences at this stage could lay the basis of cognitive and noncognitive development in the future (Knudsen et al., 2006).

Some recent studies make an attempt to examine the impact of very early child care programs on child outcomes, yet the results are inconclusive. For example, Felfe and Lalive (2018) study the effect of child care attendance at age 0-2 on child development by exploiting an early child care expansion in West Germany that started in 2005. They stress a desirable effect on children's motor skills such as coordination and motor capacity (e.g., stand on one leg and jump on one leg) in general. Besides, boys and immigrant children benefit more in language skills. Exploiting a random child care assignment lottery in Oslo, Drange and Havnes (2019) examine the impact of child care enrollment at age 1-2 on children's cognitive skills at age 6-7 and show a significant increase in children's language and mathematics skills, particularly for disadvantaged children.

By contrast, several papers suggest a negative impact of very early child care on child outcomes. Focusing on Quebec, Baker et al. (2008) investigate the impact of a highly subsidized and universal child care program for children aged 0-4. They report an undesirable effect of universal child care on child behavior and health outcomes. Besides, the negative effects are found to be persistent in the long run, as reported in Baker et al. (2019). They argue that the negative impact might result from the relatively worse quality of Quebec universal child care. Alternatively, they propose that it may relate to child care's heterogeneous effects by family background: the positive effects for disadvantaged children are offset by the negative effects for more advantaged children. A recent paper by Fort et al. (2020) study the impact of daycare attendance at age 0-2 in Bologna, Italy. They focus more on the relatively affluent population and confirm the negative impacts of attending daycare centers at age 0-2 on children's intelligence quotient and noncognitive traits.

In summary, while most research studies the impact of child care at age 3-6 on child development, a few papers (e.g., Baker et al., 2008; Felfe and Lalive, 2018; Baker et al., 2019;

Drange and Havnes, 2019; Fort et al., 2020) investigate the very early child care and report mixed results. For the studies considering child care at younger ages, a common limitation is that they focus on a city or a region (e.g., West Germany, Oslo, Quebec, and Bologna). Unlike these studies, using a national cohort data set, we estimate the impact of daycare use at age 0-2 on children's cognitive abilities and self-assessed qualities in the Netherlands.

2.3 Institutional Background

In the Netherlands, children attend primary schools once they are four years old. Up until the age of four, there are three main types of child care. The first two types are private center-based daycare (*kinderdagverblijf*) and private guest parent care/childminder (*gastouderopvang*). With the primary aim of helping employed parents combine their care and work, daycare and guest parent offer care services for children. Daycare is more popular than guest parent care. In 2010, for example, more than 451,000 children aged 0-4 used daycare only, while around 75,000 children used guest parent care only (Middleton and Slikkerveer, 2011).[9]

Specifically, center-based daycare is the most commonly-used child care service, offering full-day care for children from six to eight weeks of age to four years old. Daycare centers are available up to 52 weeks per year, and typical daycare centers open on weekdays from around 7:30 until 18:30, and children can stay up to 11 hours per day. In fact, Dutch children typically enroll in part-time daycare rather than full-time daycare. For example, the Dutch average weekly hours in early childhood education and care for children aged 0-2 was around 16.9 hours in 2017 (OECD, 2020).[10] Also, daycare enrollment among children aged 0-4 in the Netherlands has increased in recent years (OECD, 2020), and the enrollment rate is particularly high among the 0- to 2-year-olds.

The second one, private guest parent care, is a small-scale child care organized by self-employed trained individuals and usually at the guest parent's home. We do not consider guest parent care in the following analysis, given that guest parent care is less popular than daycare and we lack information on guest parent care use in the data set.

Next to daycare, another commonly-used child care service is publicly funded playgroups (*peuterspeelzaal*), which provide two to four half days of care per week for children aged 2-4. Both daycare and playgroups provide child care services with similar qualities (Akgunduz et al., 2015), but they differ in several ways, such as financing system and target group (Naumann

[9] Around 234,000, 293,000, 320,000, 343,000 children aged 0-4 enrolled only in daycare in 2006, 2007, 2008, and 2009 respectively, whereas 30,000, 64,000, 101,000, and 106,000 children only used guest parents.

[10] The Netherlands has a lower average weekly hour in early childhood education and care for children aged 0-2, compared to the OECD average level (29.7 hours).

et al., 2013; Bettendorf et al., 2015; Akgunduz and Plantenga, 2014; Schreyer and Oberhuemer, 2017; Van Huizen, 2018). Most importantly, the vast majority of the children aged between 2 to 4 attend child care (either daycare, guest parent, playgroups, or others). According to OECD (2020), more than 90% of the children aged 3-4 in the Netherlands enrolled in child care in 2017.

Child care reform has been a hot issue in the Netherlands. Here we focus on one of the most prominent policy changes that took effect between 2005 and 2010. To facilitate the combination of child care and work, the Dutch government introduced the Childcare Act (*Wet kinderopvang*) on January 1, 2005, which led to several significant changes in the Dutch child care system for children aged 0-4. First, it changed the child care financing structure from supply- and demand-financing to purely demand-financing (Plantinga et al., 2010). Before 2005, it was the child care provider to get a subsidy from the government. After 2005, instead, the parents using child care services could get a subsidy from the central government directly (Plantenga et al., 2005).

Second, which is more important in our study, the reform led to a more generous subsidy for parents using child care. Note that child care subsidy is only available to dual-earner households and single working parents.[11] On the one hand, after 2005, the child care subsidy expanded to guest parent care, increasing the subsidy for parents with children using guest parents. On the other hand, since the Child Care Act's implementation in 2005, the financing of daycare became a tripartite system- that is, the central government, parents, and employers of parents were responsible for the costs of daycare. The employers paid a third of child care costs, which is only mandatory since 2007.[12] The government paid a subsidy to the parents using daycare. The amount of daycare subsidy was determined by three factors: 1) household income, the higher household income level is, the lower the government pays the subsidy; 2) birth order of the child, the second and further child could receive a higher subsidy than the first child; and 3) the cost of daycare service, which is affected by the hours of daycare use and a maximum hourly price of daycare that can be subsidized.[13] Additionally, the daycare subsidy was increased substantially in 2006 and 2007 (Bettendorf et al., 2015).

Consequently, the 2005 Dutch child care reform brought considerable benefit to parents. Between 2005 and 2008, the child care subsidy increased substantially, as shown in Figure 2.1. More importantly, we find that the child care subsidy change exhibits different patterns for

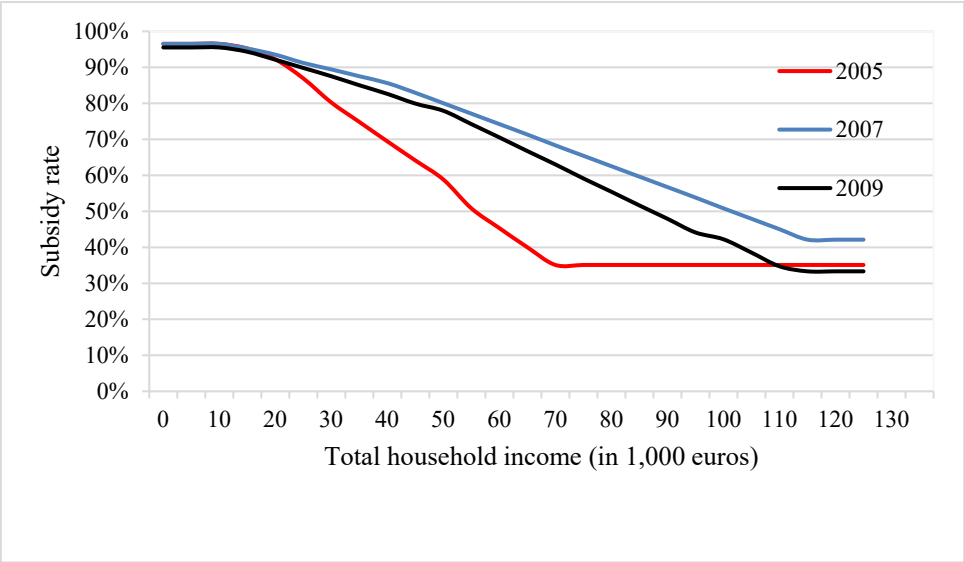
[11] A single parent or a parent and her/his partner would also be eligible for a child care subsidy if they were receiving general assistance or benefits, or following a route to work, a study, or an integration course.

[12] Source: CBS, Kinderopvang in Kaart, The Hague: CPB, 2011

[13] The maximum hourly price of daycare is adjusted annually. For example, it was € 5.68 in 2005, and it increased to € 6.36 in 2011.

different families: the subsidy change is substantial for middle-income households (income level between 20,000 and 100,000 euros); whereas the subsidy does not change for high-income households (above 100,000 euros) and low-income households (below 20,000 euros). This suggests that the policy change could affect children differently by their household income. On average, the parental share of daycare costs halved between 2005 and 2007, as reported in Table 2.1 (Bettendorf et al., 2015). Meanwhile, the use of daycare has risen significantly since 2005 (Naumann et al., 2013; Van Leeuwen, 2019). For example, the percentage of children aged 0-4 who attend daycare centers with respect to the total number of children in the same age category was fewer than 30% in 2004, but the percentage was doubled and closed to 60% in 2009 (CBS, 2011). However, the 2005 reform did not affect the playgroups, and the number of children in playgroups remained relatively stable (Akgunduz et al., 2015).

Figure 2.1. Total child care allowance for the 1st child (with maximum employer contribution in 2005)



Source: own calculations using publicly available subsidy rates

Table 2.1. Distribution of the formal childcare cost at the macro level between 2005 and 2007

	2005	2006	2007
Government	42%	48%	52%
Employers	21%	22%	29%
Parents	37%	30%	19%
Total (billion euros)	1,58	1,65	1,79

Source: CPB, 2007, Macro Economische

2.4 Data and Empirical Strategy

2.4.1 Data Source

This chapter draws data from three waves of the primary school education part of the *CohortOnderzoek OnderwijsLoopbanen van 5-18 jaar* (COOL), which is a Dutch national cohort study tracking children's academic careers. Carried out by the ITS and Kohnstamm Institute, the primary school part of the COOL study collected children's information in the second year of preschool education, the third grade of primary education, and the sixth grade of primary education.[14] The COOL study has conducted three waves of primary education data, including the baseline survey in the year 2007/2008 and two follow-up surveys in 2010/2011 and 2013/2014. The data set contains information on children's cognitive abilities, noncognitive abilities, school characteristics, and family background information (Van Huizen, 2018).

The COOL primary education sample consists of a representative school sample and a supplementary school sample with more children from disadvantaged backgrounds. The total number of participating schools accounts for approximately 8% of the primary schools in the Netherlands (Driessen et al., 2009). For example, the 2007/2008 sample contains 550 primary schools (400 reference schools and 150 additional schools). As for the sample size, the 2007/2008 COOL survey contains data from 38,060 children, including 13,842 second-year preschool education children, 12,609 third-grade primary education children, and 11,609 sixth-grade primary education.

The COOL data set has two features making it particularly suitable for this study. First, it consists of children born between 1991 and 2009 (for our working sample, which will be discussed in section 4.2, all the children were born in 2000-2006), covering the cohorts exposed to the 2005 child care reform and those who were not. This feature allows us to employ an IV approach to estimate the effect of daycare use on child outcomes. Second, it contains information on children's daycare use, capturing extensive and intensive margins, and child outcomes measured by various performances. In other data sets, either the sample does not cover children born before and after the policy change in 2005 or lacks adequate information on daycare use, hindering us from studying this question.

[14] In the Netherlands, primary schools have eight grades, including two grades of preschool education for children aged around 4-5 years old, and six grades of primary education for children between 6 to 12 years old.

2.4.2 Sample Selection

Two sets of variables are essential in this chapter. The first one is the information on daycare use, which is only available when a child participated in the survey at age 5-6 (in the second year of primary education). The second one is child outcome variables measured at age 8-9 (in the fifth year of primary education). Therefore, we need to observe the children at age 5-6 and age 8-9. To obtain this information, we pool the 2007/2008 and 2010/2011 samples and restrict the sample to children aged 5-6 as the baseline; then, we track them when they reached age 8-9 in the 2010/2011 and 2013/2014 surveys, respectively. This leaves us with a sample of 8,796 children, including 3,981 children participating in the 2007/2008 at age 5-6 and 4,815 children participating in the 2010/2011 at age 5-6. All children in the sample were born between 2000 and 2006.

We exclude three children who do not report their birth year as the year of birth is crucial in our empirical analysis. We then drop 2,970 children born in 2002 and 2003 because they were already in the daycare centers by the time the 2005 Childcare Act took effect and, therefore, they were partially affected by the reform. In other words, we keep only children born in 2000-2001 and 2004-2006 in the sample. Moreover, we keep only the children whose parents reported all the information on their daycare use before they went to primary school: whether they attend daycare centers, how many years of daycare use, and how many days per week. This further restricts the sample size to 3,619 children. The enrollment rate of child care for 0- to 4-year-olds is high in the Netherlands (OECD, 2020), and according to our sample, most children enroll in any form of child care and education at age 2-4 as a preparation for school. Therefore, instead of daycare at age 0-4, we consider the effect of daycare attendance at age 0-2. To do so, we compare the children using daycare for more than two years (therefore using daycare at age 0-2) and the children not using daycare for more than two years.

Finally, we exclude the children from our sample because they have substantial missing values in important variables: 71 observations that lack children's gender information, 181 with missing values for father's immigration status, 12 with missing values for mother's immigration status, 119 with missing values for father's educational attainment, 21 observations that lack mother's educational attainment, and 18 with missing values for whether having sibling(s).

The final sample contains information on children's gender, year of birth, whether having siblings or not, daycare use, test scores, self-assessed qualities, parental immigration status, and parental educational attainment for 3,197 children. In the final sample, 25.34% of the

children are from the 2007/2008 baseline survey, and 74.66% are from the 2010/2010 baseline survey.

2.4.3 Variable Construction

Daycare use is our explanatory variable of interest. The measure of daycare use is created from the parental questionnaire. In each wave of the COOL survey, parents of group 2 (aged 5-6) children were invited to answer three questions regarding their children's daycare use before going to primary school. The first question is whether the child attended a daycare center before primary school. The second question is for how many years the children used daycare. The answers can be one of the following: 0.5 years or less, 1 year, 1.5 years, 2 years, 2.5 years, 3 years, 3.5 years, and 4 years or more. The third is about the average number of days the child uses daycare per week, ranging from 0.5 days or less to 5 days or more.[15]

Based on parental responses on daycare use, we construct three variables to measure daycare use. The first one is a use daycare at age 0-2 dummy. It equals one if the children attended daycare centers for more than two years, meaning that they used daycare at age 0-2. The dummy equals zero if the children did not go to daycare or used daycare for less than (or equals) two years. The second one is the average weekly hours of daycare use, which is calculated by multiplying the average days of daycare use per week and 10 hours.[16] The third measure is the total thousand hours of daycare use, which is computed by multiplying the average hours of daycare use per week, the year of daycare use, and 52 weeks.

We investigate two sets of child outcome variables measured at age 8-9: children's self-assessed qualities and test scores. Child outcome variables are drawn from three modules of the COOL study: 1) child questionnaire, 2) the language, reading, and math tests, and 3) the NSCCT test.

We obtain children's self-assessed qualities from child questionnaires containing scores on their cognitive self-confidence and task orientation. Cognitive self-confidence refers to children's perceptions of their ability to do classwork (Midgley et al., 2000). Task motivation measures the degree to which children are focused on developing their skills, learning, and understanding schoolwork (Driessen et al., 2012). In the COOL study, children were presented with two lists of statements for cognitive self-confidence and task motivation, consisting of six statements for cognitive self-confidence and five statements for task motivation. For each

[15] In the 2008/2009 study, when the parent had children in multiple groups, they only had to complete the youngest child questionnaire. In the 2010//2011 and 2013/2014 survey, when the parent had more children participating in the survey, they were asked to complete each questionnaire separately.

[16] 11 hours is the average maximum open hours of daycare centers.

statement, they rated how much they agree with it on a 5-point scale ranging from 1 (definitely false) to 5 (definitely true). For example, one statement that belongs to cognitive self-confidence is "*I am sure I can manage even the most difficult tasks at school*". The COOL study computed children's scores for cognitive self-confidence and task orientation by averaging the scores from the different statements referring to that specific quality. The scores range from 1 to 5. A high score means the children rate themselves better at that aspect.

As for test scores, we consider children's vocabulary, mathematics, reading comprehension, word decoding, and non-school cognitive capacities test (NSCCT) scores. The first four tests are from the Cito student tracking system, which is developed by the Dutch National Institute for Educational Measurement (Cito) and widely used in the Dutch education system to track children's academic performance. Vocabulary scores and mathematics scores map the development of children's vocabulary skills and mathematics skills, respectively. Reading comprehension tests children's ability to understand texts. During the test, children were asked to read given texts and answer multiple-choice questions based on the texts. Word decoding was measured with the Three-Minutes-Test. Children were provided a card of words with increasing difficulty and asked to read many words as possible within one minute. The score was calculated based on the number of words that were read correctly. Reading comprehension is related to word decoding as they both present children's reading skills, but the word decoding test emphasizes the speed and accuracy of word reading, while reading comprehension focuses on understanding the meaning of the texts.

In addition to the Cito test, we also study the impact of daycare use on children's non-school cognitive capacities (NSCCT), which measures children's intelligence (for details, see Van Batenburg and Van der Werf, 2004). The NSCCT consists of 85 questions testing children's picture completion (15 questions), picture exclusion (15 questions), number sequence (15 questions), categories (20 questions), and similarities (20 questions). We use the NSCCT total score computed by summing the scores of all the 85 questions.

We control for several variables such as children's gender, whether having sibling(s), parental immigration status, and parental educational attainment. Specifically, we include dummies for a boy, having sibling(s), father/mother being a native Dutch, and father/mother having high educational attainment. We define parents as having high educational attainment if their educational attainment is university education (WO level in the Dutch education system) or high vocational education (HBO level in the Dutch education system).

2.4.4 Descriptive Statistics

Table 2.2 presents the summary statistics for the main variables in our sample. Besides, according to whether the children were influenced by the 2005 child care reform, we divide the sample into a control group and a treatment group. The control group consists of children who were born in 2000 and 2001. They were aged 4-5 when the policy change took effect and, therefore, not influenced by the reform. The treatment group includes children born in 2004-2006 who were exposed to the child care reform. Columns 1-6 are summary statistics for the full sample, columns 7-12 are for the control group, and columns 13-18 are for the treatment group. In particular, we report their demographic information and family characteristics measured at age 5-6 and their outcome variables measured at age 8-9.

As for some demographic characteristics, Table 2.2 shows that approximately 51% of the full sample are boys, and 80.7 % of them have as least a sibling. A large proportion of parents (83.2% of fathers and 82.8% of mothers, respectively) are born in the Netherlands. In terms of parental education, around 29.0% of the fathers and 27.9% of the mothers in the sample have high educational attainment (at HBO/WO level).

The enrollment rate in child care is high: more than 90% of the children enrolled in either daycare or playgroups under the age of four, about 24.7% of the children in the full sample attended daycare at age 0-2, and 70.7% attended playgroups at age 2-4. The average weekly daycare use is about 8.965 hours, and the total daycare use is around 1,271 hours. More importantly, the children born in 2004-2006 (the treatment group) differ from those born between 2000 and 2001 (the control group) in daycare use. In particular, the treatment group seems to use more daycare than the control group: 28.2% of the children in the treatment group enrolled in daycare centers under the age of two, whereas the control group is around 14.4%. Moreover, the treatment group spends more time in daycare centers than the control group with respect to average weekly daycare use and total daycare use.

For children's outcome variables, the treatment group has higher scores than the control group in vocabulary, mathematics, reading, word decoding, and the NSCCT score, whereas it is not the case for children's self-assessed qualities.

Table 2.2. Descriptive statistics of children born in 2000-2001 and 2004-2006

	Full sample						Control group						Treatment group					
Variables	Mean	sd	Min	Max	p50	N	Mean	sd	Min	Max	p50	N	Mean	sd	Min	Max	p50	N
Source: school registry data[1]																		
Boy	0.512	0.500	0	1	1	3,197	0.564	0.496	0	1	1	810	0.494	0.500	0	1	0	2,387
Year of birth	2004	1.690	2000	2006	2005	3,197	2001	0.050	2000	2001	2001	810	2005	0.413	2004	2006	2005	2,387
Father is a native Dutch	0.832	0.374	0	1	1	3,197	0.754	0.431	0	1	1	810	0.859	0.348	0	1	1	2,387
Mother is a native Dutch	0.828	0.377	0	1	1	3,197	0.757	0.429	0	1	1	810	0.853	0.355	0	1	1	2,387
Father with high education	0.290	0.454	0	1	0	3,197	0.205	0.404	0	1	0	810	0.319	0.466	0	1	0	2,387
Mother with high education	0.279	0.449	0	1	0	3,197	0.165	0.372	0	1	0	810	0.318	0.466	0	1	0	2,387
Source: parental questionnaire[2]																		
Use daycare (DC) at age 0-2[3]	0.247	0.431	0	1	0	3,197	0.144	0.352	0	1	0	810	0.282	0.450	0	1	0	2,387
How long use DC[4]	1.136	1.515	0	4	0	3,197	0.814	1.295	0	4	0	810	1.246	1.568	0	4	0	2,387
How many days use DC per week[5]	0.896	1.192	0	4.500	0	3,197	0.767	1.190	0	4.500	0	810	0.941	1.190	0	4.500	0	2,387
Average weekly hours of DC use	8.965	11.92	0	45	0	3,197	7.667	11.90	0	45	0	810	9.405	11.90	0	45	0	2,387
Total thousands hours of DC use[6]	1.271	1.877	0	8.320	0	3,197	0.952	1.676	0	8.320	0	810	1.380	1.929	0	8.320	0	2,387
Use playgroups[7]	0.707	0.455	0	1	1	3,163	0.766	0.423	0	1	1	800	0.687	0.464	0	1	1	2,363
Have siblings	0.807	0.395	0	1	1	3,197	0.817	0.387	0	1	1	810	0.803	0.398	0	1	1	2,387
Sources: the NSCCT test for children in the fifth year of primary education (group 5)																		
NSCCT total score	62.91	10.71	10	85	65	2,638	62.36	10.91	16	85	64	636	63.08	10.64	10	84	65	2,002
Source: all other tests for children in the fifth year of primary education (group 5)[8]																		
Vocabulary	64.93	15.13	12	141	64	2,882	63.07	15.53	12	141	62	695	65.52	14.95	17	141	65	2,187
Mathematics	72.86	15.20	10	132	74	3,042	70.28	15.81	15	123	70.20	752	73.71	14.90	10	132	74	2,290
Reading comprehension	26.56	14.05	-24	85	26	2,992	26.05	14.30	-24	70	26	701	26.71	13.97	-17	85	27	2,291
Word decoding[9]	73.76	16.74	7	124	75	2,932	71.31	17.35	18	118	74	711	74.54	16.47	7	124	76	2,221
Source: student questionnaires in their fifth year of primary education (group 5)[10]																		

Cognitive self-confidence	3.796	0.688	1	5	3.833	2,607	3.818	0.666	1.333	5	3.833	619	3.790	0.694	1	5	3.833	1,988
Task orientation	4.123	0.679	1	5	4.200	2,611	4.173	0.645	1.200	5	4.200	623	4.107	0.688	1	5	4.200	1,988

Note: 1. The parental socio-economic status information provided by schools is more complete but less detailed than the information provided by parents in parental questionnaires. Father/Mother with high education is a dummy variable that equals one if the father/mother has educational attainment at HBO/WO.

2. *Parental questionnaires* were parental responses when the children were aged 5-6 in group 2.

3. *Use day*care *at age 0-2* refers to whether the child went to daycare centers at age 0-2.

4. *How long use DC* refers to how many years the children have used daycare service. It ranges from 0 years or less to 4 years or more.

5. *How many days use DC* refers to how many days did the children use daycare. It ranges from 0 days or less to 5 days or more.

6. *Average weekly hours of DC use* is calculated by multiplying the average days of daycare use and 10 hours. We obtain the *Total thousand hours of DC use* by multiplying the average days using daycare, the average hour of daycare per day, the year of daycare use, and 52 weeks. We then divide the *Total thousand hours of DC use* by 1,000.

7. *Use playgroups* indicates whether the children went to the playgroups before primary school.

8. Student test results report children's test scores measured in their fifth year of primary education. A high score means the children perform better in these aspects.

9. *Word decoding* is measured by the Three Minute Test score. In one minute, children should read as many words from a card as possible. There are three reading cards in total, but children do not need to read all three cards. In practice, they first read card 3, which contains words with two, three, and four syllables. Children who achieve a certain score no longer need to read cards 2 and 1. In COOL data, the *word decoding* scores for different reading cards can be compared.

10. Student's questionnaire when the children were in Group 5 reports the children's assessment of themselves, including their cognitive self-confidence and task orientation. A high score means the children rate themselves better at those aspects.

To gain a better understanding of the differences in outcome variables between different groups of children, we report in Table 2.3 the differences in child outcomes between the children using daycare at age 0-2 and who did not (in Panel A), and children exposed to the 2005 Child Care Act and who were not (in Panel B), respectively. Again, we focus on the children born in 2000-2001 and 2004-2006. In Panel A of Table 2.3, we regress various children's outcome variables on the *Use daycare at age 0-2* dummy. It suggests that the children attending daycare centers at age 0-2 outperform the children not using daycare at age 0-2 in vocabulary, mathematics, reading comprehension, and NSCCT total scores. In Panel B of Table 2.3, we regress child outcome variables on the *Treat* dummy, measuring whether the children were eligible for the 2005 child care reform. Similar to what we have shown in Table 2.2, the results suggest that exposure to the reform has a beneficial effect on children's vocabulary, mathematics, and word decoding scores, while it harms children's task orientation scores.

Table 2.3. Descriptive evidence of the differences between children using daycare at age 0-2 and those who did not (who were eligible for the 2005 Childcare Act and who were not)

Variables	Children questionnaires		Children test results				
	Self-confidence	Task orientation	Vocabulary	Mathematics	Reading	Word decoding	NSCCT score
Panel A. Use daycare at age 0-2							
Use daycare at age 0-2[2]	-0.058	0.009	0.252***	0.216***	0.245***	0.054	0.277***
	(0.045)	(0.044)	(0.044)	(0.041)	(0.047)	(0.055)	(0.045)
Constant	0.014	-0.002	-0.062*	-0.053*	-0.060*	-0.013	-0.067**
	(0.027)	(0.029)	(0.036)	(0.028)	(0.033)	(0.029)	(0.028)
Observations	2,596	2,596	2,645	2,645	2,645	2,645	2,638
R-squared	0.001	0.000	0.012	0.009	0.011	0.001	0.014
Panel B. Age eligibility for the 2005 Childcare Act							
Treat[3]	-0.040	-0.089*	0.144**	0.209***	0.030	0.179***	0.068
	(0.051)	(0.049)	(0.060)	(0.054)	(0.056)	(0.053)	(0.049)
Constant	0.031	0.068	-0.113**	-0.165***	-0.023	-0.141***	-0.051
	(0.043)	(0.043)	(0.054)	(0.050)	(0.050)	(0.046)	(0.041)
Observations	2,596	2,596	2,645	2,645	2,645	2,645	2,638
R-squared	0.000	0.001	0.003	0.007	0.000	0.005	0.001

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. *Use daycare at age 0-2* is a dummy variable. It equals one if the children using daycare under the age of two (789 observations) and zero otherwise.

3. *Treat* is a dummy variable indicating whether the children were eligible for the 2005 Childcare Act. It equals one if the children were born after 2002.

4. Panel A shows the differences in child outcomes at age 8-9 between the children who went to daycare at age 0-2 and those who did not. Panel B reports the differences between the children eligible for the Childcare Act (born in 2004-2006) and those not eligible (born before 2002).

2.4.5 Empirical Strategy

This chapter aims to estimate the effect of daycare use on children's performance at age 8-9. We start with the following model:

$$y_i = \beta_0 + \beta_1 Daycare\ use_i + X_i'\gamma + Z_i'\delta + \varepsilon_i \quad (2.1)$$

where y_i refers to the outcome variables for child *i* at age 8-9. The main outcome variables include children's cognitive abilities and self-assessed qualities. Cognitive abilities are measured by vocabulary, mathematics, reading comprehension, word decoding, and the NSCCT scores. As for self-assessed qualities, we consider cognitive self-confidence and task orientation. To facilitate the interpretation, we standardize each outcome measure to have a mean of zero and a standard deviation of one in the final sample. The variable $Daycare\ use_i$ measures the use of daycare. We use three variables to measure daycare use: a dummy indicating daycare attendance at age 0-2, total hours of daycare use (in thousand), and average weekly hours of daycare use. β_1 is the main parameter of interest, capturing the effect of daycare use on child outcome variables.

The vector X_i' contains covariates of the children when they were aged 5-6. In line with previous studies, we consider children's gender, whether having sibling(s) or not. The vector Z_i' is parental characteristics, including father/mother having high educational attainment (educational attainment at the HBO/WO level) and father/mother is a native Dutch. In principle, we try to limit the covariates to predetermined characteristics, which are less likely to be affected by daycare use at age 0-2. The error term ε_i captures the unobservable heterogeneity. All the standard errors are clustered at the school level to capture the within-school correlation. We estimate equation (2.1) using the OLS method.

Moreover, we estimate the following equation by OLS:

$$y_i = \beta_0 + \beta_1 Treat_i * Father\ low\ education_i + \beta_2 Treat_i * Father\ high\ education_i + X_i'\gamma + Z_i'\delta + \varepsilon_i \quad (2.2)$$

The dummy variable $Treat_i$ indicates whether the children were exposed to the policy change in 2005. It equals one if the children were born in 2004-2006, and it equals zero if the children were born in 2000-2001. $Father\ low\ education_i$ and $Father\ high\ education_i$ are dummies indicating a child's father has low educational attainment (lower than HBO/WO level) and high educational attainment (at HBO/WO level). Due to the data limitation, there is no information on the household income. Instead, I use Father's educational attainment as a proxy for the family resources because they are likely to be the highest income earner in the Dutch context. We interpret β_1 and β_2 as the intention-to-treat (ITT) that captures the effect

of exposure to the child care reform among children with low-educated fathers and children with high-educated fathers. Similar to equation (2.1), we also include child characteristics X_i' and parental characteristics Z_j' measured at age 5-6. We use the error term ε_i captures the unobservable heterogeneity.

The OLS estimates of equation (2.1) may be biased. Even though we include several important covariates in the model, there might still be some unobserved variables that correlate with parental decisions on daycare use and child outcomes (e.g., household income). To deal with the issue, we exploit as an instrument that the Netherlands introduced a child care reform in 2005, which leads to a more generous child care subsidy for parents. We use the exposure to the policy change as an instrument because the Child Care Act's implementation is strongly correlated with daycare use due to the substantial reduction of parental costs after 2005. In the meantime, it should not directly affect child outcomes at age 8-9. One channel through with the IV might correlate with the error term is that the quality of primary education for children born between 2004 and 2006 improved significantly compared with the quality for children born between 2000 and 2001 and, therefore, affected child outcomes. However, this is less likely to be true because, despite some attempts to improve primary education quality,[17] primary education's quality has been relatively stable in those periods.

Besides, given that daycare use varies in particular by family background, we introduce an interaction term between exposure to the 2005 reform (*Treat*) and *Father high education dummy* (*Treat* Father high education*). Therefore, we employ the *Treat* dummy and *Treat* Father high education* as the instrument variables for children's daycare use and estimate the local average treatment effect (LATE). The interaction term captures the fact that children from advantaged families are less likely to benefit from daycare.

[17] Education and Training Monitor 2019 Netherlands, EUROPEAN COMMISSION, 2019, https://ec.europa.eu/education/sites/education/files/document-library-docs/et-monitor-report-2019-netherlands_en.pdf

2.5 Results

This section reports the estimated effect of daycare attendance on children's performance measured at age 8-9. We first present the main results, consisting of the OLS estimates, the ITT estimates, and the LATE estimates. Then, we investigate how the effects differ across children with high-educated fathers and children with low-educated fathers.

2.5.1 Main Results

We first estimate equation (2.1) using OLS estimation, and the results are shown in Table 2.4. In each column, we regress children's outcome variables on a dummy indicating using daycare under the age of two. Besides, we include several control variables such as a dummy for a boy, dummies for the father/mother being native Dutch, dummies for the father/mother having high educational attainment, and a dummy for the children having sibling(s). Columns 1 and 2 are the results for children's self-assessed qualities, including cognitive self-confidence (column 1) and task orientation (column 2). Columns 3-7 are the results for test scores, capturing children's abilities in vocabulary, mathematics, reading comprehension, word decoding, and the NSCCT score.

Panel A of Table 2.4 presents the OLS results for the whole sample. Column 7 shows that using daycare at age 0-2 is associated with a significant increase in the NSCCT score (the coefficient is 0.101). For the remaining outcomes, however, the impact is insignificant. This suggests that using daycare may not play a role in child development, except for the NSCCT score.

Because family background plays an essential role in child outcomes (Havnes and Mogstad, 2015; Felfe and Lalive, 2018), we further examine the effect of using daycare at age 0-2 separately for children with high-educated fathers (Panel B) and children with low-educated fathers (Panel C). For children with high-educated fathers, we find a positive effect on the NSCCT test scores but no significant impact on other outcome variables. For children with low-educated fathers, using daycare at age 0-2 is associated with higher task orientation and vocabulary scores. We interpret this as evidence supporting the heterogeneous effect of daycare use on child outcomes.

Table 2.4. The impact of daycare use at age 0-2 on child outcomes (OLS)

	Children questionnaires		Children test results				
Variables	Self-confidence	Task orientation	Vocabulary	Math	Reading	Word decoding	NSCCT score
Panel A: Full sample							
Use daycare at age 0-2	-0.042	0.066	0.028	0.022	0.045	0.007	0.101**
	(0.045)	(0.044)	(0.039)	(0.041)	(0.045)	(0.054)	(0.044)
Observations	2,596	2,596	2,645	2,645	2,645	2,645	2,638
R-squared	0.018	0.020	0.133	0.113	0.100	0.016	0.074
Panel B: Children with high-educated fathers							
Use daycare at age 0-2	-0.121	0.009	-0.072	0.039	0.060	-0.019	0.137**
	(0.085)	(0.078)	(0.068)	(0.072)	(0.077)	(0.076)	(0.068)
Observations	753	753	767	767	767	767	768
R-squared	0.025	0.022	0.089	0.079	0.058	0.018	0.061
Panel C: Children with low-educated fathers							
Use daycare at age 0-2	0.005	0.107*	0.095*	0.014	0.037	0.031	0.086
	(0.060)	(0.064)	(0.052)	(0.055)	(0.057)	(0.067)	(0.062)
Observations	1,843	1,843	1,878	1,878	1,878	1,878	1,870
R-squared	0.018	0.023	0.113	0.095	0.074	0.009	0.043
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. This table reports the OLS estimates of the impact of daycare use at age 0-2 on children's outcomes at age 8-9. The variable of interest is *Use daycare at age 0-2*, indicating whether the children using daycare under two years old.

3. In columns 1-2, the outcome variables are *Self-confidence* and *Task orientation,* which are reported by the children when they were in group 5. In columns 3-7, the outcome variables are the children's test results in group 5, which measure children's NSCCT score, vocabulary, mathematics, and reading capacities. A high score means the children perform better in these aspects.

4. *Father native Dutch* is a dummy variable that means father was born in the Netherlands.

6. *Father high education* is a dummy variable. It equals one if the father's highest educational attainment is HBO/WO and zero otherwise.

7. We add controls for child's gender, the child having sibling(s), father/mother being a native Dutch, and father/mother having high educational attainment.

8. Panel A reports the OLS estimates for the whole sample, Panel B shows the OLS estimates for children with high-educated fathers, and Panel C shows the estimates for children with low-educated fathers.

Table 2.5 shows the intention-to-treat (ITT) effects. We use the interaction term between children's exposure to the 2005 child care reform with the father having high/low educational attainment as the core explanatory variables and various child outcomes as dependent variables. In each column, we regress child outcomes on the interaction term *Treat *Father low education* and *Treat* Father high education*. Introducing two interaction terms allows us to compare the impact of exposure to the reform between children of high-educated fathers and children of low-educated fathers. We also include a set of child, family, and school characteristics.

For children with low-educated fathers, exposure to the child care reform improves their math scores and word decoding scores by 11.9% of a standard deviation and 16.9% of a standard deviation, respectively, while decreasing their reading comprehension score by 10.3% of a standard deviation. By contrast, for children with high-educated fathers, only adverse effects of exposure to the policy change were detected. Specifically, exposure to the reform decreases children's self-confidence (the coefficient is -0.21), task orientation (the coefficient is -0.23), vocabulary (the coefficient is -0.25), and reading comprehension scores (the coefficient is -0.29). Additionally, the impact of the reform on children's NSCCT scores is insignificant, independently of their father's educational attainment.

Overall, the impact of exposure to the 2005 child care reform shows different patterns among children with high-educated fathers and children with low-educated fathers. In particular, the effect is negative for children with better-educated fathers, while the effect for children with a low-educated father is positive and statistically insignificant (except for the reading comprehension test).

Table 2.5. The impact of exposure to the Childcare Act on child outcomes (Intention-to-treat)

	Children questionnaires		Children test results				
Variables	Self-confidence	Task orientation	Vocabulary	Math	Reading	Word decoding	NSCCT score
Treat*Father low education	0.055	0.001	0.040	0.119**	-0.103*	0.169***	-0.089
	(0.057)	(0.057)	(0.056)	(0.055)	(0.056)	(0.058)	(0.056)
Treat*Father high education	-0.210**	-0.230**	-0.251*	0.058	-0.294***	0.106	0.030
	(0.095)	(0.093)	(0.134)	(0.116)	(0.109)	(0.104)	(0.088)
Boy	0.119***	-0.051	0.110***	0.373***	-0.261***	-0.114***	-0.097***
	(0.038)	(0.042)	(0.036)	(0.038)	(0.039)	(0.040)	(0.037)
Father native Dutch	-0.285***	-0.199**	0.299***	0.250***	0.197***	-0.120*	0.278***
	(0.071)	(0.081)	(0.086)	(0.079)	(0.073)	(0.067)	(0.086)
Mother native Dutch	-0.051	-0.165*	0.517***	0.253***	0.302***	-0.076	0.218***
	(0.068)	(0.087)	(0.076)	(0.074)	(0.072)	(0.067)	(0.075)
Father high education	0.241**	0.217**	0.476***	0.204*	0.404***	0.159	0.137
	(0.097)	(0.093)	(0.137)	(0.113)	(0.107)	(0.108)	(0.094)
Mother high education	0.035	-0.046	0.231***	0.296***	0.328***	0.131**	0.242***
	(0.050)	(0.052)	(0.045)	(0.046)	(0.050)	(0.051)	(0.051)
Have siblings	-0.030	-0.058	-0.077*	0.044	0.014	0.071	0.025
	(0.053)	(0.044)	(0.044)	(0.048)	(0.047)	(0.047)	(0.050)
Constant	0.189**	0.383***	-0.832***	-0.864***	-0.370***	-0.036	-0.452***
	(0.078)	(0.072)	(0.072)	(0.078)	(0.071)	(0.078)	(0.081)
Observations	2,596	2,596	2,645	2,645	2,645	2,645	2,638
R-squared	0.020	0.021	0.135	0.115	0.104	0.020	0.074

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. This table reports the intention-to-treat effects. The variable of interest is *Treat*Father low education* and *Treat*Father high education*. *Treat* indicates whether the children were eligible for the reform in 2005. It equals one if the children were born after 2004 and therefore eligible for the reform. *Father low education* is a dummy variable that equals one if the father has educational attainment lower than HBO/WO. *Father high education* is a dummy variable that equals one if the father has educational attainment at the HBO/WO level.

As we discussed in the previous session, the OLS estimator might be biased. To proceed, we use the dummy *Treat* (exposure to the 2005 reform) and the interaction term *Treat* Father high education* as our instrument variables. Table 2.6 shows the LATE estimates of the impact of daycare use at age 0-2 on child development.

In columns 1-3, we show the effect of daycare use on children's cognitive self-confidence and task orientation. Column 1 presents the first-stage results, and columns 2 and 3 report the second-stage results. In columns 4-8, we show the first-stage and second-stage results for children's test scores. Columns 9 and 10 are the first-stage and second-stage results for children's NSCCT test scores. All regressions include a set of control variables.

For the first-stage estimates in columns 1, 4, and 9, the coefficients of *Treat* and *Treat* Father high education* are positive and statistically significant, implying a positive relationship between exposure to the 2005 child care reform and daycare use under the age of two. The instruments do not suffer from weak instrument problems because the first-stage *F*-statistics is 23.95 for children's self-confidence and task orientation, 21.99 for child test results, and 22.53 for NSCCT scores. The signs of some control variables are in line with our expectations. For example, similar to Felfe and Lalive (2018), we find that children with high-educated mothers are more likely to attend daycare at age 0-2 than those with a low-educated mother, which may result from a higher likelihood of returning to work among high-educated mothers than that among low-educated mothers.

The second-stage results indicate that 0- to 2-year-olds' daycare use has a negative and statistically significant effect on task orientation and reading comprehension scores. Using daycare at age 0-2 reduces children's task orientation by 0.820 standard deviations. This supports Fort et al. (2020), who suggest that using daycare at age 0-2 affects children's non-cognitive skills (openness and agreeableness) negatively.

Column 7 shows that children using daycare at age 0-2 have reading comprehension scores that are about 1.289 standard deviations lower than their counterparts. Previous studies report mixed evidence on the impact of child care on reading skills. Our results are in line with some papers showing an undesirable effect on children's reading achievements. For example, Herbst and Tekin (2010) find a negative impact of child care subsidy receipt the year before kindergarten on children's reading achievement in kindergarten (around 0.3 standard deviations). The negative impact is supported by Herbst and Tekin (2016). In contrast, several studies claim positive impacts (NICHD ECCRN, 2002). Felfe (2015) shows that introducing high-quality child care for children at age three enhances their PISA reading test scores at age 15 by 0.15 standard deviations. Drange and Havnes (2019) conclude improvements in

children's reading achievement at age 6-7 after randomly receiving child care offered at age 1-2 (0.16 standard deviations). These competing results may relate to several factors such as the quality of child care and children's background.

Inconsistent with reading comprehension scores, column 8 indicates that children benefit from attending daycare at age 0-2 concerning word decoding scores (the coefficient is 0.807). One would expect consistent results on reading comprehension and word decoding scores, as word decoding is a major component of children's reading comprehension ability (Gough & Tunmer, 1986; Hoover & Gough, 1990). The extant literature emphasizes a relationship between children's reading comprehension and word decoding scores because the children good at decoding could devote more resources to consider the meaning of a text and gain better reading comprehension skills. However, reading skills development is complex. In particular, children's age and the stage of reading skills development could affect such a relationship. First, the relationship between reading comprehension and decoding varies with age: it is particularly strong in the early stages but decreases with age. For example, using the same measures of reading comprehension and word decoding skills as we do in this chapter, Verhoeven and Van Leeuwe (2008) point out that word decoding has a large effect on early reading comprehension before the third grade and a small impact on the sixth grade of primary education. Another perspective concerns the development of word decoding skills, which include accuracy and speed. Verhoeven et al. (2011) claim that starting in the third grade of primary school, Dutch students have less trouble with reading accuracy, and the development in word decoding concentrates on decoding speed. As the reading comprehension test concerns less about the speed factor, we would expect that the correlation between word decoding and reading comprehension scores decreases.

We check the correlation among children's test results at age 8, as reported in Table 2.7. In general, there is a positive correlation among children's four Cito test measures. Specifically, reading comprehension scores are highly correlated with math and vocabulary scores. By contrast, word decoding scores are weakly correlated with reading, math, and vocabulary scores (the coefficients range from 0.126 to 0.375). This implies that children's word decoding and reading test scores are not strongly correlated with each other, and therefore we are less concerned about the conflicting results for reading comprehension and word decoding scores.

Table 2.6. The impact of daycare use at age 0-2 on child outcomes (IV)

Variables	First Stage	Second Stage		First Stage	Second Stage				First Stage	Second Stage
		Children questionnaires			Children test results					NSCCT
	Use daycare	Self-confidence	Task orientation	Use daycare	Vocabulary	Math	Reading	Word decoding	Use daycare	NSCCT score
Treat	0.059***			0.048***					0.058***	
	(0.017)			(0.018)					(0.017)	
Treat*Father high education	0.170***			0.204***					0.164***	
	(0.047)			(0.049)					(0.044)	
Use daycare		-0.579	**-0.820****		-0.768	0.510	**-1.289*****	**0.807***		-0.178
		(0.384)	**(0.401)**		(0.531)	(0.447)	**(0.490)**	**(0.444)**		(0.381)
Boy	0.001	0.118***	-0.051	0.014	0.118***	0.363***	-0.243***	-0.128***	0.002	-0.095**
	(0.015)	(0.039)	(0.043)	(0.015)	(0.038)	(0.039)	(0.044)	(0.042)	(0.015)	(0.037)
Father native Dutch	0.024	-0.265***	-0.175*	0.028	0.326***	0.242***	0.230***	-0.134*	0.024	0.277***
	(0.034)	(0.074)	(0.093)	(0.030)	(0.091)	(0.082)	(0.085)	(0.075)	(0.034)	(0.088)
Mother native Dutch	0.086***	0.000	-0.093	0.083***	0.583***	0.213**	0.408***	-0.139*	0.082**	0.230***
	(0.031)	(0.079)	(0.100)	(0.030)	(0.104)	(0.088)	(0.098)	(0.076)	(0.032)	(0.081)
Father high education	0.001	0.109	0.145*	-0.041	0.336***	0.090	0.411***	0.006	-0.000	0.254***
	(0.044)	(0.072)	(0.074)	(0.046)	(0.097)	(0.075)	(0.086)	(0.081)	(0.042)	(0.073)
Mother high education	0.188***	0.148	0.111	0.182***	0.373***	0.206**	0.561***	-0.012	0.188***	0.272***
	(0.023)	(0.095)	(0.099)	(0.023)	(0.112)	(0.103)	(0.111)	(0.099)	(0.022)	(0.091)
Have siblings	-0.056***	-0.064	-0.104*	-0.047**	-0.114**	0.067	-0.046	0.108*	-0.060***	0.015
	(0.021)	(0.058)	(0.055)	(0.022)	(0.057)	(0.054)	(0.063)	(0.056)	(0.021)	(0.056)
Constant	0.057**	0.281***	0.463***	0.057**	-0.735***	-0.827***	-0.326***	0.009	0.064**	-0.494***
	(0.027)	(0.077)	(0.074)	(0.027)	(0.085)	(0.077)	(0.084)	(0.081)	(0.027)	(0.083)
Observations	2,596	2,596	2,596	2,645	2,645	2,645	2,645	2,645	2,638	2,638
R-squared	0.129	-0.029	-0.108	0.120	0.028	0.073	-0.194	-0.090	0.126	0.062
First-stage F-statistics	23.95	23.95	23.95	21.99	21.99	21.99	21.99	21.99	22.53	22.53
Endogeneity test *p*-value		0.118	0.022		0.129	0.291	0.003	0.106		0.597
Overidentification test *p*-value		0.084	0.357		0.159	0.068	0.448	0.014		0.105

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. The table reports IV estimates. The variable of interest is *Use daycare at age 0-2*, indicating whether the children went to daycare at age 0-2. We use the dummy *Treat* (exposure to the 2005 reform) and *Treat* * father educational attainment as instrument variables.
3. Column 1, column 4, and column 9 report the first-stage estimates, and the dependent variable is *Use daycare at age 0-2*. Columns 2-3, columns 5-8, and column 10 report the second-stage estimates. The dependent variables are child outcomes when they are in group 5.
4. All regressions include controls for the child's gender, the child having sibling(s), father/mother being a native Dutch, and father/mother having high educational attainment.
5. The first-stage F-statistics are associated with the significance of the instrument variable in the first-stage regressions.

Table 2.7. Correlations (Pearson's r) among children's test outcomes at age 8 (N=2,645)

Measure	Vocabulary	Math	Reading	Word decoding
	(1)	(2)	(3)	(4)
1.Vocabulary	-			
2.Math	0.527***	-		
3.Reading	0.656***	0.529***	-	
4.Word decoding	0.288***	0.246***	0.375***	-

Note: *** p<0.01, ** p<0.05, * p<0.1.

The overall conclusion is that daycare use at age 0-2 hurts child performance measured by task orientation and reading comprehension scores, but it positively affects word decoding scores. The negative effects are comparable in terms of the sign to Fort et al. (2020), who show that an additional month in daycare for 0- to 2-year-olds leads to a reduction in intelligence quotient by 4.7 % of a standard deviation. However, our results differ from existing studies for Oslo (Drange and Havnes, 2019) and West Germany (Felfe and Lalive, 2018), which only shows a beneficial effect of daycare attendance on children. The difference can be attributed to the adverse effect among advantaged children in this chapter and the characteristics of the Dutch daycare centers (e.g., the deteriorated daycare center quality (de Kruif et al., 2009).

2.5.2 Sensitivity Analysis

To check whether our results are sensitive to the measure of daycare use, we conduct the same exercise as we do in the previous analysis using alternative measures of daycare use as the explanatory variable. In Appendix 2.A, we show the OLS and IV estimates that consider the impact of total hours of daycare use and average weekly hours of daycare use on child outcomes. Tables 2.A1 and 2.A2 report OLS results. We find that increased hours in daycare centers are associated with higher NSCCT test scores, but no significant effect is detected for other test scores.

Tables 2.A3-A6 show IV results. Similar to the main analysis in Table 2.6, in columns 1, 4, and 9 of Table 2.A3 and Table 2.A4, the first-stage results suggest a positive relationship between *Treat* Father high education* and the daycare use. The *F*-statistics of the exclusive restriction imply that the instruments do not suffer from weak instrument problems.[18] In table

[18] The *Treat* and *Treat* Father high education* are weak IVs for weekly hours of daycare use in the child questionnaire sample (columns 1-3 of table 2.A4) and the NSCCT test sample (columns 9-10 of table 2.A4) because the first-stage F-statistics are small.

2.A3, the second-stage results are largely in line with the main analysis in terms of the effect's signs, suggesting a negative impact of increasing weekly hours of daycare use on children's task orientation and reading comprehension skills.

As another robustness check, we use a subsample dropping the children using daycare for less than (or equals to) two years from the sample and replicate the empirical exercises. In other words, we compare the children who attended daycare centers under the age of two and the children who did not use daycare at all. By focusing on the subsample, we do not suffer from the problem that a child using daycare for less than two years at age 0-2 is assigned to the comparison group. Therefore it facilitates the interpretation of the impact of daycare use at age 0-2 on child development. The results can be found in Appendix 2.B (Tables 2.B1-2.B4). The subsample results confirm our baseline analysis findings: early-age daycare attendance harms children's task orientation and reading skills, but it improves children's technical reading ability measured by Three-minute test scores.

2.5.3 Heterogeneous Analysis

As previously discussed, eligibility for child care subsidy only applies for dual-earner households and single-working parents, and thus more affluent families are more likely to use daycare in the Netherlands. Our estimates so far consider a sample including children from both advantaged and relatively disadvantaged families. However, we would expect that the impact of daycare use concentrates among relatively advantaged children.

In fact, our ITT estimates suggest that the effects of exposure to the child care policy change differ across different subsamples, consistent with the evidence that disadvantaged children are more likely to benefit from daycare, while advantaged children may be harmed by attending daycare centers (Fort et al., 2020). To investigate whether the family background plays a role, we estimate the heterogeneous effects in terms of the father's educational attainment in this section. We divide the sample into two subgroups according to their father's educational attainment and run IV regressions (*Treat* as IV) for each subgroup. The heterogeneous effects of daycare use at age 0-2 are shown in Table 2.8. Panel A of Table 2.8 shows the estimates for children whose fathers have high educational attainment, and Panel B presents the effects for children of low-educated fathers.

Turning to the second-stage results, Panel A indicates that if a child's father has high educational attainment, using daycare at age 0-2 leads to a significant decline in cognitive self-confidence (column 2), task orientation (column 3), and reading capabilities (column 7) scores by 1.104 standard deviations, 1.106 standard deviations, and 1.258 standard deviations,

respectively. We are not able to interpret the results for the children with low-educated parents because the instrument is weak as the policy change did not affect low-income households (see Figure 2.1)

Besides, in Tables 2.A5 and 2.A6 (see Appendix 2.A), we also explore the heterogeneous effect of using total hours of daycare use and weekly hours of daycare use, reporting similar results with Table 2.8. To sum up, we find that daycare use under the age of two harms children with high-educated fathers. This suggests that the negative effect we find in the main analysis is likely to be driven by children from an advantaged background (e.g., with high-educated fathers).

Table 2.8. The heterogeneous impact of daycare use at age 0-2 on child outcomes (IV)

Variables	First Stage	Second Stage		First Stage	Second Stage				First Stage	Second Stage
		Children questionnaires			Children test results					NSCCT
	Use daycare	Self-confidence	Task orientation	Use daycare	Vocabulary	Math	Reading	Word decoding	Use daycare	NSCCT score
Panel A. Children with high-educated fathers										
Treat	0.207***			0.234***					0.203***	
	(0.043)			(0.047)					(0.041)	
Use daycare		**-1.104****	**-1.106****		-1.110	0.239	**-1.258****	0.491		0.150
		(0.475)	**(0.517)**		(0.698)	(0.521)	**(0.561)**	(0.466)		(0.509)
Observations	753	753	753	767	767	767	767	767	768	768
R-squared	0.116	-0.188	-0.252	0.100	-0.152	0.070	-0.332	-0.040	0.107	0.061
First-stage F-statistics	23.47	23.47	23.47	24.70	24.70	24.70	24.70	24.70	24.21	24.21
Endogeneity test *p*-value		0.045	0.022		0.081	0.693	0.006	0.253		0.978
Panel B. Children with low-educated fathers										
Treat	0.065***			0.052***					0.063***	
	(0.017)			(0.018)					(0.017)	
Use daycare		0.903	0.003		0.808	2.301*	-2.070	3.279**		-1.362
		(0.856)	(0.876)		(1.153)	(1.346)	(1.320)	(1.564)		(0.947)
Observations	1,843	1,843	1,843	1,878	1,878	1,878	1,878	1,878	1,870	1,870
R-squared	0.045	-0.093	0.022	0.046	0.042	-0.638	-0.548	-1.468	0.047	-0.245
First-stage F-statistics	14.79	14.79	14.79	8.28	8.28	8.28	8.28	8.28	14.54	14.54
Endogeneity test *p*-value		0.299	0.904		0.520	0.033	0.059	0.004		0.092
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. Panel A reports the IV estimates for children of high-educated fathers, and Panel B shows the estimates for children of low-educated fathers.

2.6 Conclusions

By exploiting a Dutch 2005 child care reform that leads to a more generous daycare subsidy for parents and using data from the COOL study, we estimate the impact of daycare attendance at age 0-2 on child outcomes measured at around 8-9 years old. The IV estimates show a negative effect of daycare use under the age of two on children's task orientation (0.820 standard deviations) and reading comprehension scores (1.289 standard deviations), and a beneficial impact on children's word decoding scores (0.807 standard deviations). No significant effect is detected on children's vocabulary, mathematics, and non-school cognitive capacities test scores. The negative impacts on children's self-assessed quality outcomes in our study are in line with a recent paper by Fort et al. (2020). We also estimate the intention-to-treat (ITT) effects, suggesting a heterogeneous effect of exposure to the child care reform in 2005- that is, children with low-educated fathers benefit from exposure to the policy change, while children with high-educated fathers are negatively affected by the reform. Moreover, our results are robust to alternative daycare use measures and using a subsample that drops the children using daycare for less than two years.

One possible interpretation of the negative effect is that daycare attendance has heterogeneous effects on children depending significantly on the family background (Cornelissen et al., 2018). Our study investigates the heterogeneous effect by dividing the sample into children with high-educated fathers and children with low-educated fathers. The results imply the negative effect is driven by children with advantaged families, which may explain the undesirable effects we find in the main analysis. Additionally, it might be the result of a decline in the Dutch daycare centers' quality after 2005.

Our results relate to the discussion on the effect of early childhood care. With an increasing labour force participation among females, most countries have invested heavily in child care. Our findings imply that early child care, especially child care at age 0-2, has a significant effect on child development. In particular, we show that daycare attendance harms children's cognitive and noncognitive abilities in the Netherlands, possibly because of the heterogeneous effect by family background and the quality of daycare centers. Thus, policymakers should focus on child care quality when considering childhood care programs.

Appendices

2.A. Robustness Checks using Alternative Measures of Daycare Use

Table 2.A1. The impact of total hours of daycare use on child outcomes (OLS)

	Children questionnaires		Children test results				
Variables	Self-confidence	Task orientation	Vocabulary	Math	Reading	Word decoding	NSCCT score
Total hours of daycare use	0.000	0.010	0.001	-0.000	-0.004	-0.008	0.018*
	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	(0.012)	(0.010)
Constant	0.227***	0.376***	-0.801***	-0.784***	-0.430***	0.086	-0.532***
	(0.071)	(0.062)	(0.066)	(0.069)	(0.063)	(0.069)	(0.075)
Observations	2,596	2,596	2,645	2,645	2,645	2,645	2,638
R-squared	0.0179	0.0192	0.1326	0.1127	0.0998	0.0163	0.0737
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.
2. This table reports the OLS estimates of the impact of total hours of daycare use on children's outcomes at age 8-9. The variable of interest is *Total hours of daycare use*, indicating the total (thousand) hours of daycare use before the children were four years old.

Table 2.A2. The impact of weekly hours of daycare use on child outcomes (OLS)

	Children questionnaires		Children test results				
Variables	Self-confidence	Task orientation	Vocabulary	Math	Reading	Word decoding	NSCCT score
Weekly hours of daycare use	-0.001	0.000	-0.001	-0.001	-0.003*	-0.002	0.002
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.237***	0.385***	-0.784***	-0.771***	-0.406***	0.103	-0.528***
	(0.072)	(0.062)	(0.067)	(0.070)	(0.065)	(0.071)	(0.077)
Observations	2,596	2,596	2,645	2,645	2,645	2,645	2,638
R-squared	0.0180	0.0189	0.1329	0.1129	0.1007	0.0168	0.0729
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. This table reports the OLS estimates of the impact of total hours of daycare use on children's outcomes at age 8-9. The variable of interest is *Total hours of daycare use*, indicating the total (thousand) hours of daycare use at age 0-4.

Table 2.A3. The impact of total hours of daycare use (in thousand) on child outcomes (IV)

Variables	First Stage	Second Stage		First Stage	Second Stage				First Stage	Second Stage
		Children questionnaires			Children test results					NSCCT
	Hours of daycare use	Self-confidence	Task orientation	Hours of daycare use	Vocabulary	Math	Reading	Word decoding	Hours of daycare use	NSCCT score
Treat	0.097			0.076					0.116	
	(0.089)			(0.091)					(0.087)	
Treat*Father high education	0.855***			0.968***					0.769***	
	(0.227)			(0.242)					(0.214)	
Total hours of daycare use		-0.195*	-0.233**		-0.226	0.084	-0.302**	0.142		-0.008
		(0.100)	(0.107)		(0.143)	(0.112)	(0.127)	(0.108)		(0.099)
Observations	2,596	2,596	2,596	2,645	2,645	2,645	2,645	2,645	2,638	2,638
R-squared	0.109	-0.102	-0.167	0.095	-0.034	0.089	-0.189	-0.057	0.106	0.071
First-stage F-statistics	11.91	11.91	11.91	11.94	11.94	11.94	11.94	11.94	10.93	10.93
Endogeneity test *p*-value		0.042	0.015		0.075	0.530	0.010	0.255		0.903
Overidentification test *p*-value		0.227	0.705		0.314	0.042	0.179	0.006		0.102
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level

2. The table reports IV estimates. The variable of interest is *Total hours of daycare use*, indicating how many hours (in thousands) in total did the children go to daycare before four years old. We use the dummy *Treat* (exposure to the 2005 reform) and *Treat * Father high education* as instrument variables.

3. Column 1, column 4, and column 9 report the first-stage estimates, and the dependent variable is *Total hours of daycare use*. Columns 2-3, columns 5-8, and column 10 report the second-stage estimates. The dependent variables are child outcomes when they are in group 5.

4. The first-stage F-statistics are associated with the significance of the instrument variable in the first-stage regressions.

Table 2.A4. The impact of weekly hours of daycare use on child outcomes (IV)

Variables	First Stage	Second Stage		First Stage	Second Stage				First Stage	Second Stage
		Children questionnaires			Children test results					NSCCT
	Hours of daycare use	Self-confidence	Task orientation	Hours of daycare use	Vocabulary	Math	Reading	Word decoding	Hours of daycare use	NSCCT score
Treat	0.207			0.189					0.436	
	(0.648)			(0.655)					(0.622)	
Treat*Father high education	4.781***			5.674***					4.256***	
	(1.309)			(1.314)					(1.223)	
Weekly Hours of daycare use		-0.041**	-0.046**		-0.042	0.012	-0.052**	0.021		0.001
		(0.020)	(0.021)		(0.026)	(0.020)	(0.022)	(0.019)		(0.019)
Observations	2,596	2,596	2,596	2,645	2,645	2,645	2,645	2,645	2,638	2,638
R-squared	0.075	-0.192	-0.262	0.064	-0.089	0.089	-0.227	-0.057	0.072	0.073
First-stage F-statistics	8.969	8.969	8.969	12.28	12.28	12.28	12.28	12.28	8.807	8.807
Endogeneity test *p*-value		0.035	0.016		0.072	0.612	0.019	0.325		0.926
Overidentification test *p*-value		0.338	0.878		0.423	0.038	0.145	0.005		0.104
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. The table reports IV estimates. The variable of interest is *Weekly hours of daycare use*, indicating, on average, how many hours the children went to daycare every week. We use the dummy *Treat* (exposure to the 2005 reform) and *Treat* * father educational attainment as instrument variables.

3. Column 1, column 4, and column 9 report the first-stage estimates, and the dependent variable is *Weekly hours of daycare use*. Columns 2-3, columns 5-8, and column 10 report the second-stage estimates. The dependent variables are children's outcomes when they are in group 5.

4. The first-stage F-statistics are associated with the significance of the instrument variable in the first-stage regressions.

Table 2.A5. The heterogeneous impact of total hours of daycare use on child outcomes (IV)

Variables	First Stage	Second Stage		First Stage	Second Stage				First Stage	Second Stage
		Children questionnaires			Children test results					NSCCT
	Hours of daycare use	Self-confidence	Task orientation	Hours of daycare use	Vocabulary	Math	Reading	Word decoding	Hours of daycare use	NSCCT score
Panel A. Children with high-educated fathers										
Treat	0.840***			0.921***					0.782***	
	(0.209)			(0.229)					(0.202)	
Total Hours of daycare use		**-0.272****	**-0.272****		-0.281	0.061	**-0.319****	0.124		0.039
		(0.124)	**(0.133)**		(0.182)	(0.132)	**(0.150)**	(0.120)		(0.132)
Observations	753	753	753	767	767	767	767	767	768	768
R-squared	0.103	-0.277	-0.295	0.091	-0.241	0.063	-0.429	-0.076	0.096	0.058
First-stage F-statistics	12.02	16.23	16.23	10.84	16.18	16.18	16.18	16.18	10.77	14.97
Endogeneity test *p*-value		0.034	0.027		0.078	0.651	0.008	0.202		0.907
Panel B. Children with low-educated fathers										
Treat	0.136			0.109					0.149*	
	(0.089)			(0.091)					(0.086)	
Total Hours of daycare use		0.434	0.001		0.387	1.102	-0.992	1.571		-0.579
		(0.457)	(0.421)		(0.645)	(1.058)	(0.969)	(1.405)		(0.496)
Observations	1,843	1,843	1,843	1,878	1,878	1,878	1,878	1,878	1,870	1,870
R-squared	0.029	-0.441	0.022	0.025	-0.264	-3.147	-2.492	-6.543	0.030	-0.852
First-stage F-statistics		2.31	2.31		1.42	1.42	1.42	1.42		2.97
Endogeneity test *p*-value		0.304	0.960		0.479	0.033	0.067	0.004		0.105
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. The table reports the heterogeneous effect of total hours of daycare use (in thousand) on child outcomes. Panel A shows the IV estimates for children with high-educated fathers, and Panel B shows the estimates for children with low-educated fathers.

Table 2.A6. The heterogeneous impact of weekly hours of daycare use on child outcomes (IV)

Variables	First Stage	Second Stage		First Stage	Second Stage				First Stage	Second Stage
		Children questionnaires			Children test results					NSCCT
	Hours of daycare use	Self-confidence	Task orientation	Hours of daycare use	Vocabulary	Math	Reading	Word decoding	Hours of daycare use	NSCCT score
Panel A. Children with high-educated fathers										
Treat	4.393***			5.251***					4.143***	
	(1.197)			(1.215)					(1.138)	
Weekly hours of daycare use		**-0.052****	**-0.052****		-0.049	0.011	**-0.056****	0.022		0.007
		(0.024)	**(0.026)**		(0.032)	(0.023)	**(0.026)**	(0.021)		(0.025)
Observations	753	753	753	767	767	767	767	767	768	768
R-squared	0.090	-0.296	-0.289	0.086	-0.211	0.059	-0.370	-0.083	0.087	0.054
First-stage F-statistics		13.46	13.46		18.67	18.67	18.67	18.67		13.26
Endogeneity test *p*-value		0.040	0.038		0.085	0.598	0.010	0.171		0.839
Panel B. Children with low-educated fathers										
Treat	0.403			0.371					0.610	
	(0.651)			(0.660)					(0.625)	
Weekly hours of daycare use		0.146	0.000		0.113	0.323	-0.291	0.460		-0.142
		(0.255)	(0.142)		(0.261)	(0.592)	(0.536)	(0.827)		(0.168)
Observations	1,843	1,843	1,843	1,878	1,878	1,878	1,878	1,878	1,870	1,870
R-squared	0.034	-2.706	0.022	0.024	-1.597	-13.722	-10.792	-27.969	0.033	-2.553
First-stage F-statistics		0.38	0.38		0.32	0.32	0.32	0.32		0.95
Endogeneity test *p*-value		0.296	0.989		0.462	0.032	0.067	0.004		0.111
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. The table reports the heterogeneous effect of weekly hours of daycare use on child outcomes. Panel A shows the IV estimates for children with high-educated fathers, and Panel B shows the estimates for children with low-educated fathers.

2.B. Robustness Checks using the Subsample Dropping the Children using Daycare Less than Two Years from the Sample

Table 2.B1. The impact of daycare use at age 0-2 on child outcomes (OLS)

	Children questionnaires		Children test results				
Variables	Self-confidence	Task orientation	Vocabulary	Math	Reading	Word decoding	NSCCT score
Panel A: Full sample							
Use daycare at age 0-2	-0.061	0.036	0.010	0.004	0.014	-0.022	0.094**
	(0.046)	(0.046)	(0.041)	(0.043)	(0.047)	(0.057)	(0.046)
Observations	2,139	2,139	2,189	2,189	2,189	2,189	2,171
R-squared	0.0189	0.0166	0.1151	0.1095	0.0851	0.0173	0.0735
Panel B: Children with high-educated fathers							
Use daycare at age 0-2	-0.157*	-0.078	-0.081	0.028	0.030	-0.076	0.156**
	(0.085)	(0.075)	(0.075)	(0.079)	(0.081)	(0.082)	(0.078)
Observations	649	649	664	664	664	664	661
R-squared	0.0253	0.0221	0.0794	0.0729	0.0519	0.0294	0.0562
Panel C: Children with low-educated fathers							
Use daycare at age 0-2	-0.007	0.105	0.065	-0.011	0.002	0.016	0.069
	(0.061)	(0.067)	(0.054)	(0.058)	(0.060)	(0.068)	(0.064)
Observations	1,490	1,490	1,525	1,525	1,525	1,525	1,510
R-squared	0.0188	0.0223	0.0953	0.0932	0.0563	0.0069	0.0426

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. This table reports the OLS estimates of the impact of daycare use at age 0-2 on children's outcomes at age 8-9. The variable of interest is *Use daycare at age 0-2*, indicating whether the children using daycare under two years old.

3. All regressions include controls for the child's gender, the child having sibling(s), father/mother being a native Dutch, and father/mother having high educational attainment.

4. Panel A reports the OLS estimates for the whole sample, Panel B shows the OLS estimates for children with high-educated fathers, and Panel C shows the estimates for children with low-educated fathers.

Table 2.B2. The impact of exposure to the Childcare Act on child outcomes (Intention-to-treat)

	Children questionnaires		Children test results				
Variables	Self-confidence	Task orientation	Vocabulary	Math	Reading	Word decoding	NSCCT score
Treat*Father low education	0.017	-0.005	0.022	0.098*	-0.119*	0.154**	-0.095
	(0.060)	(0.065)	(0.059)	(0.058)	(0.062)	(0.062)	(0.061)
Treat*Father high education	-0.186*	-0.236**	-0.208	0.092	-0.247*	0.148	0.124
	(0.105)	(0.104)	(0.152)	(0.140)	(0.127)	(0.107)	(0.102)
Father high education	0.175	0.229**	0.416***	0.161	0.367***	0.119	0.068
	(0.111)	(0.104)	(0.153)	(0.134)	(0.124)	(0.113)	(0.109)
Observations	2,139	2,139	2,189	2,189	2,189	2,189	2,171
R-squared	0.020	0.019	0.117	0.111	0.089	0.021	0.074
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. This table reports the intention-to-treat effects. The variable of interest is *Treat*Father low education* and *Treat*Father high education*. *Treat* indicates whether the children were eligible for the reform in 2005. It equals one if the children were born after 2004 and therefore eligible for the reform. *Father low education* is a dummy variable that equals one if the father has educational attainment lower than HBO/WO. *Father high education* is a dummy variable that equals one if the father has educational attainment at the HBO/WO level.

Table 2.B3. The impact of daycare use at age 0-2 on child outcomes (IV)

Variables	First Stage	Second Stage		First Stage	Second Stage				First Stage	Second Stage
		Children questionnaires			Children test results					NSCCT
	Use daycare	Self-confidence	Task orientation	Use daycare	Vocabulary	Math	Reading	Word decoding	Use daycare	NSCCT score
Treat	0.070***			0.060***					0.071***	
	(0.021)			(0.023)					(0.021)	
Treat*Father high education	0.171***			0.211***					0.164***	
	(0.057)			(0.059)					(0.054)	
Use daycare		-0.552	**-0.783***		-0.589	0.541	**-1.077****	**0.861****		0.102
		(0.379)	**(0.404)**		(0.541)	(0.473)	**(0.505)**	**(0.432)**		(0.398)
Observations	2,139	2,139	2,139	2,189	2,189	2,189	2,189	2,189	2,171	2,171
R-squared	0.146	-0.025	-0.104	0.135	0.049	0.057	-0.133	-0.126	0.142	0.073
First-stage F-statistics	**19.12**	**19.12**	**19.12**	**18.46**	**18.46**	**18.46**	**18.46**	**18.46**	**18.52**	**18.52**
Endogeneity test *p*-value		0.210	0.040		0.284	0.205	0.020	0.043		0.867
Overidentification test *p*-value		0.309	0.407		0.312	0.233	0.369	0.066		0.052
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. The table reports IV estimates. The variable of interest is *Use daycare at age 0-2*, indicating whether the children went to daycare at age 0-2. We use the dummy *Treat* (exposure to the 2005 reform) and *Treat* * father educational attainment as instrument variables.

3. Column 1, column 4, and column 9 report the first-stage estimates, and the dependent variable is *Use daycare at age 0-2*. Columns 2-3, columns 5-8, and column 10 report the second-stage estimates. The dependent variables are child outcomes when they are in group 5.

4. All regressions include controls for the child's gender, the child having sibling(s), father/mother being a native Dutch, and father/mother having high educational attainment.

5. The first-stage F-statistics are associated with the significance of the instrument variable in the first-stage regressions.

Table 2.B4. The heterogeneous impact of daycare use at age 0-2 on child outcomes (IV)

Variables	First Stage	Second Stage		First Stage	Second Stage				First Stage	Second Stage
		Children questionnaires			Children test results					NSCCT
	Use daycare	Self-confidence	Task orientation	Use daycare	Vocabulary	Math	Reading	Word decoding	Use daycare	NSCCT score
Panel A. Children with high-educated fathers										
Treat	0.221***			0.252***					0.217***	
	(0.053)			(0.057)					(0.051)	
Use daycare		**-0.894***	**-0.999***		-0.895	0.354	**-1.022***	0.625		0.700
		(0.475)	**(0.527)**		(0.729)	(0.586)	**(0.592)**	(0.469)		(0.593)
Observations	649	649	649	664	664	664	664	664	661	661
R-squared	0.132	-0.102	-0.180	0.116	-0.071	0.049	-0.200	-0.083	0.124	-0.010
First-stage F-statistics	**17.22**	**17.22**	**17.22**	**19.45**	**19.45**	**19.45**	**19.45**	**19.45**	**18.15**	**18.15**
Endogeneity test *p*-value		0.142	0.058		0.193	0.570	0.040	0.115		0.323
Panel B. Children with low-educated fathers										
Treat	0.076***			0.065***					0.076***	
	(0.021)			(0.023)					(0.021)	
Use daycare		0.284	-0.064		0.365	1.515	-1.867	2.386*		-1.251
		(0.777)	(0.849)		(0.951)	(1.037)	(1.180)	(1.252)		(0.862)
Observations	1,490	1,490	1,490	1,525	1,525	1,525	1,525	1,525	1,510	1,510
R-squared	0.054	0.005	0.018	0.053	0.081	-0.286	-0.513	-0.908	0.057	-0.237
First-stage F-statistics	**12.79**	**12.79**	**12.79**	8.41	8.41	8.41	8.41	8.41	**13.22**	**13.22**
Endogeneity test *p*-value		0.711	0.841		0.749	0.090	0.058	0.014		0.094
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the school level.

2. Panel A reports the IV estimates for children of high-educated fathers, and Panel B shows the estimates for children of low-educated fathers.

Chapter 3

3. Parental Housing Wealth and Children's Marriage Prospects in China - Evidence from CHARLS[19]

3.1 Introduction

For centuries, marriage has been a fundamental institution among Chinese households. However, in recent years individual marriage behavior has been changing dramatically, and marriage rates have been decreasing (Wrenn et al., 2019). Specifically, some young males might never get married due to the high pressure in the marriage market. The pressure partly comes from the unbalanced sex ratios in China (males largely outnumber females), which is affected by the one-child policy and a traditional preference for sons.[20,21] As a result, many males have difficulty in finding a female partner and getting married (Li and Wu, 2017), while females have opportunities to marry males with a better background and wealth holdings. In this context, males and their parents are motivated to accumulate more wealth to enhance males' probabilities of getting married (Wei and Zhang, 2011).

In this chapter, we investigate whether parental housing wealth affects young males' transitions into marriage in China. We focus on the impact of housing wealth for three reasons. First, housing wealth is the largest form of household wealth in China (Li and Wu, 2017; Xie and Jin, 2015). For example, Xie and Jin (2015) find that housing wealth accounts for more than 70% of household wealth. Second, affected by their traditional culture, Chinese households prefer housing asset holdings and regard it as a necessity for marriage (Wrenn et al., 2019). Third, as housing wealth is more visible than other types of wealth, such as stock and savings, we would expect housing wealth to be a better signal of household wealth in the marriage market than other forms of wealth.

Different from previous studies that emphasize individual wealth, we focus on parental wealth as parents play a non-trivial role in their children's marriage decisions in China. First, it is difficult for young individuals to purchase houses at marriageable age due to their insufficient wealth holdings and the high housing prices in many cities (Wrenn et al., 2019).

[19] This chapter is based on Gao et al. (2021).

[20] The skewed sex ratio affects society in many aspects, such as the crime rate (Edlund et al. 2013), labor force participation (Angrist 2002), entrepreneurship behaviors (Chang and Zhang 2015), and consumption behaviour (Grier et al. 2016).

[21] In China, the sex ratio of the population aged 0-19 is 114.84 males to 100 females, according to 2010 Population Census Data of the People's Republic of China.

Second, according to the traditional Chinese social norms, households pursue the accumulation of housing equity, especially when they have unmarried sons, as they view housing as a status good (Wei et al., 2017). This implies that in China, while young individuals have low homeownership rates, parents have very high homeownership rates. Moreover, parental housing wealth is important for the newlyweds because they are very likely to coreside with the groom's parents. Our analytic sample of the 2015 survey shows that more than 47% of newlyweds coreside with the groom's parents after marriage. Therefore, a better parental house can also directly affect the wellbeing of newlyweds. Finally, in the Chinese context, it is common practice for sons to obtain the parental house as an inheritance. A better parental house means a more generous inheritance for males, implying that parental housing wealth also affects the future wealth of the newlyweds. Noted that parental housing wealth acts as an important signal of current and future wellbeing, this chapter focuses on the effect of parental housing wealth.

To empirically investigate the role of parental housing wealth on young males' transitions into marriage, we use the 2011, 2013, and 2015 waves of the China Health and Retirement Longitudinal Survey (CHARLS hereinafter). CHARLS is a nationally representative data set, and it has a unique advantage for this research. That is, it focuses on individuals aged 45 and above, which means that their children are very likely to be at marriage ages. Moreover, the CHARLS data provides detailed information on respondents' housing and non-housing wealth and their children's demographic information.

The results show that parental housing wealth plays a crucial role in young males' transitions into marriage. First, we find that parental housing value has a positive and significant impact on men's marriage transitions. A better house enhances men's attractiveness in the marriage market and increases their chances of getting married. Second, the results suggest that the role of parental housing wealth varies with children's *hukou* status. We find that the impact of parental housing wealth is only significant for males with rural *hukou*. In other words, parental housing wealth is more likely to be a signal in rural areas than in urban areas.

Our study contributes to the existing literature mainly in two ways. First, the structure of our data set allows us to rule out potential reverse causality issues. For example, the coresidence between the newlyweds and their parents after getting married may lead to a need for larger or better parental houses. In that sense, marriage would affect parental housing wealth positively. To address this concern, we restrict our sample to unmarried children aged 16 to 35 in the 2011 survey and observe their marriage transitions in 2015. We can thus estimate the effect of parental housing wealth on children's transitions into marriage without worrying about reverse

causality. This strategy is different from the existing studies in China, in which individuals are observed in only one wave and cannot be tracked over time (Fang and Tian, 2018; Wei and Zhang, 2011). Second, different from other studies that only have information on homeownership (Hu and Wang, 2020) or the size of the house (Fang and Tian, 2018), the detailed wealth information provided by CHARLS allows us to use a measure of the financial value of the parental house.

In the remainder of the paper, we review the relevant literature in Section 3.2. Section 3.3 discusses the data and empirical strategy. Section 3.4 shows the main results, and Section 3.5 concludes.

3.2 Relevant Literature

The existing literature shows that individuals' marital status is often associated with housing wealth in both developed countries and developing countries. However, the underlying mechanisms in developed countries and developing countries are different. In developed countries such as the United States, the most prominent explanation is that if marriage serves as a contract for couples to invest in their children in the long run, then homeownership before marriage can act as collateral (Lafortune and Low, 2017a). As a consequence, homeowners in the United States are found more willing to get married than renters (Lafortune and Low, 2017b). In developing countries such as China and India, the increased sex ratio imbalance makes it difficult for single males to find a female partner and get married. To enhance males' relative attractiveness in the marriage market, unmarried males and their families have strong incentives to compete with other males in wealth accumulation. In other words, the competitive motive is one of the mechanisms through which wealth affects marriage. In countries with unbalanced sex ratios, parents with unmarried sons prefer to accumulate saving rates (Wei and Zhang, 2011), construct a toilet (Stopnitzky, 2017), and hold more risky assets (Li et al., 2020) to enhance their sons' chances in the marriage market.

For China, Wrenn et al. (2019) reveal that the rise in housing prices discourages young individuals from entering into marriages. An increase in housing prices leads to a significant decline in the rate of young people's first-time marriage entry. Using Taiwan registration data, Chu et al. (2020) find that owning higher values of housing enhances young men's chances of entering their first marriage in any particular year. They also show a positive association between parental wealth and young men's marriage prospects. This chapter considers only the male sample without a discussion of the effect of wealth on females' marriage. Moreover, they concentrate on individual housing wealth. Similarly, Hu and Wang (2020) explore the

relationship between individual homeownership and marital status. By using the China Family Panel Studies (CFPS) data, they show that homeowners are more likely to be married than renters. They also find that the impact of homeownership is more prominent for females. They argue that female homeowners are less concerned about their potential partners' housing wealth, which gives them more choice in the marriage market and thus a higher probability of getting married. However, the authors select a broad sample that includes respondents aged 22 to 60 years old, but it might be hard for young unmarried individuals to purchase their own houses and be homeowners. As a result, instead of individual housing wealth, parental housing wealth could be more crucial in explaining the marriage transitions of young individuals.

Similar to our work, a strand of literature studies the role of parental housing wealth on young people's marriage success. Wei et al. (2017) argue that housing is a status good in China, and it is an essential sorting trait for young individuals in the marriage market. They show descriptive evidence that, in regions where males outnumber females, housing prices are higher. Using two different cross-sectional data sets, Wei and Zhang (2011) explore the association between parental housing wealth and the marriage probability of young individuals. Drawing from the 2002 wave of the Chinese Household Income Project (CHIP) data, they find that owning a better house made of concrete, bricks, or stones decreases their likelihood of having an unmarried son for rural households. For urban households, homeowners are less likely to have an unmarried son at home than renters. Additionally, they employ household census for rural households in Guizhou Province (a province of China located in the southwestern part) in 2007 and report that adult males with a high parental housing value (an estimate of the housing value owned by the family) are more likely to be married.

Fang and Tian (2018) study the impact of household housing wealth on individuals' marriage outcomes in rural areas. Using data from a field survey that was conducted in 54 rural villages in 2011, they find that house size can explain the probability of males' marriage. In contrast, there is no impact on females' marriage. However, they only use a small sample of households that are from rural areas and in three provinces. Besides, similar to Wei and Zhang (2011), they only employ cross-sectional data. The results are thus very likely to be threatened by the reverse causality of marital status on parental housing wealth.

In summary, the existing literature suggests that housing wealth plays a vital role in individuals' marriage outcomes, especially in China. Wei and Zhang (2011) and Fang and Tian (2018) provide evidence that parental housing wealth is important for sons' marriage outcomes in China. However, a common limitation is that they rely on cross-sectional data that do not

track individuals over time. Besides, they lack information on the detailed housing value and only use indicators such as homeownership rate and the size of the house.

3.3 Data and Model

3.3.1 Data Source

In this chapter, we employ data from CHARLS, which is a nationally representative household survey administered by the National School of Development at Peking University. CHARLS aims to collect household-level and individual-level information of people aged 45 and above. CHARLS conducted the national-level baseline survey in 2011 and two follow-up surveys in 2013 and 2015. The sample covers respondents from 450 communities or villages in 28 provinces (including autonomous regions and municipalities). It contains rich information on health status and function, health care and insurance, work, income, and consumption of respondents. Besides, CHARLS also includes detailed information on family background, household members' demographics, and household wealth. To track children's marriage transitions across the three waves, we draw data from the 2011, 2013, and 2015 waves of the CHARLS and construct a child-level data set.

3.3.2 Sample Selection

We restrict the analysis to children who were 16-35 years old and unmarried in the 2011 survey. We hypothesize that parental housing wealth might act as a signal for unmarried young individuals and enhance their relative attractiveness in the marriage market, while parental housing wealth should be less important for married individuals. By focusing on unmarried individuals at baseline, we attempt to mitigate the potential effect of marital status on parental housing wealth holdings. We choose 16 as the youngest age because individuals prefer to marry earlier in China, affected by the mindset of "early marriage". According to the 2010 Population Census Data of the People's Republic of China, the average age at first marriage is 23.64 years old,[22] and around 58.73% of individuals enter their first marriage between the age of 20 and 24. A non-trivial proportion of individuals gets married even before the age of 20. The age screening rule reduces our sample size to 3,740 children and 9,913 observations in total.

We also drop children who fail to appear in all three waves and restrict the sample size to 3,386 children and 9,559 child-year observations in total. Additionally, the family structure

[22] For males, the average first marriage age is 24.55 years old, and the average age is 22.76 years old for females. People in rural areas marry earlier than urban residents. On average, rural individuals enter the first marriage at the age of 22.99. Rural males become married when they are 23.92 years old, and rural females are married when they are 22.09 years old.

may influence children's outcomes. For example, Ginther and Pollak (2004) find that the children who have grown up in blended families, i.e., families in which one of the parents is not the children's biological parent, tend to have lower educational attainment. For this reason, we exclude children who grew up in blended families. This leaves us with a sample of 3,220 children.

We exclude some children from our sample because they have substantial missing values in important variables. We drop 153 observations that lack children's marital status, 500 observations with missing values for parental homeownership, and 806 observations with missing values for parental housing value. We further drop 28 observations that fail to report children's education levels, 459 that lack information on children's ethnicity, and 468 that lack information on children's income level. Besides, we excluded 83 observations since we cannot identify their parents in the household. Finally, we delete 48 observations due to the inconsistency in marriage information between waves. Overall, the final child-level data set includes 2,249 children, and it contains information on children's gender, *hukou* status, education levels, age, ethnicity, siblings, income level, birth order, parental wealth, and parental education levels.

3.3.3 Variable Construction

The outcome variable of interest is the transition into marriage dummy, which measures children's marital status in the 2015 survey. If children are married in 2015, the transition into marriage dummy would equal one. Our key explanatory variables measure two types of household wealth. The first type is parental housing wealth, which measures the housing wealth owned by parents in the 2011 wave. We use three variables to measure parental housing wealth. The first measure is a homeownership dummy, indicating whether parents own their primary house in 2011. The second measure is housing value, which is defined as the total gross value of the primary house and other houses in 2011. Housing value is defined as the total gross value of the primary house and other houses in 2011, and it is equal to zero if the parents do not own any real estate. In the analysis, we employ the inverse hyperbolic sine form of housing wealth to retain zero-valued observations. The third measure is an indicator of high-value houses, which is a dummy that takes the value of one if the parental house value is equal to or higher than the median value of all homeowners from the same city and with the same type of residence (rural or urban). In particular, as we consider the median housing value among all the homeowners, the high-value houses dummy is equal to zero if the respondents are not homeowners. To compare the impact of parental housing wealth and other forms of wealth on

children's marriage outcomes, we use non-housing wealth as our second key explanatory variable. We calculate it by adding up all non-housing wealth, including cash and deposits, stocks and mutual funds, government bonds, other financial assets, public housing funds, *jizikuan*,[23] consumer durable assets, fixed capital assets, irrigable land, agricultural asset, and unreceived cash lending, and subtracting all loans including credit card debts and outstanding borrowing. Similar to parental housing wealth, we employ the inverse hyperbolic sine form of non-housing wealth in the analysis.

We control for other child-level and household-level variables that may affect children's marriage prospects. At the child level, we introduce children's demographic information, including gender, *hukou* status, age, and ethnicity. As the previous literature shows that individual homeownership is associated with their marriage outcomes (Hu and Wang, 2020), one might argue that individual housing wealth is more important for marriage prospects than parental housing wealth. To mitigate the concern, we also add several other child-level characteristics, including education level and income level. We do not observe the housing wealth of unmarried children in the CHARLS data, but we believe that income level and education level are important indicators of individual wealth.

Moreover, having siblings plays a role in children's outcomes (Lei et al., 2017), which might also affect children's marriage prospects. We thus introduce dummies for having a brother who is alive and having a sister who is alive. There is also evidence showing that birth order affects children's outcomes (Chu et al., 2020; Price, 2008). For example, Ho (2019) argues that parental investment in children may be heterogeneous by children's birth order. If this is true, we would expect birth order to play a role in children's marriage prospects. Therefore, we also add a set of birth order dummies. For example, if a child is a first-born child among all the children that are still alive within a household, the first child dummy equals one, and the second child dummy equals zero. Family background characteristics include the education level of both the father and the mother.

3.3.4 Summary Statistics

Table 3.1 provides the summary statistics of male and female children in the 2011 survey. The sample consists of 2,249 children, including 1,404 males and 845 females. Due to our sample selection strategy, all the children in our sample are never married in 2011. The children are 22.95 years old on average. The average age of males is 23.41 years old, which is higher than females' average age. Approximately 24.3% of single men are aged 25 and above, whereas

[23] *Jizikuan* is the funds that individual provides to their work unit. The purpose is to invest, build staff apartments, etc.

only 15.4% of single women are aged 25 and above. This reflects the fact that women are more likely to marry earlier than men in China (Wrenn et al., 2019). More than half of the children have at least middle-level educational attainment. Consistent with the existing evidence (Yu and Xie, 2015), we find that young female children tend to have higher education levels than male children. In our sample, around 48.1% of young individuals have at least one brother alive, and 46.6% have at least one sister who is alive. In particular, male children account for 62.4% of the whole sample, which shows a strong sex ratio imbalance in our sample.[24] Moreover, the average income level of children for the past year is more than 2,000 yuan (approximately 284.14 US dollars and 256.59 euros), and men seem to earn more than women. As for parental characteristics, parents' education levels are quite low, and most parents only obtain an education level that is less than lower secondary school.

Our sample is reasonably consistent with the 2010 Population Census Data of the People's Republic of China in several ways. For example, the Census data shows that the proportion of the rural population is 70.86%. In our sample, the proportion of rural children is approximately 75%. Besides, according to the Census data, the fraction of ethnic minorities among the whole population is about 8%. The proportion of the ethnic minorities in our sample is around 9.8%.

In terms of wealth, the average net non-housing value held by the households is 13,930 yuan (approximately 1,950 US dollars or 1,753 euros) in 2011. Households with unmarried male children own more non-housing wealth than households with unmarried female children. Housing equity is the main part of the household's portfolio, as around 90% of parents own their primary house, and housing value is the major component of household total wealth. The average parental housing value is 176,700 yuan in 2011. Yet, it seems that the average housing value owned by parents of sons is less than that of parents of daughters.

[24] Males account for 55.4% of all the children aged 16-35 in the 2011 survey. For the children who were married in 2011, males account for about 51.4%. However, the sex ratio is much more imbalanced for the unmarried sample, as at marriageable ages males are less likely to get married than females.

Table 3.1. Descriptive statistics at the first-wave, by gender

Variable	Full sample, N=2,249					Male, N=1,404					Female, N=845					*p*-value
	Mean	SD	Min	Max	Median	Mean	SD	Min	Max	Median	Mean	SD	Min	Max	Median	
Child information																
Age group																
16-20	0.244	0.430	0	1	0	0.202	0.402	0	1	0	0.314	0.464	0	1	0	0.000
21-25	0.546	0.498	0	1	1	0.554	0.497	0	1	1	0.533	0.499	0	1	1	0.320
26-30	0.162	0.369	0	1	0	0.182	0.386	0	1	0	0.129	0.335	0	1	0	0.001
30	0.048	0.213	0	1	0	0.061	0.240	0	1	0	0.025	0.156	0	1	0	0.000
Education level[a]																
Low[b]	0.425	0.494	0	1	0	0.492	0.500	0	1	0	0.314	0.464	0	1	0	0.000
Middle	0.246	0.431	0	1	0	0.226	0.418	0	1	0	0.279	0.449	0	1	0	0.004
High	0.329	0.470	0	1	0	0.282	0.450	0	1	0	0.407	0.492	0	1	0	0.000
Married	0[c]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Male	0.624	0.484	0	1	1	1	0	1	1	1	0	0	0	0	0	-
Rural	0.752	0.432	0	1	1	0.778	0.416	0	1	1	0.709	0.455	0	1	1	0.000
Age	22.95	3.775	16	35	23	23.41	3.846	16	35	23	22.18	3.527	16	34	22	0.000
Has brother(s)	0.481	0.500	0	1	0	0.437	0.496	0	1	0	0.553	0.498	0	1	1	0.000
Has sister(s)	0.466	0.499	0	1	0	0.498	0.500	0	1	0	0.414	0.493	0	1	0	0.000
Ethnic minority	0.098	0.298	0	1	0	0.090	0.286	0	1	0	0.112	0.316	0	1	0	0.080
Income[d]	3.338	2.018	0	11	4	3.507	1.990	0	8	4	3.057	2.034	0	11	3	0.000
Occupation[e]	5.535	1.874	1	7	7	5.427	1.858	1	7	6	5.670	1.888	1	7	7	0.047
Parental assets[f,g]																
Net non-housing value	1.393	15.52	-119.6	414.0	0.652	1.672	17.63	-119.6	414.0	0.621	0.930	11.14	-114.3	81.85	0.740	0.273
Gross housing value	17.67	114.1	0	4,074	7	17.23	118.6	0	4,074	6	18.40	106.3	0	3,000	8	0.814
Homeownership[h]	0.896	0.306	0	1	1	0.901	0.299	0	1	1	0.886	0.318	0	1	1	0.273
High housing value	0.534	0.499	0	1	1	0.536	0.499	0	1	1	0.529	0.499	0	1	1	0.736
Ln(housing value)	10.62	3.817	0	18.22	11.85	10.63	3.720	0	18.22	11.70	10.60	3.973	0	17.91	11.98	0.835
Father education																
Low education	0.771	0.420	0	1	1	0.784	0.412	0	1	1	0.750	0.433	0	1	1	0.073
Middle education	0.195	0.397	0	1	0	0.186	0.389	0	1	0	0.211	0.408	0	1	0	0.172
High education	0.033	0.180	0	1	0	0.030	0.170	0	1	0	0.039	0.195	0	1	0	0.237
Mother education																
Low education	0.887	0.317	0	1	1	0.890	0.313	0	1	1	0.880	0.325	0	1	1	0.447
Middle education	0.098	0.297	0	1	0	0.097	0.296	0	1	0	0.099	0.299	0	1	0	0.878
High education	0.016	0.125	0	1	0	0.013	0.112	0	1	0	0.021	0.144	0	1	0	0.139

Note: [a] For children who have finished their education, we choose their highest educational attainment as their education level; for those who are still at school, we choose their future educational attainment as their education level.

[b] Low education equals one if they report their education levels are less than lower secondary; Middle education equals one if they finish high school or vocational school; High education equals one if they have above two/three-year college education.

[c] Married equals zero because we restrict our sample to unmarried children in the 2011 wave.

[d] Income refers to the category of children's income one year before the interview. There are 11 categories: 1) None, 2) under 2,000, 3) 2,000-5,000 yuan, 4) 5,000-10,000 yuan, 5) 10,000-20,000 yuan, 6)20,000-50,000 yuan, 7) 50,000-100,000 yuan, 8) 100,000-150,000 yuan, 9) 150,000-200,000 yuan, 10) 200,000-300,000 yuan, and 11) Above 300,000 yuan.

[e] Occupation includes 1) Managers, 2) Professionals and technicians, 3) Clerk, 4) Commercial and service workers, 5) Agricultural, forestry, husbandry and fishery producers, 6) Production and transportation workers, and 7) Still at school.

[f] All the household wealth is in ten thousand China yuan, which is approximately 1,258 euros.

[g] We calculate net household wealth by adding up all wealth such as the value of cash and deposits, stocks and mutual funds, government bonds, other financial assets, public housing funds, *jizikuan*, primary and other houses, consumer durable assets, fixed capital assets, irrigable land, agricultural asset, and unreceived cash lending, and subtracting all the loans such as loans for primary and other houses, other loans, credit card debts, and outstanding borrowing.

[h] Homeownership is a dummy variable indicating whether parents own their primary house. If the parents own the primary house in wave 1 it equals one, and it equals zero if they do not own their primary house.

[i] In our sample, we also include those children with information on a single parent. This leads to some missing values on parents' information. In wave 1, we have 2,098 observations for father's education and 2,141 observations for mother's education, and 946 for children's occupation. For the male sample, we have 1,310 observations for father's education, 1,332 observations for their mother's education, and 525 for children's occupation. For the female sample, we have 788 observations for father's education, 809 observations for mother's education, and 421 for children's occupation.

[j] *p*-value tests the equality of the means between the male sample and the female sample.

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Table 3.2. Marriage rate, by housing wealth and *hukou* status

Marriage rate		2011-2013(wave 1-wave 2)					2011-2015 (wave 1-wave 3)				
		Male		Female		*p*-value[d]	Male		Female		*p*-value
		Percentage	N	Percentage	N		Percentage	N	Percentage	N	
By parental housing value[c]	Low housing wealth	21.04%[a]	109[b]	32.49%	103	0.000	38.70%	221	56.20%	195	0.000
	High housing wealth	26.05%	199	31.28%	142	0049	46.70%	389	49.20%	245	0.378
By *hukou* status	Urban *hukou*	21.69%	64	27.54%	65	0.119	46.45%	157	52.59%	142	0.123
	Rural *hukou*	24.72%	244	33.64%	180	0.002	42.50%	453	51.83%	298	0.000

Note: [a] The percentage is the number of married males with low parental housing value in wave 2 divided by the total number of males with low parental housing value in wave 2.

[b] N is the number of married males with low parental housing wealth in wave 2.

[c] If the parental housing value is above the median value among all the homeowners from the same city and with the same residence location (rural areas or urban areas) in the 2011 wave, it belongs to the high housing wealth category. If parental housing value is below the median value, it belongs to the low housing value category.

[d] *p*-value tests the equality of the means between the male sample and the female sample.

Table 3.2 presents the marriage transitions of males and females between 2011 and 2015. It shows that the average marriage rates of female children are higher than male children. To further investigate the differences in marriage transitions between males and females, we report their marriage transitions by parental housing wealth and *hukou* status.

Table 3.2 suggests that the higher the parents' housing wealth, the better their sons' marriage prospects will be. This result indicates that parental housing wealth might serve as a signal in the marriage market: a better parental house enhances the relative attractiveness in the marriage market and leads to a higher probability of getting married. Interestingly, the same is not true for daughters. This may be due to the fact that males face a fiercer competitive marriage market due to the skewed sex ratios in the marriage market, parental housing wealth is more important for males than females in the marriage market. Besides, affected by the social norm in China, the grooms' family is expected to provide a house for the marriage (Li and Wu, 2019).

Overall, the differences in Table 3.2 suggest a positive association between parental housing wealth and males' transitions into marriage, yet we need a formal analysis to investigate the effect of parental housing wealth on young males' chances of transitions into marriage. As for the differences between rural and urban individuals, the overall marriage transitions from 2011 to 2015 seem to be similar for young individuals with rural and urban *hukou*.

3.3.5 Empirical Strategy

The objective of this chapter is to estimate the effect of parental housing wealth on individuals' transitions into marriage. Therefore, we focus on the transitions into marriage of unmarried individuals in 2011 and estimate the following linear probability model:

$$y_{ijpt} = \beta_0 + \beta_1 Housing\ wealth_{jpt-1} + \beta_2 NonHousing\ wealth_{jpt-1} + X'_{ijpt-1}\gamma + \lambda_p + \varepsilon_{ijpt} \quad (3.2)$$

where y_{ijpt} is the marriage outcome for child *i* in household *j* and province *p* at time *t*. In our analysis, *t-1* refers to the year 2011, and *t* is the year 2015. y_{ijpt} is a dummy variable that is equal to one if the child i is married in 2015, and it is zero if the child is still single in 2015. We make use of the panel structure of our data and estimate the impact of parental housing wealth in 2011 on children's marriage transitions four years later in a cross-sectional regression. This strategy is similar to Lafortune and Low (2017b), who study the association between individual homeownership and marriage in the United States.

$Housing\ wealth_{jpt-1}$ is the housing wealth owned by parent *j* in province *p* in the 2011 survey. We use three measures: a dummy for $Homeowner_{jpt-1}$, a measure of $Housing\ value_{jpt-1}$, and a dummy for $High\ value\ houses_{jpt-1}$. β_1 is our key parameter.

We expect β_1 to be positive and significant, especially for men. This would mean that parental housing wealth is a signal for males in the marriage market: better parental housing can enhance males' competence in the marriage market. On the contrary, females face a less competitive marriage market, and it is also not common that females' families provide a house for marriage. Therefore, parental housing wealth plays a less important role in females' marriage.

$NonHousing\ wealth_{jpt-1}$ refers to the household non-housing wealth in the 2011 survey. We expect β_2 to be of a smaller magnitude or to be insignificant, because non-housing wealth accounts for a smaller fraction of parental wealth than housing wealth. Additionally, non-housing wealth is typically less visible and more difficult to verify than housing wealth.[25] Consequently, non-housing wealth would be a less important signal for children in the marriage market.

The vector X_{ijpt-1} contains covariates including children's gender, age, education levels, *hukou* status, whether having siblings who are alive, ethnicity, and their parents' educational attainment in the 2011 survey. Besides, we introduce a province fixed effect λ_p in our analysis. The main advantage of introducing province fixed effects is that it can control for the problem of confounding regional factors on people's marriage outcomes. For example, individual marriage probabilities are sensitive to local sex ratios (Wrenn et al., 2019), and men from regions with more excess men than women may find it more difficult to get married than men from regions with less skewed sex ratio imbalance. Of course, there could still be other unobservables, such as family preferences for marriage, that affect both the accumulation of housing wealth and the probability of getting married. For this reason, we refrain from using causal language when interpreting our results. The error term, ε_{ijpt}, captures the remaining unobservable heterogeneity. We estimate our regression model by OLS. We cluster the standard errors at the household level to capture the within household correlation.

[25] Compared to housing wealth, it is easier to borrow non-housing wealth such as a car and a piece of jewelry from others to enhance own attractiveness in the marriage market (Wei et al. 2017).

3.4 Results

In this section, we estimate the effect of parental housing wealth on children's marriage prospects.

3.4.1 The Effect of Housing Value on Children's Marriage

Table 3.3 presents the impact of parental housing value in 2011 on children's transitions into marriage in 2015. In the first three columns, we regress individuals' transition into marriage in 2015 on baseline parental housing value and homeownership. As wealth background may be more important for men than women in the marriage market (Li et al., 2020), we also investigate the impact of parental housing wealth on children's marriage outcomes for men and women, respectively. The results can be found in columns 2 and 3 of Table 3.3. In columns 4-6, we add covariates measuring children's characteristics, including age groups, birth orders, income level, and dummies for males, for a high education level, for rural *hukou*, for having a sister and a brother who is alive, and for the ethnic minority.

Columns 2 and 3 show that parental housing value in 2011 has different effects on children's marriage transitions in 2015 for males and females. Parental housing value has a positive and statistically significant effect for males, while a negative but insignificant effect for females.

The results are similar after adding all control variables and province fixed effects, as shown in columns 4-6. The estimates suggest that parental housing value has a strong positive impact on males' transition into marriage, while the effect is negative but statistically insignificant for females. In particular, column 5 shows that, for men whose parents are homeowners in the 2011 survey, a ten percent increase in parental housing wealth leads to a 0.14 percentage points increase in their sons' probability of getting married in 2015. Given that the mean probability of marriage for men in 2015 is 43.45%, the probability of marriage increases by 0.32%. The magnitude of this effect is larger than the one obtained by Chu et al. (2020), who report that a 10% increase in individual housing wealth results in a 0.0392 percentage points increase in the probability of marriage for men. Moreover, men whose parents own a house worth 200,000 yuan in 2011 are 6.46 percentage points more likely to be married in 2015 than men whose parents rent a house in 2011.

The test statistics for the impact of parental housing value across males and females confirm that the effect is different. This is in line with our expectation that parental housing wealth is more likely to be a signal for males and improve their chances of getting married than for females. Contrary to housing wealth, we find no significant effect of non-housing value on the

marriage transitions for both men and women. This finding is supported by Chu et al. (2020), who show a positive effect of individual housing wealth on males' chances of getting married, but no significant impact of individual financial wealth on marriage. One potential reason is that financial wealth is not a good signal in the marriage market because it accounts for a small fraction of total household wealth and it is less visible than housing wealth.

In terms of the control variables, several control variables are shown to affect children's transitions into marriage significantly. For example, on average, males are less likely to marry than females (see column 4), as they face a more competitive marriage market. Moreover, being highly educated decreases young individuals' chances of getting married since young individuals might delay marriage to pursue higher education. In our results, *hukou* status, having sisters or brothers who are alive, ethnicity, and parental education are less important for young individuals' marriage transitions. Children's income level, which is an indicator of children's wealth, plays a role in their marriage outcomes; a higher income level in 2011 increases individuals' chances of getting married in 2015. More importantly, adding child income in columns 4-6 does not influence the impact of parental housing value on children's transition into marriage. This suggests that parental housing value indeed has a positive impact on males' marriage probabilities, even after we control for individual wealth. Besides, we also find that birth order affects men's marriage probability, while no evidence shows that birth order affects women's marriage possibilities.

Table 3.3. Parental housing value on children's marriage success (OLS)

Variables	Full sample	Male	Female	Full sample	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
ln(housing value) $_{t=1}$	0.0047	0.0115**	-0.0089	0.0063	0.0140**	-0.0089
	(0.0042)	(0.0051)	(0.0072)	(0.0043)	(0.0055)	(0.0063)
Homeowner $_{t=1}$	-0.0012	-0.0575	0.1336	-0.0560	-0.1160*	0.0743
	(0.0511)	(0.0624)	(0.0883)	(0.0534)	(0.0677)	(0.0758)
ln(non-housing value) $_{t=1}$				-0.0020	-0.0015	-0.0021
				(0.0020)	(0.0026)	(0.0031)
Age group: Child aged under 20 (reference)						
Child aged 21-25 $_{t=1}$				0.2788***	0.2723***	0.2920***
				(0.0254)	(0.0322)	(0.0407)
Child aged 26-30 $_{t=1}$				0.3176***	0.3028***	0.3799***
				(0.0373)	(0.0471)	(0.0629)
Child aged above 30 $_{t=1}$				0.1361**	0.1717**	0.0891
				(0.0630)	(0.0713)	(0.1378)
Child male				-0.1502***		
				(0.0225)		
Child high education $_{t=1}$				-0.0520**	0.0016	-0.1610***
				(0.0244)	(0.0311)	(0.0392)
Child rural *hukou* $_{t=1}$				-0.0056	-0.0332	0.0135
				(0.0298)	(0.0385)	(0.0482)
Child has brother $_{t=1}$				-0.0390	-0.0421	-0.0403
				(0.0245)	(0.0316)	(0.0398)
Child has sister $_{t=1}$				-0.0105	-0.0030	-0.0075
				(0.0243)	(0.0325)	(0.0361)
Child Ethnic Minority				-0.0644	-0.0635	-0.0767
				(0.0446)	(0.0615)	(0.0742)
Child income level $_{t=1}$				0.0487***	0.0453***	0.0528***
				(0.0060)	(0.0077)	(0.0100)
Birth order: Fifth child or beyond (reference)						
First child				0.1213	0.1240	0.1082
				(0.0763)	(0.0992)	(0.1522)
Second child				0.1162	0.1376	0.0703
				(0.0742)	(0.0963)	(0.1506)
Third child				0.1330*	0.1102	0.1710
				(0.0750)	(0.0971)	(0.1528)
Fourth child				0.1757**	0.1952*	0.1665
				(0.0831)	(0.1111)	(0.1610)
Father high education $_{t=1}$				-0.0548**	-0.0695*	-0.0548
				(0.0272)	(0.0359)	(0.0420)
Mother high education $_{t=1}$				-0.0238	-0.0537	0.0075
				(0.0384)	(0.0502)	(0.0604)
Constant	0.4185***	0.3641***	0.4967***	-0.2599	-0.2083	-0.3507
	(0.0341)	(0.0434)	(0.0552)	(0.1785)	(0.1283)	(0.2319)
Observations	2,249	1,404	845	1,990	1,238	752
Number of households	1,752	1,241	758	1,537	1,096	671
R-squared	0.0012	0.0044	0.0029	0.1669	0.1498	0.2513
Regional fixed effect				Yes	Yes	Yes
Test for the impact of parental housing wealth on males and females						
		F(2,1751)=2.77			F(2,1536)=3.92	
		Prob>F=0.0631			Prob>F=0.0200	

Note: [a] *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

[b] In the regressions, we restrict our sample to unmarried children in the 2011 wave and track their marriage transitions. Finally, we obtain 2,249 children of 1,752 households in our sample.

[c] The main explanatory variable in the regressions is parental housing value. We employ the inverse hyperbolic sine form of housing wealth and non-housing wealth.

[d] In columns 2-3 and columns 5-6, we estimate the impact of parental housing value in 2011 on males' and females' marital status.

[e] If the children or their parents are with middle or high education levels, the high education dummy equals one, otherwise it equals zero.

[f] First child is a dummy variable, and it equals one if the child is the first-born child among all the children who are still alive within the households, zero otherwise.

[g] In the last row, we test whether the coefficients estimated over different groups are equal to each other.

The impact of parental housing wealth on children's marriage prospects might be different between children with rural *hukou* and children with urban *hukou*. In Table 3.4, we estimate the effect of housing value on marriage transitions for children with urban *hukou* (columns 1 and 2) and rural *hukou* (columns 3 and 4) separately. Column 1 of Table 3.4 suggests that for rural males whose parents are homeowners in the 2011 survey, a ten percent increase in parental housing value leads to a 0.18 percentage points increase in their chances of marriage in 2015, corresponding to 0.42% relative to the mean probability of marriage for rural males in 2015.

The main finding is that parental housing wealth is positively associated only with rural males' transitions into marriage. For males with urban *hukou*, however, the impact is positive but insignificant. Consistent with the results in Table 3.3, we find no significant impact of parental housing value on females' marriage prospects.

Table 3.4. Parental housing value on children's marriage success, by *hukou* status (OLS)

Variables	Rural sample		Urban sample	
	Rural male	Rural female	Urban male	Urban female
	(1)	(2)	(3)	(4)
ln(housing value) $_{t=1}$	0.0183***	-0.0065	0.0018	-0.0217
	(0.0067)	(0.0078)	(0.0116)	(0.0141)
Homeowner $_{t=1}$	-0.1688**	0.0454	-0.0057	0.2299
	(0.0845)	(0.0975)	(0.1346)	(0.1570)
ln(non-housing value) $_{t=1}$	0.0000	0.0017	-0.0051	-0.0085
	(0.0031)	(0.0036)	(0.0057)	(0.0069)
Age group: Child aged under 20 (reference)				
Child aged 21-25 $_{t=1}$	0.2728***	0.2852***	0.3346***	0.3392***
	(0.0373)	(0.0476)	(0.0763)	(0.1000)
Child aged 26-30 $_{t=1}$	0.2753***	0.3590***	0.3902***	0.4112***
	(0.0550)	(0.0742)	(0.1021)	(0.1435)
Child aged above 30 $_{t=1}$	0.1276	0.1076	0.3972**	0.0429
	(0.0789)	(0.1713)	(0.1811)	(0.2199)
Child high education $_{t=1}$	-0.0070	-0.1700***	0.0419	-0.0769
	(0.0341)	(0.0411)	(0.0994)	(0.1747)
Child has brother $_{t=1}$	-0.0287	-0.0612	-0.1015	0.1025
	(0.0349)	(0.0468)	(0.0827)	(0.0891)
Child has sister $_{t=1}$	0.0090	-0.0204	-0.0153	0.0410
	(0.0365)	(0.0418)	(0.0833)	(0.0798)
Childe ethnic minority	-0.0476	-0.0794	-0.0934	0.0143
	(0.0696)	(0.0865)	(0.1622)	(0.1481)
Child income level $_{t=1}$	0.0403***	0.0602***	0.0568***	0.0326*
	(0.0090)	(0.0123)	(0.0170)	(0.0188)
Birth order: Fifth child or beyond (reference)				
First child	0.1488	-0.0267	0.0901	0.7464***
	(0.1082)	(0.1655)	(0.2329)	(0.2274)
Second child	0.1455	-0.0219	0.1549	0.5440**
	(0.1052)	(0.1644)	(0.2219)	(0.2188)
Third child	0.1172	0.1179	0.1357	0.3632
	(0.1060)	(0.1657)	(0.2273)	(0.2733)
Fourth child	0.2168*	0.0678	0.1317	0.4802
	(0.1215)	(0.1702)	(0.2593)	(0.3304)
Father high education $_{t=1}$	-0.0750*	-0.0434	-0.0322	-0.0557
	(0.0427)	(0.0519)	(0.0728)	(0.0768)
Mother high education $_{t=1}$	-0.0067	0.1275	-0.1001	-0.1134
	(0.0800)	(0.0916)	(0.0739)	(0.0912)
Constant	-0.1674	0.6708***	-0.0490	-0.8461**
	(0.2525)	(0.2001)	(0.2721)	(0.3722)
Observations	968	550	270	202
R-squared	0.1448	0.2886	0.2679	0.3500
Regional fixed effect	Yes	Yes	Yes	Yes
Test for the impact of parental housing wealth on males and females				
	F(2, 1168)= 3.05		F(2, 416)= 0.91	
	Prob>F=0.0477		Prob>F=0.4019	

Notes: [a] *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

[b] The explanatory variable in the regressions is parental housing value. We employ the inverse hyperbolic sine form of wealth.

[c] In columns 1-2, we estimate the impact of parental housing value in 2011 on rural males' marriage transitions and rural females' marriage transitions, respectively. In columns 3-4, we estimate the impact of parental housing value on urban males' marriage transitions and urban females' marriage transitions, respectively.

The differences between males with rural and urban *hukou* can be explained in several ways. First, housing wealth is the largest household wealth component in rural areas (Gan et al., 2016), while in urban areas, the fraction of housing wealth among total household wealth is lower. Therefore, housing value could be more critical for rural *hukou* children than for those with urban *hukou*.

Second, rural households have a stronger preference for conspicuous spending than urban households (Brown et al., 2011). As an essential form of conspicuous expenditure in rural areas, the expenditure on marriage, especially on housing wealth, plays a more important role in the status competition. Therefore, housing wealth is more important for rural households than for urban households.

Third, coresidence can also be a potential explanation. In rural areas, a popular social norm is that the bride lives together with the groom's parents after getting married (Lei et al., 2015). In that sense, the bride would benefit from better parental housing. Thus, higher parental housing wealth improves rural men's relative attractiveness to the partner and affects their marriage prospects positively. On the contrary, a more widespread practice in urban areas is that parents help their children purchase a house before the children get married (Sun and Zhang, 2020). In that case, individual housing wealth might be a more important signal than parental housing wealth for men with urban *hukou*. In Table 3.5, we show different coresidence patterns after children get married using the analytic sample. Panel B reports coresidence rates of 51.58% and 33.83% for married men in the rural sample and urban sample, respectively. The higher rates in the rural sample can support the coresidence mechanism. Furthermore, Table 3.6 reports the homeownership rates for rural and urban children in 2015 (this question was not asked in 2011), indicating that rural males have lower homeownership rates than urban males. Therefore, parental housing wealth is likely to be more important for rural males than for urban males.

Table 3.5. Coresidence rates of children and their parents

	Male		Female		*p*-value
	Percentage (%)	N	Percentage (%)	N	
Panel A: Coresidence rates of 2011 sample (N=2,231[c])					
Full sample	78.18	1,089	77.21	647	
A. Rural sample	78.26	846	77.53	459	0.723
B. Urban sample	77.88	243	76.42	188	0.083
p-value	0.887		0.727		
Panel B: Coresidence rates in 2015 of the children who get married (N=1,050)					
Full sample	47.49	274	12.24	52	
A. Rural sample	51.58	229	12.62	39	0.000
B. Urban sample	33.83	45	11.21	13	0.000
p-value	0.000		0.693		

Note: The percentage is the number of males coreside with parents by the number of males. N is the number of males coreside with parents. We observe the coresidence information for 2,231 children in the 2011 sample. *p*-value tests the equality of the means between the male sample and the female sample.

Table 3.6. Children's homeownership in the 2015 survey

	Male		Female	
	Percentage (%)	N	Percentage (%)	N
Full sample	25.89	363	25.21	211
A. Rural sample	23.49	256	24.66	146
B. Urban sample	34.29	107	26.53	65

Note: Homeownership rates are calculated based on the question CB071_W3 in the 2015 CHARLS survey: Does [child's name] own a house? However, this question was not asked in the 2011 survey.

3.4.2 The Effect of Owning High-value Houses on Children's Marriage

In Table 3.7, we show the results of a similar analysis with another measure of housing wealth. High-value houses is a dummy that equals one if parents own high-value houses in 2011. In columns 1-3, we regress children's transitions into marriage in 2015 on high-value houses and their parents' homeownership in 2011. We then regress the marriage transitions of children in 2015 on high-value houses and homeownership of their parents, and a full set of controls in columns 4-6. Column 2 shows that owning high-value parental houses plays a role in young males' marriage success. The results are consistent after we add controls, as shown in columns 4-6. Column 5 indicates that for males, owning high-value parental houses increases their probability of getting married by 9.14 percentage points. However, for females, the coefficient of high-value parental houses is insignificant and negative. Additionally, in Table 3.7, we observe no significant effect of parental homeownership on children's transitions into marriage. The most likely cause is that the vast majority (around 90%) of parents in our sample own their primary house in 2011. Therefore, the parental homeownership indicator is not a signal in the marriage market.

Table 3.7. Parental high-value houses on children's marriage success (OLS)

Variables	Full sample	Male	Female	Full sample	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
High-value houses $_{t=1}$	0.0321	0.0841***	-0.0562	0.0436*	0.0914***	-0.0434
	(0.0230)	(0.0287)	(0.0372)	(0.0229)	(0.0295)	(0.0363)
Homeowner $_{t=1}$	0.0223	-0.0070	0.0804	-0.0269	-0.0552	0.0160
	(0.0371)	(0.0465)	(0.0603)	(0.0387)	(0.0524)	(0.0558)
ln(non-housing value) $_{t=1}$				-0.0021	-0.0018	-0.0021
				(0.0020)	(0.0026)	(0.0031)
Age group: Child aged under 20 (reference)						
Child aged 21-25 $_{t=1}$				0.2782***	0.2692***	0.2912***
				(0.0254)	(0.0318)	(0.0408)
Child aged 26-30 $_{t=1}$				0.3176***	0.3005***	0.3799***
				(0.0373)	(0.0469)	(0.0628)
Child aged above 30 $_{t=1}$				0.1343**	0.1665**	0.0913
				(0.0633)	(0.0719)	(0.1373)
Child male				-0.1509***		
				(0.0225)		
Child high education $_{t=1}$				-0.0514**	0.0016	-0.1636***
				(0.0244)	(0.0311)	(0.0393)
Child rural *hukou* $_{t=1}$				-0.0081	-0.0392	0.0181
				(0.0298)	(0.0386)	(0.0476)
Child has brother $_{t=1}$				-0.0415*	-0.0459	-0.0357
				(0.0245)	(0.0317)	(0.0397)
Child has sister $_{t=1}$				-0.0121	-0.0079	-0.0069
				(0.0243)	(0.0323)	(0.0362)
Child Ethnic Minority				-0.0657	-0.0727	-0.0799
				(0.0446)	(0.0609)	(0.0734)
Child income level $_{t=1}$				0.0489***	0.0454***	0.0520***
				(0.0060)	(0.0077)	(0.0100)
Birth order: Fifth child or beyond (reference)						
First child				0.1185	0.1226	0.1130
				(0.0778)	(0.1011)	(0.1496)
Second child				0.1125	0.1331	0.0745
				(0.0758)	(0.0983)	(0.1482)
Third child				0.1314*	0.1136	0.1770
				(0.0764)	(0.0990)	(0.1502)
Fourth child				0.1722**	0.1901*	0.1691
				(0.0842)	(0.1129)	(0.1583)
Father high education $_{t=1}$				-0.0561**	-0.0693*	-0.0519
				(0.0272)	(0.0358)	(0.0421)
Mother high education $_{t=1}$				-0.0249	-0.0533	0.0122
				(0.0382)	(0.0490)	(0.0600)
Constant	0.4298***	0.3957***	0.4792***	-0.2463	-0.1300	-0.3521
	(0.0324)	(0.0410)	(0.0530)	(0.1852)	(0.1258)	(0.2281)
Observations	2,249	1,404	845	1,990	1,238	752
Number of households	1,752	1,241	758	1,537	1,096	671
R-squared	0.0015	0.0069	0.0036	0.1676	0.1521	0.2512
Regional fixed effect				Yes	Yes	Yes

Test for the impact of parental housing wealth on males and females		
	F(2,1751)=4.52	F(2,1536)=4.22
	Prob>F=0.0110	Prob>F=0.0149

Note: [a] Standard errors, clustered at the household level, are shown in parentheses.

[b] The explanatory variable in the regressions is a dummy variable (High-value houses), indicating whether the parental housing value is above the median value among all the homeowners within the same city and with the same location (rural areas or urban areas) in wave 1. It equals one if parental housing value in 2011 is equal to or above the median value and zero if it is below the median value.

[c] We employ the inverse hyperbolic sine form of non-housing wealth to solve the negative wealth problem.

[d] Homeowner is a dummy variable. It equals one if the parents own a primary home in 2011 and zero if not.

*p<0.1, ** p<0.05, ***p<0.01.

Similar to Table 3.4, we estimate the impact of high-value parental houses on children's marriage success by children's *hukou* status. The results are reported in Table 3.8. In columns 1 and 2, we regress the marriage transitions of rural males and rural females on the high-value houses owned by their parents and other control variables. Columns 3 and 4 show the estimates of high-value parental houses and other control variables on urban males' and females' marriage transitions, respectively. In line with our findings in Table 3.4, we find that parental high-value houses are only crucial for rural males: the marriage prospects of rural males are 10.77 percentage points higher if their parents own high-value houses. Similar to the earlier results, we find no significant effect for urban males. In addition, the test statistics imply that there is no significant difference between urban males and females.

Table 3.8. Parental high-value houses on children's marriage success, by *hukou* status (OLS)

Variables	Rural sample		Urban sample	
	Rural male	Rural female	Urban male	Urban female
	(1)	(2)	(3)	(4)
High-value houses $_{t=1}$	0.1077***	-0.0643	0.0345	0.0097
	(0.0336)	(0.0409)	(0.0670)	(0.0787)
Homeowner $_{t=1}$	-0.0725	0.0184	-0.0142	0.0248
	(0.0614)	(0.0659)	(0.1035)	(0.1094)
ln(non-housing value) $_{t=1}$	-0.0003	0.0019	-0.0053	-0.0104
	(0.0030)	(0.0036)	(0.0057)	(0.0067)
Age group: Child aged under 20 (reference)				
Child aged 21-25 $_{t=1}$	0.2680***	0.2842***	0.3361***	0.3422***
	(0.0367)	(0.0474)	(0.0763)	(0.1027)
Child aged 26-30 $_{t=1}$	0.2722***	0.3548***	0.3920***	0.4262***
	(0.0546)	(0.0739)	(0.1022)	(0.1459)
Child aged above 30 $_{t=1}$	0.1216	0.1142	0.3978**	0.0497
	(0.0798)	(0.1689)	(0.1795)	(0.2246)
Child high education $_{t=1}$	-0.0060	-0.1739***	0.0412	-0.0968
	(0.0339)	(0.0411)	(0.0992)	(0.1778)
Child has brother $_{t=1}$	-0.0327	-0.0554	-0.1033	0.0986
	(0.0349)	(0.0465)	(0.0831)	(0.0911)
Child has sister $_{t=1}$	0.0052	-0.0176	-0.0183	0.0427
	(0.0361)	(0.0418)	(0.0840)	(0.0802)
Childe ethnic minority	-0.0618	-0.0891	-0.0921	0.0280
	(0.0681)	(0.0858)	(0.1640)	(0.1409)
Child income level $_{t=1}$	0.0412***	0.0589***	0.0563***	0.0303
	(0.0089)	(0.0124)	(0.0169)	(0.0190)
Birth order: Fifth child or beyond (reference)				
First child	0.1467	-0.0216	0.0910	0.7112***
	(0.1092)	(0.1579)	(0.2359)	(0.2231)
Second child	0.1399	-0.0159	0.1584	0.5047**
	(0.1063)	(0.1570)	(0.2249)	(0.2142)
Third child	0.1213	0.1243	0.1425	0.3344
	(0.1071)	(0.1581)	(0.2309)	(0.2735)
Fourth child	0.2120*	0.0779	0.1313	0.4591
	(0.1225)	(0.1632)	(0.2638)	(0.3039)
Father high education $_{t=1}$	-0.0764*	-0.0401	-0.0345	-0.0535
	(0.0425)	(0.0521)	(0.0731)	(0.0757)
Mother high education $_{t=1}$	-0.0017	0.1357	-0.1010	-0.1189
	(0.0778)	(0.0901)	(0.0743)	(0.0889)
Observations	968	550	270	202
R-squared	0.1479	0.2914	0.2686	0.3390
Regional fixed effect	Yes	Yes	Yes	Yes
Test for the impact of parental housing wealth on males and females				
	F(2,1168)= 5.36 Prob>F=0.0048		F(2,416)=0.05 Prob>F=0.9539	

Note: *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

In summary, we find that parental housing wealth is an important determinant of children's transitions into marriage. More importantly, the effect of parental housing wealth is more prominent for males, while it is statistically insignificant for females. The differences can be confirmed by investigating the heterogeneous effects of parental housing wealth using interaction terms (see Tables 3.A1-3.A3). This supports the view that in China, parental wealth serves as a signal of young males' marriage prospects. The signal is more crucial for males, due to the increased pressure in the marriage market caused by unbalanced sex ratios and the social norm that males are expected to provide a house for the marriage. Moreover, the effect of parental housing wealth is different for individuals with different *hukou* types. Rural males' marriage transitions are more likely to be affected by their parental housing wealth. Nevertheless, no evidence shows that parental housing wealth affects the marriage prospects of children with urban *hukou*.

The results are broadly consistent, regardless of whether we use housing value or high-value houses to measure parental housing wealth. However, if we use homeownership to measure parental housing wealth (see Tables 3.9-3.10), the impact is positive but statistically insignificant. We think that this result is because homeownership rates are very high (around 90%), and therefore owning a home does not act as a signal. In contrast to parental housing wealth, we find no effect of non-housing wealth on children's transitions into marriage.

Table 3.9. Parental homeownership on children's marriage success (OLS)

Variables	Full sample	Male	Female	Full sample	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
Homeowner $_{t=1}$	0.0414	0.0431	0.0469	-0.0003	0.0004	-0.0107
	(0.0343)	(0.0434)	(0.0560)	(0.0359)	(0.0495)	(0.0514)
ln(non-housing value) $_{t=1}$				-0.0019	-0.0013	-0.0022
				(0.0020)	(0.0026)	(0.0031)
Observations	2,249	1,404	845	1,990	1,238	752
R-squared	0.0006	0.0007	0.0009	0.1660	0.1450	0.2496
Controls				Yes	Yes	Yes
Regional fixed effect				Yes	Yes	Yes
Test for the impact of parental housing wealth on males and females						
		F(1,1751)=0.00			F(1,1536)=0.02	
		Prob>F=0.9750			Prob>F=0.8791	

Note: [a] *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

[b] The explanatory variable in the regressions is a dummy variable (Homeowner), which indicates whether the parents own their primary house. If the parents own the primary house in wave 1 it is equal to one and zero if they do not own their primary house.

Table 3.10. Parental homeownership on children's marriage success, by *hukou* status (OLS)

Variables	Rural sample		Urban sample	
	Rural male	Rural female	Urban male	Urban female
	(1)	(2)	(3)	(4)
Homeowner $_{t=1}$	-0.0073	-0.0181	0.0070	0.0308
	(0.0581)	(0.0617)	(0.0950)	(0.0962)
ln(non-housing value) $_{t=1}$	0.0003	0.0016	-0.0051	-0.0105
	(0.0030)	(0.0036)	(0.0056)	(0.0066)
Observations	968	550	270	202
R-squared	0.1379	0.2879	0.2678	0.3390
Controls	Yes	Yes	Yes	Yes
Regional fixed effect	Yes	Yes	Yes	Yes
Test for the impact of parental housing wealth on males and females				
	F(1,1168)=0.02		F(1,416)=0.04	
	Prob>F=0.8998		Prob>F= 0.8509	

Note: *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

3.4.3 Sensitivity Analysis

As a robustness check, we restrict our sample to the children who live with their parents in the 2015 wave. By applying the same analysis as aforementioned, we check the impact of parental housing wealth on the marriage transitions of individuals who are living together with their parents. The results are shown in Tables 3.A4 and 3.A5 in the Appendix. As we expected, we find that parental housing value and high-value parental houses are still important for males' marriage transitions, and the effect is only significant for males with rural *hukou*. This reflects that the prevalent coresidence between sons and parents in rural areas after males get married may partly contribute to the difference between the impact of parental housing wealth for rural males and urban males. Moreover, parental homeownership is not essential for children's marriage outcomes.

To take into account the possibility that the number of siblings is associated with parental housing wealth and individual marriage outcomes, we further explore the effect of parental housing wealth by including the number of siblings in the analysis. The results are presented in Table 3.A6 in the Appendix. Table 3.A6 shows that the number of siblings has a negative effect on the probability of getting married. However, the effect of parental housing wealth does not change much from the main analysis in terms of economic and statistical significance.

In Table 3.A7, we check whether the results are robust to the inclusion of city characteristics. Ideally, we would like to include city fixed effects. However, this is not easy because there are very few observations for some cities in our sample. For example, there is one observation for Shanghai, Jiaxing, and Yancheng in the analysis sample, and only 2 or 3 for many others.

Therefore, we include dummies for first-tier and second-tier cities to capture city characteristics. This is a common method of classifying cities in China (Fang et al., 2016) and is related to cities' economic and social development. The results align with our main findings, confirming that parental housing wealth is positively associated with males' marriage prospects.

Finally, we also examine the role of local sex ratios in the analysis. We calculate the city-level sex ratios (males/females) of children born in 1976-1995 using data from the 2005 China Population Census 1% Sampling Survey. We use the census data to calculate the sex ratio for individuals born between 1976-1995 and the sex ratio for unmarried individuals born between 1976-1995 separately. The results are reported in Table 3.A8. Although we might expect housing wealth to be more important in regions with highly skewed sex ratios, there is no evidence that the effect of parental housing wealth depends on local sex ratios. The explanation for this result might be that in our data there is limited variability in sex ratios as they are all highly skewed.

3.5 Conclusions

In this chapter, we employ the China Health and Retirement Longitudinal Survey (CHARLS) to estimate the effect of parental housing wealth on children's transitions into marriage. We focus on children who were unmarried in 2011 and track their marriage outcomes in 2015.

Our results indicate that parental housing wealth plays a crucial role in children's transitions into marriage. First, an increase in the parental house's value leads to a significant increase in males' probability of getting married. Second, the effect of parental housing wealth varies with the gender and *hukou* status of the children. In particular, housing wealth is important only for males with rural *hukou*. The effect is sizeable as owning high-value houses increases rural men's probability to marry by 10.77 percentage points. This implies that parental housing wealth acts as a signal for rural males in the marriage market. Conditional on other characteristics, high-value houses enhance young males' attractiveness in the marriage market, thus leading to a higher probability of getting married. Third, in contrast to housing wealth, no evidence shows that non-housing wealth affects young people's marriage transitions.

The finding has important policy implications. First, it is in line with the research showing that China's rising sex ratios and the twisted marriage market are likely to contribute to the competition in parental housing wealth, which further leads to an increase in housing prices. In fact, competing in housing wealth may impose financial constraints on young individuals and their parents and depress their consumption of other goods (Wrenn et al., 2019). At the same time, the aggregate number of males getting married is not affected by housing wealth.

These effects combined imply that some of the increases in house costs resulted from the competition are socially inefficient (Wei et al., 2017). Second, in the long run, considering the assortative mating in the marriage market (Sun and Zhang, 2020), competing in owing high-value houses may also contribute to wealth inequality and the intergenerational transmission of this inequality. Therefore, for policy makers, when implementing housing market regulations, it is important to consider the marriage market. Although we focus on the context of China, this chapter could also shed light on other economies, especially other countries with unbalanced sex ratios (e.g., India and Singapore).

While our paper provides evidence that housing wealth is associated with individual marriage transitions, more research needs to be conducted in the future. For instance, the effect of housing wealth on the quality of marriage, instead of only marriage outcomes, is an interesting avenue for future research. To do so, one could investigate the impact of housing wealth on the partner's education level, the intra-household resource allocation, or the subjective well-being within the marriage.

Appendix

Table 3.A1. Heterogeneous effects of parental housing wealth on children's marriage success (using interaction *child gender * parental housing wealth*)

Variables	(1)	(2)	(3)
ln(housing value)$_{t=1}$	-0.0121*		
	(0.0065)		
High-value houses$_{t=1}$		-0.0410	
		(0.0364)	
Homeowner$_{t=1}$	0.1216	0.0326	0.0078
	(0.0776)	(0.0555)	(0.0507)
Child male	-0.2183***	-0.1381**	-0.1381**
	(0.0697)	(0.0664)	(0.0663)
Child male* ln(housing value)$_{t=1}$	0.0281***		
	(0.0082)		
Child male* High-value houses$_{t=1}$		0.1359***	
		(0.0467)	
Child male* Homeowner$_{t=1}$	-0.2601***	-0.0958	-0.0138
	(0.0971)	(0.0748)	(0.0698)
Observation	1,990	1,990	1,990
Controls	Yes	Yes	Yes
Regional fixed effect	Yes	Yes	Yes
Average marginal effects			
ln(housing value) $_{t=1}$	0.0053		
	(0.0043)		
High-value houses $_{t=1}$		0.0435*	
		(0.0229)	
Homeowner $_{t=1}$			-0.0008
			(0.0364)

Note: *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

Table 3.A2. Heterogeneous effects of parental housing wealth on children's marriage success (using interaction *child hukou * parental housing wealth*)

Variables	(1)	(2)	(3)
ln(housing value)$_{t=1}$	-0.0046		
	(0.0077)		
High-value houses$_{t=1}$		0.0013	
		(0.0477)	
Homeowner$_{t=1}$	0.0576	0.0171	0.0184
	(0.0930)	(0.0706)	(0.0639)
Child rural *hukou* $_{t=1}$	-0.0269	0.0162	0.0167
	(0.0788)	(0.0747)	(0.0746)
Child rural *hukou* $_{t=1}$* ln(housing value) $_{t=1}$	0.0168*		
	(0.0092)		
Child rural *hukou* $_{t=1}$* High-value houses $_{t=1}$		0.0538	
		(0.0544)	
Child rural *hukou* $_{t=1}$* Homeowner $_{t=1}$	-0.1799	-0.0605	-0.0293
	(0.1131)	(0.0835)	(0.0767)
Observation	1,990	1,990	1,990
Controls	Yes	Yes	Yes
Regional fixed effect	Yes	Yes	Yes
Average marginal effects			
ln(housing value) $_{t=1}$	0.0082*		
	(0.0042)		
High-value houses $_{t=1}$		0.0424*	
		(0.0229)	
Homeowner $_{t=1}$			-0.0040
			(0.0361)

Note: *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

Table 3.A3. Heterogeneous effects of parental housing wealth on children's marriage success (using interaction *child gender * child hukou * parental housing wealth*)

Variables	(1)	(2)	(3)
ln(housing value)$_{t=1}$	-0.0216*		
	(0.0113)		
High-value houses$_{t=1}$		0.0107	
		(0.0755)	
Homeowner$_{t=1}$	0.1924	-0.0166	-0.0107
	(0.1233)	(0.0995)	(0.0867)
Child male	-0.2241*	-0.1372	-0.1377
	(0.1230)	(0.1093)	(0.1091)
Child rural *hukou* $_{t=1}$	-0.0314	0.0188	0.0187
	(0.1065)	(0.0994)	(0.0994)
Child male* Child rural *hukou* $_{t=1}$	0.0140	-0.0061	-0.0056
	(0.1482)	(0.1362)	(0.1360)
Child male* ln(housing value) $_{t=1}$	0.0276*		
	(0.0143)		
Child male* High-value houses $_{t=1}$		-0.0070	
		(0.0958)	
Child male* Homeowner $_{t=1}$	-0.1997	0.0519	0.0481
	(0.1574)	(0.1326)	(0.1187)
Child rural *hukou* $_{t=1}$* ln(housing value) $_{t=1}$	0.0161		
	(0.0138)		
Child rural *hukou* $_{t=1}$* High-value houses $_{t=1}$		-0.0637	
		(0.0866)	
Child rural *hukou* $_{t=1}$* Homeowner $_{t=1}$	-0.1343	0.0531	0.0168
	(0.1597)	(0.1194)	(0.1062)
Child male* Child rural *hukou* $_{t=1}$* ln(housing value) $_{t=1}$	-0.0013		
	(0.0175)		
Child male* Child rural *hukou* $_{t=1}$* High-value houses $_{t=1}$		0.1785	
		(0.1095)	
Child male* Child rural *hukou* $_{t=1}$* Homeowner $_{t=1}$	-0.0628	-0.1811	-0.0753
	(0.2033)	(0.1614)	(0.1464)
Observation	1,990	1,990	1,990
Controls	Yes	Yes	Yes
Regional fixed effect	Yes	Yes	Yes
Average marginal effects			
ln(housing value) $_{t=1}$	0.0073*		
	(0.0043)		
High-value houses $_{t=1}$		0.0446*	
		(0.0229)	
Homeowner $_{t=1}$			-0.0046
			(0.0364)

Note: *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

Table 3.A4. Parental housing wealth on children's marriage success (OLS) - sample restricted to the children living together with their parents in 2015

Variables	Full sample (1)	Male (2)	Female (3)	Full sample (4)	Male (5)	Female (6)
Panel A: The effects of parental housing value						
ln(housing value) $_{t=1}$	0.0158***	0.0198***	0.0084	0.0203***	0.0266***	-0.0029
	(0.0061)	(0.0075)	(0.0095)	(0.0068)	(0.0086)	(0.0087)
Homeowner $_{t=1}$	-0.1196	-0.1617*	-0.0759	-0.2432***	-0.2433**	-0.0102
	(0.0784)	(0.0938)	(0.1285)	(0.0916)	(0.1054)	(0.1348)
ln(non-housing value) $_{t=1}$				0.0015	0.0008	0.0063
				(0.0030)	(0.0037)	(0.0056)
Panel B: The effects of parental high-value houses						
High-value houses $_{t=1}$	0.0878**	0.1230***	0.0109	0.0858**	0.1128**	-0.0280
	(0.0342)	(0.0417)	(0.0539)	(0.0359)	(0.0450)	(0.0597)
Homeowner $_{t=1}$	-0.0245	-0.0656	0.0087	-0.1026	-0.0821	-0.0244
	(0.0552)	(0.0723)	(0.0775)	(0.0626)	(0.0822)	(0.1005)
ln(non-housing value) $_{t=1}$				0.0014	0.0008	0.0064
				(0.0029)	(0.0037)	(0.0056)
Panel C: The effects of parental homeownership						
Homeowner $_{t=1}$	0.0304	0.0107	0.0156	-0.0467	-0.0091	-0.0433
	(0.0511)	(0.0678)	(0.0691)	(0.0578)	(0.0764)	(0.0934)
ln(non-housing value) $_{t=1}$				0.0016	0.0010	0.0062
				(0.0097)	(0.0120)	(0.0189)
Observations	913	647	266	788	561	227
Controls	No	No	No	Yes	Yes	Yes
Regional fixed effect	No	No	No	Yes	Yes	Yes

Note: 1. *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.
2. Other controls are the same as in Table 3.3.

Table 3.A5. Parental housing wealth on children's marriage success, by *hukou* status (OLS) -sample restricted to the children living together with their parents in 2015

Variables	Rural sample		Urban sample	
	Rural male	Rural female	Urban male	Urban female
	(1)	(2)	(3)	(4)
Panel A: The effects of parental housing value				
ln(housing value) $_{t=1}$	0.0197*	-0.0168*	0.0425**	0.0014
	(0.0105)	(0.0100)	(0.0164)	(0.0294)
Homeowner $_{t=1}$	-0.0922	0.0489	-0.5900***	0.1341
	(0.1349)	(0.1757)	(0.1799)	(0.4498)
ln(non-housing value) $_{t=1}$	-0.0005	0.0107*	0.0084	-0.0029
	(0.0042)	(0.0060)	(0.0118)	(0.0245)
Panel B: The effects of parental high-value houses				
High-value houses $_{t=1}$	0.1363***	-0.1021	-0.0190	0.0913
	(0.0495)	(0.0747)	(0.1318)	(0.1415)
Homeowner $_{t=1}$	-0.0038	-0.0706	-0.2442	0.0947
	(0.1001)	(0.1441)	(0.1807)	(0.2632)
ln(non-housing value) $_{t=1}$	-0.0005	0.0109*	0.0108	-0.0029
	(0.0041)	(0.0062)	(0.0123)	(0.0236)
Panel C: The effects of parental homeownership				
Homeowner $_{t=1}$	0.0871	-0.1322	-0.2535	0.1513
	(0.0936)	(0.1324)	(0.1624)	(0.2250)
ln(non-housing value) $_{t=1}$	-0.0005	0.0098	0.0106	-0.0026
	(0.0042)	(0.0061)	(0.0124)	(0.0230)
Observations	457	164	104	63
Controls	Yes	Yes	Yes	Yes
Regional fixed effect	Yes	Yes	Yes	Yes

Note: 1. *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.
2. Other controls are the same as in Table 3.4.

Table 3.A6. Parental housing wealth on children's marriage success (OLS), controlling for the number of siblings

Variables	Full sample	Male	Female
	(1)	(2)	(3)
Panel A: The effects of parental housing value			
ln(housing value) $_{t=1}$	0.0065	0.0135**	-0.0083
	(0.0042)	(0.0055)	(0.0063)
Number of Siblings $_{t=1}$	-0.0704***	-0.0887***	-0.0505*
	(0.0182)	(0.0256)	(0.0258)
Panel B: The effects of parental high-value houses			
High-value houses $_{t=1}$	0.0498**	0.0956***	-0.0363
	(0.0229)	(0.0292)	(0.0366)
Number of Siblings $_{t=1}$	-0.0728***	-0.0932***	-0.0489*
	(0.0183)	(0.0256)	(0.0260)
Panel C: The effects of parental homeownership			
Homeowner $_{t=1}$	0.0006	-0.0012	-0.0083
	(0.0351)	(0.0492)	(0.0502)
Number of Siblings $_{t=1}$	-0.0700***	-0.0901***	-0.0520**
	(0.0182)	(0.0257)	(0.0259)
Observations	1,990	1,238	752
Controls	Yes	Yes	Yes
Regional fixed effect	Yes	Yes	Yes

Note: *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

Table 3.A7. Parental housing wealth on children's marriage success (OLS), including dummies for first-tier and second-tier cities

Variables	Full sample	Male	Female
	(1)	(2)	(3)
Panel A: The effects of parental housing value			
ln(housing value) $_{t=1}$	0.0065	0.0138**	-0.0089
	(0.0043)	(0.0055)	(0.0062)
Homeowner $_{t=1}$	-0.0579	-0.1188*	0.0794
	(0.0534)	(0.0673)	(0.0743)
First tier city	0.0497	-0.1035	0.4402***
	(0.0863)	(0.1078)	(0.1607)
Second tier city	0.0025	0.0323	-0.0377
	(0.0382)	(0.0514)	(0.0565)
Panel B: The effects of parental high-value houses			
High-value houses $_{t=1}$	0.0437*	0.0906***	-0.0513
	(0.0229)	(0.0296)	(0.0364)
Homeowner $_{t=1}$	-0.0275	-0.0597	0.0273
	(0.0386)	(0.0519)	(0.0550)
First tier city	0.0387	-0.1249	0.4556***
	(0.0877)	(0.1122)	(0.1611)
Second tier city	0.0041	0.0296	-0.0459
	(0.0380)	(0.0508)	(0.0573)
Panel C: The effects of parental homeownership			
Homeowner $_{t=1}$	-0.0009	-0.0043	-0.0038
	(0.0358)	(0.0489)	(0.0505)
First tier city	0.0410	-0.1268	0.4427***
	(0.0878)	(0.1112)	(0.1638)
Second tier city	0.0028	0.0313	-0.0402
	(0.0381)	(0.0511)	(0.0567)
Observations	1,990	1,238	752
Controls	Yes	Yes	Yes
Regional fixed effect	Yes	Yes	Yes

Note: 1. *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

Table 3.A8. Parental housing wealth on children's marriage success, including local sex ratios

Variables	Regional sex ratio of all individuals born in 1976-1995			Regional sex ratio of unmarried individuals born in 1976-1995		
	Full sample	Male	Female	Full sample	Male	Female
Panel A: The effects of parental housing value						
ln(housing value)$_{t=1}$	-0.0126	-0.0213	-0.0106	-0.0036	-0.0067	-0.0032
	(0.0345)	(0.0493)	(0.0522)	(0.0276)	(0.0400)	(0.0430)
Sex ratio	0.0037	-0.2475	0.2407	-0.0312	-0.1992	0.1511
	(0.4103)	(0.5931)	(0.5931)	(0.2821)	(0.4166)	(0.4092)
Sex ratio * ln(housing value) $_{t=1}$	0.0193	0.0365	0.0015	0.0088	0.0186	-0.0053
	(0.0354)	(0.0509)	(0.0528)	(0.0247)	(0.0359)	(0.0377)
Average marginal effects of ln(housing value)$_{t=1}$						
	0.0062	0.0144***	-0.0091	0.0063	0.0142**	-0.0091
	(0.0043)	(0.0055)	(0.0063)	(0.0043)	(0.0055)	(0.0063)
Panel B: The effects of parental high-value houses						
High-value houses$_{t=1}$	-0.1040	-0.2742	0.2491	0.1842	-0.0212	0.5583
	(0.2793)	(0.3601)	(0.4649)	(0.2263)	(0.2942)	(0.3713)
Sex ratio	0.1434	-0.0138	0.4053	0.1417	-0.0278	0.3833
	(0.2357)	(0.3002)	(0.3814)	(0.1718)	(0.2255)	(0.2696)
Sex ratio * High-value houses$_{t=1}$	0.1515	0.3748	-0.2991	-0.1249	0.1004	-0.5344
	(0.2857)	(0.3673)	(0.4762)	(0.2006)	(0.2608)	(0.3287)
Average marginal effects of High-value houses$_{t=1}$						
	0.0438*	0.0916***	-0.0429	0.0439*	0.0914***	-0.0425
	(0.0229)	(0.0295)	(0.0362)	(0.0229)	(0.0295)	(0.0362)
Panel C: The effects of parental homeownership						
Homeowner$_{t=1}$	-0.3575	-0.2885	-0.2361	-0.1635	-0.0665	-0.1587
	(0.4506)	(0.6623)	(0.6532)	(0.3490)	(0.4860)	(0.5597)
Sex ratio	-0.1054	-0.0894	0.0465	-0.0617	-0.0368	-0.0227
	(0.4507)	(0.6725)	(0.6282)	(0.2995)	(0.4326)	(0.4512)
Sex ratio * High-value houses$_{t=1}$	0.3644	0.2946	0.2283	0.1460	0.0602	0.1319
	(0.4620)	(0.6807)	(0.6624)	(0.3119)	(0.4382)	(0.4912)
Average marginal effects of Homeowner$_{t=1}$						
	-0.0019	-0.0010	-0.0133	0.0005	0.0010	-0.0105
	(0.0361)	(0.0499)	(0.0505)	(0.0361)	(0.0502)	(0.0490)
Observation	1,990	1,238	752	1,990	1,238	752
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Regional fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Note: 1. *p<0.1, ** p<0.05, ***p<0.01. Standard errors, clustered at the household level, are shown in parentheses.

2. We calculate *Sex ratio* at the city level using the 2005 China Population Census 1% Sampling Survey data. To obtain the local sex ratio, we use the number of males divided by the number of females in the city.

Chapter 4

4. Parental Bereavement and Health: Evidence from China[26]

4.1 Introduction

Adverse life events play an important role in explaining the wellbeing of older individuals. The death of a child, among all adverse life events, has a considerable long-term impact on parents' physical (Rogers et al., 2008) and mental health (Li et al., 2005; Galatzer-Levy and Bonanno, 2012), and on their socioeconomic status (Bucciol and Zarri, 2015; Van den Berg et al., 2017). Losing a child affects parental wellbeing by increasing emotional grief and decreasing emotional support. In China, the adverse effect of losing a child on parents can be even more severe. Due to social customs and the lack of a developed social security system, in China children are still the primary source of support for older individuals (Oliveira, 2016). Therefore, in addition to increasing emotional grief and reducing emotional support, the death of a child also reduces the financial and functional support for parents, which further deteriorates their wellbeing.

In this chapter, we examine the long-term effect of losing a child on parental health at older ages, using data from the 2011 and 2013 waves of the China Health and Retirement Longitudinal Survey (CHARLS hereinafter). The survey is particularly suitable for this chapter because it focuses on individuals aged 45 and over, meaning that the respondents have a larger chance of experiencing the death of a child. At the same time, compared to younger generations, current middle-aged and older parents in CHARLS are more likely to rely on financial support from their children when they retire. Therefore, the loss of a child could reduce the support they receive and further deteriorate their wellbeing.

We study a variety of parental health outcomes: subjective survival expectations, depression symptoms, self-rated health status, and subjective wellbeing. Child death might not be exogenous as there might be confounders that affect both child death and parental health, such as the family health endowment and resources. To deal with this issue, we rely on the richness of the retrospective information available in CHARLS to control for a large set of predetermined characteristics of the parents, including their education, *hukou* at birth, whether they suffered from poor health in childhood and whether they come from a family in which the mother and/or the father were illiterate. We also study the heterogeneity of the effect by gender

[26] This chapter is based on Gao et al. (2021).

of the parent and of the child. Due to a traditional son preference in China, for mothers having a son means that they will receive more respect in the family and have a greater role in household decision-making, increasing their bargaining power (Li and Wu, 2011; Fan et al., 2018). Therefore, we expect a stronger impact on mothers of losing a son rather than a daughter.

We find that having a child who died has an adverse impact on parental health. Compared to parents who never experienced the death of a child, bereaved parents are more pessimistic about their survival expectations, have more depression symptoms and lower subjective wellbeing, and have a higher probability of reporting being in poor health. We do not find significant differences between the impact of losing a child on maternal health outcomes and paternal health conditions. However, the gender of the deceased child plays a crucial role in explaining parental health consequences. In particular, mothers are more likely to be affected by the death of a son than by the death of a daughter, as regards depression symptoms and self-assessed health.

In the remainder of the chapter, we review relevant literature in Section 4.2. Section 4.3 discusses the data and empirical strategy. Section 4.4 shows the main results, and Section 4.5 offers conclusions.

4.2 Relevant Literature

The health consequences of parental bereavement are not yet fully known in the extant literature. Our paper relates to two streams of literature: 1) health consequences of parental bereavement, 2) subjective survival beliefs. A strong association has been found between the death of a child and parental health conditions in many countries. For example, Roger et al. (2008) investigate the long-term impact of a child's death on parents using data from 1957, 1975, and 1992 waves of Wisconsin Longitudinal Study (WLS hereinafter). They choose parents who lost a child between 1957 and 1992 as the treatment group. They choose the control group by matching the gender and family background of the respondents in the 1957 survey with the treatment group. They show that bereaved parents are more likely to have poor mental health conditions, poor wellbeing, and marital disruption in 1992 compared to non-bereaved parents. Similarly, Song et al. (2010) use the 2004 wave of WLS and find that losing a child hurts parental health conditions. Besides, it is also observed that the death of a child also increases the mortality risk for parents. Rostila et al. (2012) find that child's death is linked with elevated mortality risks for parents in Sweden. Song et al. (2019) use the Midlife in the United States (MIDUS) data and find that compared to non-bereaved parents, bereaved parents have higher risks of dying earlier than their objective life expectancies. Using registry data for

the entire Swedish population from 1993 to 2003, van den Berg et al. (2017) study the effect of losing a child on labour income up to 6 years after the event, and look also at health as a potential mechanism. They show that losing a child results in worse mental health, which further affects labour market outcomes. Thanks to the richness of the data, which includes information on the cause of death, they can focus on unanticipated deaths. As they are interested in labour income, their sample is composed of younger parents, aged 20 to 55.

Several studies show that the impact of the death of a child on parental health status is heterogeneous by the gender of bereaved parents and deceased children. Li et al. (2005) find that in Denmark, bereaved parents have higher risks of psychiatric hospitalization than non-bereaved parents. They also find that mothers are more likely to be negatively affected by the death of a child than fathers. Lee et al. (2014) use 1999, 2003, and 2007 waves of Taiwanese Longitudinal Study of Aging (TLSA). By examining the impact of losing a child between waves on the parental health outcomes in the next wave, they show that losing a child is associated with adverse outcomes for parental depressive symptoms and self-rated health. In particular, they find that mothers are more likely to be negatively affected by the death of a child than fathers. They also show that compared to a daughter's death, a son's death has a more considerable impact on parents. Espinosa and Evans (2013) use the National Longitudinal Mortality Survey and examine the effect of losing a child on maternal mortality. By comparing bereaved mothers with a child who died and non-bereaved parents, they argue that losing a child leads to an increase in mortality for bereaved mothers.

The mechanisms of the health consequences of parental bereavement are not completely known. Li et al. (2005) point out that the acute phase following the death of a child results in emotional distress and the psychophysical burden of bereaved parents. In the long run, the child's death affects parents' sleeping, drinking behaviour, eating behaviour, and physical activity (Vance et al., 1994; Roger et al., 2008). Beyond the literature on parental bereavement, other related studies may provide some explanations. First, the studies on the widowhood effect (Nystedt, 2006; Stroebe et al., 2005; Van den Berg et al., 2011; Buckley et al., 2010; Möller et al., 2011; Siflinger, 2017) highlight that losing a spouse affects individual health status through a mental pathway, such as shock, emotional stress, anxiety, and despair. In the long run, losing a spouse also influences smoking behaviour, drinking behaviour, and social and financial supports, which hurts the health status of the survivors. Second, a set of studies concentrate on the health consequences of children's migration or emigration for parents (Guo et al., 2009; Böhme et al., 2015; Yi et al., 2019; Scheffel and Zhang, 2019). They show two opposite effects of children's migration on parents. On the one hand, as parents typically receive better financial

support from the children who are migrated, children's migration improves parental wellbeing. On the other hand, children's migration negatively affects parental health status due to a reduction in functional supports from children and a sense of psycho-social isolation of parents. Although having a child who migrated and having a child who died are not compared with each other, we argue that losing a child may affect parents' health status similarly. That is, the death of a child may lead to adverse health outcomes for parents due to a reduction in support and an increase in emotional stress.

In recent years, a stream of literature has investigated the impact of losing a child on parental health status in China. Using a nationally representative sample, Ren and Ye (2017) link a child's death to poor parental mental health. They employ the 2011 wave of CHARLS to compare the mental health status of bereaved parents and the parents who have at least one biological child and all children are still alive. They show that losing a child, particularly if losing all children, has a negative impact on parental mental health. Besides, they show that gender of the parent and age at which the child died do not play a role. In addition to focusing only on mental health, the causal inference of the study is limited by the presence of omitted variables that potentially affect both child death and parental health. Lei et al. (2014) also use the 2011 wave of the CHARLS data to study the effect of a recent death of a spouse or a child on depression. They show that having a child who died in the past two years is associated with severe depressive symptoms, but the effect is only significant for females.

The studies by Ren and Ye (2017) and Lei et al. (2014) do not distinguish between the impact of losing a son and a daughter. This distinction is essential in China because sons and daughters may affect their parents differently. On the one hand, affected by traditional son preference in China, parents typically prefer sons than daughters, and they regard their sons as the primary caregiver. For mothers, having a son usually means receiving more respect in the family and having a greater role in household decision-making. For example, Li and Wu (2011) find that if the first-born child is a son, the mother's relatively bargaining position within the family (e.g., the decision on major household consumption) and mother's calorie and protein intakes will be improved. Similarly, Fan et al. (2018) show that the presence of sons negatively affects maternal time on household chores. Using survey data collected in 2013 in Xi'an city, Wei et al. (2016) compare the wellbeing of parents who lost their only one child (*shidu fumu* hereinafter) and non-bereaved parents who live in the same communities as the *shidu fumu*. They find that *shidu fumu* tend to report worse health status and economic wellbeing than non-bereaved parents. Importantly, compared to losing their only daughter, losing their only son has a larger negative impact on parental wellbeing. However, they only use data from one city,

and their study is mostly correlational as they control for a limited set of contemporaneous variables.

The second stream of literature relates to subjective survival beliefs. Subjective survival expectations are important in determining individual economic decisions about retirement, investment, and savings (Puri and Robinson, 2007). According to Hurd and McGarry (1995), subjective survival expectations are consistent with objective survival probabilities. However, recent evidence shows that subjective survival expectations can be affected by factors such as age, gender, health, income, and psychological factors (Peracchi and Perotti, 2014; Grevenbrock et al., 2021). As losing a child is associated with parents' deteriorated health and psychological disorders, we would expect that a child's death affects parental survival expectations. Nevertheless, no evidence shows that parental bereavement would influence parental subjective survival beliefs.

In sum, the previous studies on the consequences of parental bereavement in China have several limitations, including using a non-representative sample (Wei et al., 2016) and only studying parental mental health consequences (Ren and Ye, 2017; Lei et al., 2014). Besides, a common limitation is that they use parental characteristics that are very likely to be affected by the death of a child, such as the current marital status, income, and the number of children that are still alive. Thus, the interpretation of their found impacts tends to be affected by endogeneity issues.

4.3 Data and Model

4.3.1 Data and Sample

In this chapter, we employ data from the first two waves of the China Health and Retirement Longitudinal Survey (CHARLS), which is a household survey administrated by the National School of Development at Peking University. CHARLS focuses on a nationally representative sample of people aged 45 and over. It contains detailed information on family background characteristics, health status and function, health care and insurance, work, income and consumption of the respondents, and wealth at the household level. CHARLS conducted the national-level baseline survey in 2011 and follow-up surveys in 2013 and 2015. The sample covers 450 communities or villages from 28 provinces (including autonomous regions and municipalities).

We construct the sample as follows. First, we pool the 2011 and 2013 waves. To avoid overlaps of observations across waves, we restrict the sample to those respondents who report information on their biological children for the first time. For example, if the respondents report

information on their biological children in the 2011 survey, we keep their responses in the 2011 survey regardless of whether they report information on their biological children in the 2013 survey.[27] The sample includes 20,613 observations in total, including 17,570 observations from the 2011 survey and 3,043 from the 2013 survey. Second, we exclude from the sample parents who fail to report whether they have at least one biological child and whether they have a biological child who died in the 2011 and 2013 waves. This gives a sample of 19,988 parents. Finally, we keep the parents who report having had at least one biological child and obtain a sample of 19,889 parents as having no biological child may also influence individual health conditions.

We drop some observations in our sample because they have substantial missing values in important variables, such as the gender of their deceased children (64 cases), survival expectation (4,163 cases), self-rated health status (7 cases), mental health status (495 cases), subjective wellbeing (1,270 cases), and demographic characteristics (1,753 cases). Overall, the final analytical sample consists of 12,138 parents from the 2011 and 2013 waves. The data set has information on parental subjective survival expectations, health status, subjective wellbeing, demographic characteristics, and information on their deceased children.

4.3.2 Variable Construction

Our health outcomes include subjective survival expectations, depression symptoms, poor health, and subjective wellbeing. The first outcome variable, i.e., subjective survival expectation, captures the respondent's subjective expectations of living to a certain target age, which is chosen conditional on the age of the respondent in the survey year. Respondents rate their subjective survival chances from 1 (almost impossible) to 2 (not very likely), to 3 (maybe), to 4 (very likely), and to 5 (almost certain). The lower the subjective survival expectation category is, the more pessimistic the respondents are about their chances of living to the target age. Factors that could affect subjective survival expectations include age, gender, health status, and income.

The second outcome variable is depression symptoms. Similar to Lei et al. (2014), we obtain the depression symptoms score from the 10-item Center for the Epidemiological Studies of Depression (CESD-10) questionnaire in CHARLS. The CESD-10 score is an indicator of depressive symptoms, and the score is obtained from 10 questions regarding how the

[27] 250 households report information on their deceased biological children inconsistently in the sample. They report having no deceased biological child in the 2011 wave but report having biological children passed away before 2011 in the 2013 wave. For those 250 households, we use the information on their deceased children in the 2013 wave to impute the information in the 2011 wave and only keep the 2011 observations in the sample.

respondents felt during the past week. The questions are measured on a four-point scale, ranging from none of the time (less than 1 day) to some or a little of the time (1-2 days), to occasionally (3-4 days), and to most of the time (5-7 days). In the CHARLS survey, respondents were asked 8 questions on their negative feeling, such as "I felt depressed". The values of these questions range from 0 (rarely) to 3 (most of the time). Besides, there are two questions on their positive feelings during the past week, including "I felt happy" and "I felt hopeful about the future". For these two questions, we reverse the values from 0 (most of the time) to 3 (none of the time). Based on the responses to these 10 questions, we obtain a CESD-10 score, ranging from 0 to 30. A higher CESD-10 score is associated with higher levels of depression symptoms, and a CESD-10 score of 10 or above is regarded as an indicator of depression symptoms (Singhal, 2018).

The third one is a poor health dummy, indicating whether respondents rate their health conditions as poor or very poor. In the CHARLS survey, all respondents were asked to assess their health status from very good to good, to fair, to poor, and to very poor. If the respondents report being in poor or very poor health, the health indicator of poor health equals 1.

The last outcome variable is subjective wellbeing, which is measured according to whether the respondents are satisfied with their life in general. There are five response options for subjective wellbeings: 1 (not at all satisfied), 2 (not very satisfied), 3 (somewhat satisfied), 4 (very satisfied), and 5 (completely satisfied).

Our primary explanatory variable is a child death dummy. It takes the value one if respondents report that they have at least one biological child who passed away. To examine the heterogeneous effect of losing a child, we also introduce several other explanatory variables, including the gender of the deceased biological children, the duration since the biological child passed away, the number of deceased biological children in the household, and the age at which the biological child died.

As to the control variables, we select parental characteristics that may affect their late-life health conditions. In principle, we try to limit the covariates to characteristics that are predetermined to avoid endogeneity. Therefore, we introduce demographic information, including age, gender, *hukou* at birth, and education level (Lindeboom et al., 2002; Lei et al., 2014; Lee et al., 2014; Tseng et al., 2017). Because previous studies find that childhood background plays a role in late-life health status (Huang et al., 2013), we follow Huang et al. (2013) and add the education level of respondents' parents as childhood background characteristics in the analysis. Moreover, the extant evidence suggests that childhood health is linked to the health status of older individuals (Huang et al., 2013; Lei et al., 2014; Song et al.,

2019). We thus also introduce a childhood health poor dummy, which is derived from a retrospective question on self-rated health status before age 16. The dummy equals one if the respondents report being in poor health before age 16, and zero if the respondents report excellent, very good, good, or fair health status before age 16.

4.3.3 Summary Statistics

Table 4.1 shows the summary statistics of deceased children in our sample, including 1,142 deceased children in the 2011 and 2013 surveys. The average year of birth of deceased children is 1971. More than half of the deceased children passed away in the past 25 years, and the average year of death is 1986. The average age at which they died is around 14.4. Approximately 28.8% of the children died at 0 years old, and 13.7% died above 35 years old. Specifically, more than half of the children passed away between 0 and 16 years old. This is an important period for the physical, health, and cognitive development of children. Besides, deceased male children account for 57.6% of the whole sample.

Table 4.1. Descriptive statistics of deceased children

Variables	Mean	s.d.	Min	Max	p25	Median	p75	N
Wave 1and Wave 2 (N=1,142) [2]								
Year of birth [3]	1971	11.60	1935	2010	1964	1971	1980	944
Year of death [4]	1986	15.96	1945	2013	1973	1987	2000	951
Age at the time of death [5]	14.40	16.23	0	67	0	6	27	923
At the time of death: aged at 0 [6]	0.288	0.453	0	1	0	0	1	923
At the time of death: aged between 0 and 16	0.309	0.462	0	1	0	0	1	923
At the time of death: aged between 17and 35	0.267	0.442	0	1	0	0	1	923
At the time of death: aged above 35	0.137	0.344	0	1	0	0	0	923
Male [7]	0.576	0.494	0	1	0	1	1	1,139

Note: 1. N is the full sample observations in wave 1 and wave 2.

2. *Year of birth* refers to the year of birth of the deceased children.

3. *Year of death* refers to the year at which the children passed away.

4. *Age at the time of death* indicates the age that the children passed away.

5. *At the time of death: aged at 0* is a dummy variable indicating that the children are aged at 0 when they passed away.

6. *Male* equals 1 if the deceased children are male.

Table 4.2 summarizes the characteristics of parents who have at least one biological child, including 10,673 respondents from the 2011 survey and 1,465 from the 2013 wave. According to whether the respondents lost at least one biological child, our sample is divided into a control group and a treatment group. The control group refers to the parents whose biological children are all alive. The treatment group includes bereaved parents who lost at least one biological

child. The vast majority of the sample has no child's death experience, and around 10% of the respondents in the sample lost at least one biological child.

For bereaved parents, the average number of children who died is 1.26 for fathers and 1.30 for mothers. Approximately 13% of them have a biological child who died in the past 5 years. The average age at which bereaved parents lost their child for the first time is 41.27 for males and 40.19 for females. More than half of the parents lost their children before age 50.

Bereaved parents are different from non-bereaved parents in several aspects. First, the average age of bereaved parents is 65 years old, which is higher than that of non-bereaved parents. Second, compared to non-bereaved parents, the chance of being married is relatively lower for bereaved parents, which may reflect the adverse impact of losing a child on marital status (Van den Berg et al., 2017). Third, for socioeconomic factors, bereaved parents tend to have lower educational attainments and a rural *hukou* at birth. Finally, in terms of childhood background, bereaved parents are more likely than non-bereaved parents to report being in poor health before age 16.

Table 4.2. Descriptive statistics of parents[1]

Variables	Child & no loss (Control group)					Child & loss (Treatment group)				
	Mean	s.d.	Min	Max	N	Mean	s.d.	Min	Max	N
Panel A: Males										
Number of deceased children	-	-	-	-	-	1.255	0.614	1	5	568
Child deceased within 5 years [2]	-	-	-	-	-	0.137	0.345	0	1	495
Current age	58.11	9.290	34	90	5,293	65.02	10.13	39	91	568
Aged under 65 [3]	0.766	0.424	0	1	5,293	0.467	0.499	0	1	568
Aged between 65 and 69	0.106	0.308	0	1	5,293	0.187	0.390	0	1	568
Aged above 70 and 74	0.072	0.258	0	1	5,293	0.164	0.370	0	1	568
Aged between 75 and 79	0.040	0.195	0	1	5,293	0.109	0.312	0	1	568
Aged above 80	0.017	0.131	0	1	5,293	0.074	0.262	0	1	568
Age of parent when the first child died	-	-	-	-	-	41.27	16.50	17	85	498
Aged under 30	-	-	-	-	-	0.369	0.483	0	1	498
Aged between 30 and 50	-	-	-	-	-	0.315	0.465	0	1	498
Aged between 50 and 70	-	-	-	-	-	0.249	0.433	0	1	498
Aged above 70	-	-	-	-	-	0.066	0.249	0	1	498
Education level										
Illiterate	0.099	0.299	0	1	5,293	0.171	0.377	0	1	568
Low education	0.414	0.493	0	1	5,293	0.590	0.492	0	1	568
Middle education	0.437	0.496	0	1	5,293	0.224	0.417	0	1	568
High education	0.049	0.217	0	1	5,293	0.016	0.125	0	1	568
Rural *hukou* at birth	0.848	0.359	0	1	5,293	0.924	0.265	0	1	568
Childhood health poor	0.055	0.227	0	1	5,293	0.086	0.281	0	1	568
Ethnic minority	0.065	0.246	0	1	4,697	0.118	0.323	0	1	517
Homeowner	0.835	0.371	0	1	5,261	0.794	0.405	0	1	562

Married	0.932	0.251	0	1	5,293	0.887	0.316	0	1	568
Retired	0.233	0.423	0	1	5,271	0.278	0.448	0	1	568
Father illiterate	0.588	0.492	0	1	5,293	0.662	0.473	0	1	568
Mother illiterate	0.865	0.342	0	1	5,293	0.951	0.217	0	1	568
Panel B: Females										
Number of deceased children	-	-	-	-	-	1.299	0.702	1	5	665
Child deceased within 5 years	-	-	-	-	-	0.125	0.331	0	1	594
Current age	55.99	9.460	16	100	5,612	64.39	10.95	32	95	665
Aged under 65	0.817	0.387	0	1	5,612	0.483	0.500	0	1	665
Aged between 65 and 69	0.088	0.284	0	1	5,612	0.186	0.390	0	1	665
Aged above 70 and 74	0.052	0.222	0	1	5,612	0.132	0.339	0	1	665
Aged between 75 and 79	0.028	0.164	0	1	5,612	0.119	0.324	0	1	665
Aged above 80	0.015	0.121	0	1	5,612	0.080	0.271	0	1	665
Age of parent when the first child died	-	-	-	-	-	40.19	17.34	16	91	598
Aged under 30	-	-	-	-	-	0.416	0.493	0	1	598
Aged between 30 and 50	-	-	-	-	-	0.293	0.455	0	1	598
Aged between 50 and 70	-	-	-	-	-	0.234	0.424	0	1	598
Aged above 70	-	-	-	-	-	0.057	0.232	0	1	598
Education level										
Illiterate	0.323	0.468	0	1	5,612	0.570	0.495	0	1	665
Low education	0.366	0.482	0	1	5,612	0.316	0.465	0	1	665
Middle education	0.289	0.453	0	1	5,612	0.111	0.315	0	1	665
High education	0.022	0.145	0	1	5,612	0.003	0.055	0	1	665
Rural *hukou* at birth [4]	0.850	0.357	0	1	5,612	0.911	0.285	0	1	665
Childhood health poor	0.070	0.255	0	1	5,612	0.083	0.276	0	1	665
Ethnic minority	0.082	0.275	0	1	4,994	0.133	0.340	0	1	608
Homeowner	0.821	0.383	0	1	5,569	0.745	0.436	0	1	662
Married [6]	0.883	0.322	0	1	5,612	0.717	0.451	0	1	665
Retired	0.322	0.467	0	1	5,594	0.388	0.488	0	1	662
Father illiterate	0.587	0.492	0	1	5,612	0.734	0.442	0	1	665
Mother illiterate	0.853	0.354	0	1	5,612	0.944	0.229	0	1	665

Note: 1. This table summarizes the information of all parents in our sample.

2. *Child death within 5 years* is a dummy variable indicating whether the parents have experienced loss of child within 5 years.

3. *Current age* is the age at which the respondents are being interviewed. *At the time of first child death* is the age at which the respondents experienced loss of the child for the first time. *At the time of first child death: aged under 30* is a dummy variable indicating that the respondents are aged under 30 when they experienced loss of children for the first time.

4. *Rural hukou* is a dummy indicating that the respondents have a rural *hukou* at birth.

5. *Illiterate* is a dummy variable indicating that the respondent has no formal education. *Low education* is a dummy variable indicating that the respondent belongs to low-education level. *Low education* equals 1 if they report their education level is less than lower secondary; *Middle education* equals 1 if they report high school or vocational school; *High education* equals 1 if they report above two/three-year college.

6. *Married* equals 1 if the parents are married in the year they are interviewed.

Tables 4.3-4.5 show the health conditions of non-bereaved parents and bereaved parents, respectively. Table 4.3 shows that compared to non-bereaved parents, bereaved parents in the treatment group seem to have significantly poorer mental health and self-rated health status. For example, approximately 23% of non-bereaved parents report being in poor health for self-rated health status, whereas 32.8% of bereaved parents report being in poor health.

Table 4.3. Mental health and self-reported poor health

	Child & no loss (Control group)			Child & loss (Treatment group)			The difference
	Mean	s.d.	N	Mean	s.d.	N	
Panel A. Full sample							
Mental health	7.848	6.144	10,905	10.09	6.709	1,233	-2.24***
Poor health	0.230	0.421	10,905	0.328	0.470	1,233	-0.10***
Panel B. Male							
Mental health	6.884	5.627	5,293	9.202	6.328	568	-2.32***
Poor health	0.206	0.404	5,293	0.306	0.461	568	-0.10***
Panel C. Female							
Mental health	8.757	6.465	5,612	10.85	6.934	665	-2.09***
Poor health	0.252	0.434	5,612	0.347	0.476	665	-0.10***

Note: 1. *Mental health* is measured using the 10-item Center for the Epidemiological Studies of Depression short form (CES-D-10). We calculate the total individual score of the 10 questions asked in the CHARLS survey (Dc009- Dc018), and the score ranges from 0 to 30. A higher score increases the mental health problem.

2. *Poor health* is a dummy variable constructed based on two self-report health questions, they are Da002) and Da079) How would you rate your health status? Would you say your health is very good, good, fair, poor or very poor? These two questions are identical, Da002) was asked at the beginning of the health status and functioning section and Da079) was asked at the end of the section. Respondents were assigned randomly to answer these two questions. We define respondents have poor health if they report their health is poor or very poor.

3. There are two groups of parents: the first group includes those who have at least one biological child, and all biological children are alive, and we define this group as Child & no loss (Control group). The second group includes those parents who lost at least one biological child, and we define them as group Child & loss (Treatment group).

4. The difference is the mean differences between the control groups (Child & no loss) and the treatment groups (Child & loss).

Table 4.4 the subjective survival expectations for the sample of parents as a whole and by whether parents have experienced the death of a child. It suggests that the death of a child is associated with lower parental survival expectations. About 26.77% of non-bereaved parents feel almost impossible or not very likely to live to the target age, while 40.47% of bereaved parents feel almost impossible or not very likely to live to a certain age. In contrast, 37.24% of non-bereaved parents are optimistic about their survival chances, while only 24.82% of bereaved parents have optimistic survival expectations. The difference between bereaved parents and non-bereaved parents, however, could be explained by the fact that non-bereaved

parents are on average younger than bereaved parents in our sample. For the subjective wellbeing, it seems that there is no significant difference between bereaved parents and non-bereaved parents, as shown in Table 4.5.

Table 4.4. Subjective survival expectations

	Child & no loss (Control group)	Child & loss (Treatment group)	*p*-value
	(%)	(%)	
Panel A. Full sample			0.000
Almost impossible	8.02	13.06	
Not very likely	18.75	27.41	
Maybe	35.98	34.71	
Very likely	17.45	11.68	
Almost certain	19.79	13.14	
Panel B. Male			0.000
Almost impossible	7.94	13.03	
Not very likely	16.46	25.35	
Maybe	35.03	35.04	
Very likely	18.59	12.15	
Almost certain	21.99	14.44	
Panel C. Female			0.000
Almost impossible	8.11	13.08	
Not very likely	20.92	29.17	
Maybe	36.89	34.44	
Very likely	16.38	11.28	
Almost certain	17.71	12.03	

Note: We obtain subjective survival expectations from question Da081. The respondents were asked to rate their survival chances to target ages from 1 (almost impossible) to 5 (almost certain). We also report the *p*-value for the hypothesis that subjective wellbeing and having a child who died are independent.

Table 4.5. Subjective wellbeing

	Child & no loss (Control group)	Child & loss (Treatment group)	*p*-value
	%	%	
Panel A. Full sample			0.030
Not at all satisfied	2.28	2.76	
Not very satisfied	12.32	15.00	
Somewhat satisfied	62.61	58.64	
Very satisfied	20.61	21.17	
Completely satisfied	2.17	2.43	
Panel B. Male			0.171
Not at all satisfied	1.78	2.82	
Not very satisfied	11.79	14.26	
Somewhat satisfied	63.80	61.44	
Very satisfied	20.40	19.19	
Completely satisfied	2.23	2.29	
Panel C. Female			0.092
Not at all satisfied	2.76	2.71	
Not very satisfied	12.83	15.64	
Somewhat satisfied	61.49	56.24	
Very satisfied	20.79	22.86	
Completely satisfied	2.12	2.56	

Note: We calculate the subjective wellbeing based on the question Dc028) Please think about your current life. How satisfied are you with it? Are you not at all satisfied, not very satisfied, very satisfied, somewhat satisfied, or completely satisfied? A higher category indicates that the respondents are more satisfied with their current life. We also report the *p*-value for the hypothesis that subjective wellbeing and having a child who died are independent

4.3.4 Empirical Strategy

The objective of this chapter is to estimate whether child death affects the physical and mental health status of parents. We estimate the following model:

$$y_{ij} = \beta_0 + \beta_1 Child\ death_j + X_{ij}\gamma + \beta_2 Interview\ year_i + \varepsilon_{ij} \quad (4.3)$$

where y_{ij} is the health status of individual i in household j. We consider several self-reported health status measures in this chapter. The first one is parental subjective survival expectations, which is an ordered categorical variable ranging from 1 (almost impossible) to 2 (not very likely), to 3 (maybe), to 4 (very likely), and to 5 (almost certain). The higher the subjective survival expectation category is, the more optimistic the respondents are about their chances of reaching a certain age. The second one is depression symptoms, which ranges from 0 to 30. A higher score is associated with severe mental health problems. The third one is a poor health dummy, which equals one if the respondents report being in poor health and zero otherwise. The fourth one is subjective wellbeing, which ranges from 1 (not at all satisfied) to 5

(completely satisfied). For parental subjective survival expectations and subjective wellbeing, we estimate an ordered probit model.

Our key explanatory variable is $Child\ death_j$. It is a dummy variable that takes the value one if the household *j* lost at least one biological child. β_1 is the parameter of interest. For the specifications with depression symptoms and poor health as our dependent variables, we expect β_1 to be positive. For subjective survival expectations and subjective wellbeing, we expect β_1 to be negative. This would suggest that a child's death has an adverse impact on parents' health status.

The vector X_{ij} contains pre-treatment characteristics of the parents, which control for family health and resources that could potentially affect both their current health status and the child's death. In the analysis, these parental characteristics include education level, age, age squared, gender dummy, *hukou* status at birth, health status during childhood, and whether the parents' mother and/or father were illiterate. These variables are predetermined and, therefore, not likely to be affected by the child's death. Because we pool data collected in different years, we also include dummies of the interview years. The error term ε_{ij}, captures the unobservable heterogeneity. We estimate our regression model using the OLS method (for parental depression symptoms and poor health) and pooled ordered probit method (for parental subjective survival expectations and subjective wellbeing). All the standard errors are clustered at the household level to capture the within household correlation.

4.4 Results

In this section, we estimate the effect of losing a child on a variety of parental health outcomes: parental subjective survival expectations (Table 4.6), depression symptoms (Table 4.7), self-reported poor health (Table 4.8), and subjective wellbeing (Table 4.9). Besides, we also investigate whether the impact of losing a child is heterogenous by the age, the number, and the duration since the death of the deceased children, as shown in Tables 4.A1-4.A4.

4.4.1 Child Death on Parental Subjective Survival Expectations

Table 4.6 presents the effect of losing a child on parental subjective survival expectations. The dependent variable is subjective survival expectations, which is an ordered categorical variable. The model is estimated by ordered probit. In the first column of Table 4.6, we regress parental subjective survival expectations on the child death dummy. We add covariates measuring parental gender, age, education level, and childhood background, including dummies for rural hukou at birth, for poor health in childhood, and for the education level of the respondent's

father and mother. The impact of age on individual survival probabilities may be different for males and females. We thus introduce an interaction term between age and gender in Column 1. As respondents were asked to rate their chances of living to different target ages conditional on their current age, we add a set of cohort dummies in the analysis. Moreover, because many studies find that the effect of losing a child is larger and longer-lasting for mothers than for fathers (Van den Berg et al., 2017), it is important to investigate whether the impact of losing a child varies between mothers and fathers in our sample. In Columns 2 and 3, we regress parental survival expectations on the child death separately for fathers and mothers.

In fact, given the prevalence of son preference in China (Li and Wu, 2011), we expect that parents' reaction to the death of a son is larger than the reaction to losing a daughter. Thus, we regress parental subjective survival expectations on dummies for having a son who died, having a daughter who died, and other covariates in Columns 4-6. Columns 5 and 6 show the impact of a son's death and a daughter's death on fathers and mothers, respectively.

In Columns 1-3, the coefficient of child death is negative and statistically significant, suggesting that the death of a child has a negative effect on parental survival expectations. The impact is negative and significant for both fathers and mothers. Besides, the effects for mothers and fathers are not significantly different from each other, as suggested by the Wald test statistics. The results imply that losing a child is associated with more pessimistic survival expectations for parents. This is consistent with Song et al. (2019), who find that bereaved parents have higher risks of dying earlier than their life expectancies and lower survival probabilities than non-bereaved parents in the US.

Columns 4-6 present the effect of losing a son and a daughter. We find that the gender of the deceased child plays a crucial role in parental survival expectations. A daughter's death seems to have a negative effect on maternal and paternal survival expectations, whereas a son's death only has a negative and smaller impact on paternal survival expectations. This is different from our expectation that losing a son may have a more substantial effect on parental health conditions due to the prevalence of son preference in China.

Table 4.6. The impact of the child death on parental survival expectations

Variables	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female
Child death	-0.1597***	-0.1785***	-0.1408***			
	(0.0365)	(0.0482)	(0.0458)			
Have son died				-0.0622	-0.0966*	-0.0272
				(0.0439)	(0.0582)	(0.0555)
Have daughter died				-0.2472***	-0.2850***	-0.2148***
				(0.0514)	(0.0686)	(0.0645)
Male	0.1510			0.1475		
	(0.1089)			(0.1091)		
Age	0.0071	0.0044	0.0167	0.0064	0.0024	0.0167
	(0.0226)	(0.0381)	(0.0282)	(0.0226)	(0.0382)	(0.0282)
Age squared	-0.0000	0.0000	-0.0001	-0.0000	0.0000	-0.0001
	(0.0002)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0003)
Cohort: Aged above 80 (reference)						
Aged under 64	0.5339***	0.6719**	0.3454	0.5330***	0.6721**	0.3469
	(0.1893)	(0.2821)	(0.2636)	(0.1893)	(0.2823)	(0.2637)
Aged 65-69	0.1847	0.3229	-0.0002	0.1840	0.3237	0.0009
	(0.1617)	(0.2403)	(0.2240)	(0.1617)	(0.2405)	(0.2242)
Aged 70-74	0.2022	0.2795	0.0928	0.1974	0.2747	0.0901
	(0.1359)	(0.1972)	(0.1912)	(0.1359)	(0.1973)	(0.1914)
Aged 75-79	0.0572	0.1388	-0.0509	0.0542	0.1357	-0.0539
	(0.1082)	(0.1521)	(0.1563)	(0.1083)	(0.1519)	(0.1569)
Education level: High education (reference)						
Illiterate	-0.6139***	-0.6219***	-0.5261***	-0.6133***	-0.6185***	-0.5276***
	(0.0622)	(0.0816)	(0.0972)	(0.0621)	(0.0816)	(0.0972)
Low education	-0.5314***	-0.5922***	-0.4123***	-0.5326***	-0.5924***	-0.4138***
	(0.0584)	(0.0713)	(0.0947)	(0.0584)	(0.0713)	(0.0947)
Middle education	-0.3133***	-0.3392***	-0.2452***	-0.3139***	-0.3391***	-0.2466***
	(0.0564)	(0.0692)	(0.0922)	(0.0563)	(0.0692)	(0.0922)
Rural *hukou* at birth	-0.1819***	-0.1701***	-0.2011***	-0.1805***	-0.1676***	-0.2006***
	(0.0315)	(0.0425)	(0.0424)	(0.0316)	(0.0425)	(0.0424)
Childhood health poor	-0.2183***	-0.1820***	-0.2459***	-0.2145***	-0.1776***	-0.2421***
	(0.0418)	(0.0634)	(0.0555)	(0.0419)	(0.0635)	(0.0555)
Father illiterate	-0.0730***	-0.0778**	-0.0714**	-0.0737***	-0.0779**	-0.0730**
	(0.0222)	(0.0306)	(0.0309)	(0.0222)	(0.0306)	(0.0309)
Mother illiterate	-0.0356	0.0233	-0.0981**	-0.0358	0.0237	-0.0984**
	(0.0327)	(0.0467)	(0.0430)	(0.0327)	(0.0467)	(0.0430)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Interaction between Age and Male	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,138	5,861	6,277	12,138	5,861	6,277
R-squared	0.0217	0.0215	0.0201	0.0220	0.0220	0.0202
Number of households	8307	5861	6277	8307	5861	6277
Log-likelihood	-17976.57	-8700.88	-9259.02	-17971.87	-8696.93	-9257.69
Wald test for the impact of losing a child on fathers and mothers						
p-value			0.5227			
Wald test of the coefficient difference (Son(s) death = Daughter(s) death)						
p-value				0.0096	0.0455	0.0347

Note: 1. We consider those parents who have experienced one biological child death as the treated group, and those who have at least one biological child but have never experienced the loss of a biological child as the control group.

2. The dependent variable *survival expectation* is an ordered categorical variable ranging from 1 (almost impossible) to 2 (not very likely), to 3 (maybe), to 4 (very likely), to 5 (almost certain). A higher category of subjective survival expectations is associated with respondent's optimism about reaching a target age.
3. In Columns 1-3, we regress the *survival expectation* of the parents on Child death and a set of covariates. In Columns 2 and 3, we show the impact of losing a child on males and females, respectively. We then regress *survival expectation* on the death of a son and the death of a daughter in Columns 4-7.
4. *Illiterate* is a dummy variable indicating the respondent has no formal education. *Low education* is a dummy, and it equals 1 if the highest educational attainment of the respondent is a primary school. *Middle education* is a dummy variable, and it equals 1 if the respondent has graduated from middle, high school or vocational school, and 0 otherwise. *High education* is a dummy, and it equals 1 if the respondent has an associate degree, bachelor degree, master degree, or doctoral degree, and 0 otherwise.
5. *hukou* is the household registration system in mainland China. Rural *hukou* is a dummy variable indicating whether the respondent has a rural *hukou* at birth and 0 otherwise.
6. *Childhood health poor* is a dummy variable measuring the respondent's health status before age 16. It equals 1 if the respondent report being in poor health during childhood and 0 otherwise.
7. *Father illiterate* and *mother illiterate* measure the education level of the respondent's parents. The dummy equals 1 if the father/mother of the respondent has no formal education.
8. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard errors clustered at the household level.
9. We test whether the coefficients estimated over different groups are equal to each other.

4.4.2 Child Death on Parental Depression Symptoms

Table 4.7 presents the impact of a child's death on parental depression symptoms. In the first column, we regress the depression symptoms of parents on a child death dummy and a full set of controls. In Columns 2 and 3, we explore the impact of losing a child on parental depression symptoms for fathers and mothers, respectively. We then regress parental depression symptoms on dummies for having a son who died, having a daughter who died, and other covariates in Columns 4-6.

In Columns 1-3, the coefficient of the child death dummy is positive and significant for parents, indicating that depressive symptoms increase among bereaved parents. In other words, bereaved parents are more likely to have mental health problems than non-bereaved parents. Although the coefficients in Columns 2 and 3 suggest that the death of a child has a more considerable impact on fathers than on mothers, the Wald test statistics indicate that the difference is not significant.

As to the control variables, several covariates are shown to have significant impacts on parental depressive symptoms. We find that having a low education level, a rural *hukou*, poor health in childhood, and illiterate parents are associated with higher levels of depression symptoms. Age is also an important factor for depression symptoms as depressive symptoms increase with age. Besides, males have fewer depressive symptoms than females. All the associations have the expected sign and are consistent with the findings by Ren and Ye (2017) and Lee et al. (2014).

Columns 4-6 imply that the gender of the deceased child also affects parental mental health conditions. For fathers, the impact of the death of a son and a daughter are both positive and significant, and the Wald test shows that the difference between losing a son and losing a daughter is not significant. In contrast to fathers, for mothers, we find that the death of a son has a significant impact on maternal mental health, while the effect of losing a daughter is not significant. Moreover, the test for the coefficient differences for mothers gives a *p*-value lower than 0.05, suggesting that the influence of the death of a son and a daughter is different for mothers. One possible explanation is that having a son enhances mothers' bargaining power and intrahousehold resources in China (Li and Wu, 2011; Fan et al., 2018). As a consequence, compared to the death of a daughter, the death of a son may have a more substantial impact on maternal mental health.

Table 4.7. The impact of the child death on parental depression symptoms

Variables	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female
Child death	1.3761***	1.5656***	1.2256***			
	(0.2251)	(0.2787)	(0.2922)			
Have son died				1.5706***	1.6199***	1.5487***
				(0.2791)	(0.3489)	(0.3642)
Have daughter died				0.6979**	1.1940***	0.2849
				(0.3108)	(0.3869)	(0.3926)
Male	-1.4725***			-1.4716***		
	(0.1042)			(0.1042)		
Age	0.2084***	0.2323***	0.1926**	0.2099***	0.2366***	0.1943**
	(0.0601)	(0.0830)	(0.0768)	(0.0602)	(0.0829)	(0.0771)
Age squared	-0.0015***	-0.0017**	-0.0013**	-0.0015***	-0.0018***	-0.0013**
	(0.0005)	(0.0007)	(0.0006)	(0.0005)	(0.0007)	(0.0006)
Education level: High education (reference)						
Illiterate	3.3592***	3.4681***	3.2837***	3.3588***	3.4722***	3.2876***
	(0.2883)	(0.3779)	(0.4928)	(0.2886)	(0.3781)	(0.4936)
Low education	2.7463***	2.7482***	2.7306***	2.7465***	2.7404***	2.7388***
	(0.2577)	(0.2936)	(0.4774)	(0.2581)	(0.2939)	(0.4782)
Middle education	1.2660***	1.2633***	1.2849***	1.2627***	1.2568***	1.2858***
	(0.2428)	(0.2750)	(0.4553)	(0.2432)	(0.2753)	(0.4560)
Rural *hukou* at birth	1.1181***	0.8079***	1.4397***	1.1216***	0.8067***	1.4463***
	(0.1578)	(0.2030)	(0.2269)	(0.1576)	(0.2029)	(0.2270)
Childhood health poor	1.7138***	1.4801***	1.8943***	1.7176***	1.4705***	1.9089***
	(0.2353)	(0.3368)	(0.3206)	(0.2352)	(0.3364)	(0.3201)
Father illiterate	0.2746**	0.4093**	0.1483	0.2714**	0.4083**	0.1414
	(0.1244)	(0.1612)	(0.1833)	(0.1245)	(0.1611)	(0.1835)
Mother illiterate	0.3517**	0.3346	0.3659	0.3530**	0.3353	0.3660
	(0.1677)	(0.2113)	(0.2484)	(0.1676)	(0.2112)	(0.2484)
Year 2011	0.1963	0.1322	0.2669	0.1976	0.1331	0.2695
	(0.1753)	(0.2077)	(0.2441)	(0.1753)	(0.2079)	(0.2439)
Constant	-2.2708	-4.1100*	-2.1693	-2.3065	-4.2197*	-2.2150
	(1.7638)	(2.4680)	(2.2338)	(1.7664)	(2.4650)	(2.2406)
Observations	12,138	5,861	6,277	12,138	5,861	6,277
R-squared	0.0829	0.0657	0.0601	0.0833	0.0663	0.0605
Wald test for the impact of losing a child on fathers and mothers						
		F(1, 8306) = 0.94				
		Prob > F =0.3331				
Test the coefficient difference (Son(s) death = Daughter(s) death)						
F-statistics				3.85	0.59	5.10
p-value				0.0497	0.4440	0.0240

Notes *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the household level. *Depressive symptom* measures parental mental health. A higher value of *Depressive symptom* is associated with worse mental health.

4.4.3 Child Death on Parental Self-rated Health Status

In Table 4.8, we report the impact of the death of a child on parental self-rated health status. The outcome variable is a dummy indicating the respondents' health conditions, with a value of 1 for poor health conditions and 0 otherwise. In Column 1, we regress parents' poor health on a child death dummy and a set of covariates. We then regress parents' poor health on child death and covariates separately for fathers and mothers in Columns 2 and 3. In Columns 4-6, we regress parental poor health on dummies for having a son who died, having a daughter who died, and other covariates.

Column 1 suggests that, on average, the death of a child leads to 4.6 percentage points higher likelihood that the parents become in poor health. The impact is significant for both fathers and mothers, but the two effects are not different from each other, as shown in Columns 2 and 3. There are two possible mechanisms through which a child's death would affect parental physical health status. The first one is that, following a child's death, parents may adjust their behaviour, such as increasing drinking and smoking behaviour and reducing social interactions. In this sense, the death of a child could influence parental physical health. The second one is the decrease in financial support following the child's death. Affected by the social custom and the underdeveloped pension system in China, financial support from children to parents is the primary support for older individuals, especially for older parents in rural areas. For bereaved parents, losing a child leads to fewer financial supports when they are aged, which may reduce their necessary health expenditure and harm their health status.

We also find that the death of a son and the death of a daughter influence fathers and mothers differently, as suggested in Columns 5 and 6. For fathers, the death of a daughter has a negative and significant effect on their health status, but the impact of a son's death is insignificant. For mothers, a son's death increases the probability of being in poor health by 7.7 percentage points, while no significant effect of the death of a daughter on maternal health status. This again reflects the fact that the death of a son may lead to a more substantial reduction in mothers' bargaining power and intrahousehold resources than the death of a daughter.

Table 4.8. The impact of the child death on parental poor health

Variables	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female
Child death	0.0461***	0.0509**	0.0451**			
	(0.0152)	(0.0205)	(0.0202)			
Have son died				0.0515***	0.0266	0.0772***
				(0.0186)	(0.0245)	(0.0251)
Have daughter died				0.0242	0.0778**	-0.0194
				(0.0217)	(0.0306)	(0.0273)
Male	-0.0370***			-0.0369***		
	(0.0078)			(0.0078)		
Age	0.0164***	0.0222***	0.0146***	0.0165***	0.0226***	0.0147***
	(0.0040)	(0.0061)	(0.0051)	(0.0040)	(0.0061)	(0.0051)
Age squared	-0.0001***	-0.0001***	-0.0001**	-0.0001***	-0.0001***	-0.0001**
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0001)	(0.0000)
Education level: High education (reference)						
Illiterate	0.1292***	0.1345***	0.1315***	0.1292***	0.1336***	0.1317***
	(0.0203)	(0.0278)	(0.0303)	(0.0203)	(0.0279)	(0.0303)
Low education	0.1058***	0.0976***	0.1166***	0.1059***	0.0977***	0.1170***
	(0.0181)	(0.0213)	(0.0290)	(0.0181)	(0.0213)	(0.0290)
Middle education	0.0533***	0.0625***	0.0474*	0.0532***	0.0625***	0.0473*
	(0.0170)	(0.0201)	(0.0273)	(0.0171)	(0.0201)	(0.0273)
Rural *hukou* at birth	0.0430***	0.0244	0.0594***	0.0431***	0.0238	0.0600***
	(0.0109)	(0.0150)	(0.0154)	(0.0109)	(0.0150)	(0.0154)
Childhood health poor	0.1226***	0.1260***	0.1206***	0.1227***	0.1248***	0.1220***
	(0.0176)	(0.0262)	(0.0238)	(0.0176)	(0.0262)	(0.0238)
Father illiterate	0.0360***	0.0328***	0.0387***	0.0359***	0.0328***	0.0382***
	(0.0085)	(0.0117)	(0.0122)	(0.0085)	(0.0116)	(0.0122)
Mother illiterate	0.0200*	0.0196	0.0188	0.0200*	0.0196	0.0187
	(0.0112)	(0.0152)	(0.0160)	(0.0112)	(0.0152)	(0.0160)
Year 2011	0.0029	0.0006	0.0032	0.0029	0.0009	0.0033
	(0.0118)	(0.0155)	(0.0166)	(0.0118)	(0.0155)	(0.0166)
Constant	-0.5023***	-0.7220***	-0.4437***	-0.5035***	-0.7332***	-0.4453***
	(0.1160)	(0.1792)	(0.1477)	(0.1160)	(0.1792)	(0.1477)
Observations	12,138	5,861	6,277	12,138	5,861	6,277
R-squared	0.0402	0.0386	0.0380	0.0402	0.0392	0.0389
Wald test for the impact of losing a child on fathers and mothers						
Chow test		F(1, 8306) = 0.05				
		Prob > F =0.8301				
Test the coefficient difference (Son(s) death = Daughter(s) death)						
F-statistics				0.84	1.57	6.23
p-value				0.3585	0.2100	0.0126

Notes: 1. *Poor health* is a binary variable which equals 1 if the respondent has bad self-rated health and 0 otherwise.
2. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the household level.

4.4.4 Child Death on Parental Subjective Wellbeing

Table 4.9 demonstrates the effect of losing a child on parental subjective wellbeing. The model is estimated by ordered probit. We first regress parental subjective wellbeing on the child death dummy and covariates in Columns 1-3. We then regress parental subjective wellbeing on dummies for having a son who died and having a daughter who died and other control variables in Columns 4-6. Column 1 implies that the death of a child is associated with a decline in parental subjective wellbeing. However, the effect is not significant for mothers, as shown in Column 3. Columns 4-6 suggest that the death of a son and a daughter affect fathers and mothers differently. Bereaved fathers who lost a daughter have lower subjective wellbeing than non-bereaved fathers. In contrast, bereaved mothers who lost a son tend to report lower subjective wellbeing than non-bereaved mothers. We do not find any significant differences in parental subjective well-being between losing a son and losing a daughter.

4.4.5 Sensitivity Analysis

We also examine whether the impact of losing a child on parental health outcomes differs by the duration since the child passed away, the age of the deceased children, and the number of deceased children in the household. Table 4.A1 shows the impact of the child's death on parental survival expectations. Columns 1-3 show that having a child that passed away more than 5 years ago seems to have a more considerable impact than having a child who died in the past 5 years. However, the difference in the coefficients is not significantly different from zero, indicating that the impact of losing a child does not differ by the duration since the child died. This might be affected by the relatively small number of children who passed away in the past 5 years. [28] As to the number of deceased children, we find no difference in the effect of losing one child and losing more than one child, as reported in Columns 4-6. Columns 7-9 indicate that parents tend to have more pessimistic survival expectations if their children passed away before 16 years old. In Table 11-13, we also investigate the heterogeneous impacts of losing a child on parental depressive symptoms (Table 4.A2), self-rated physical health (Table 4.A3), and subjective wellbeing (Table 4.A4). However, we do not find any significant differences between the heterogeneous impacts of losing a child on a battery of parental health outcomes.

In sum, we find that the death of a child deteriorates parents' health status. Bereaved parents tend to have lower survival expectations, more depression symptoms, more inferior health status, and be unsatisfied with their current life. In contrast to previous studies by Van den Berg

[28] In the analytical sample of 12,138 parents, 947 parents have children who died more than 5 years ago, whereas 142 parents have children who passed away in the past 5 years.

Table 4.9. The impact of the child death on parental subjective wellbeing

Variables	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female
Child death	-0.0756*	-0.1013*	-0.0598			
	(0.0388)	(0.0524)	(0.0489)			
Have son died				-0.0905*	-0.0771	-0.1093*
				(0.0466)	(0.0633)	(0.0602)
Have daughter died				-0.0598	-0.1609**	0.0195
				(0.0566)	(0.0777)	(0.0681)
Male	0.0056			0.0055		
	(0.0198)			(0.0198)		
Age	0.0074	0.0180	-0.0011	0.0070	0.0167	-0.0013
	(0.0118)	(0.0179)	(0.0140)	(0.0118)	(0.0180)	(0.0140)
Age squared	0.0000	-0.0001	0.0001	0.0000	-0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Education level: High education (reference)						
Illiterate	-0.1718***	-0.1843**	-0.2016*	-0.1707***	-0.1816**	-0.2014*
	(0.0612)	(0.0823)	(0.1069)	(0.0612)	(0.0823)	(0.1070)
Low education	-0.2014***	-0.1922***	-0.2321**	-0.2007***	-0.1909***	-0.2325**
	(0.0568)	(0.0682)	(0.1043)	(0.0568)	(0.0682)	(0.1043)
Middle education	-0.1508***	-0.1279*	-0.2067**	-0.1503***	-0.1273*	-0.2065**
	(0.0553)	(0.0665)	(0.1021)	(0.0553)	(0.0666)	(0.1021)
Rural *hukou* at birth	-0.0110	-0.0118	-0.0122	-0.0105	-0.0100	-0.0126
	(0.0309)	(0.0412)	(0.0424)	(0.0309)	(0.0413)	(0.0424)
Childhood health poor	-0.2286***	-0.1979***	-0.2502***	-0.2283***	-0.1952***	-0.2523***
	(0.0424)	(0.0657)	(0.0546)	(0.0424)	(0.0656)	(0.0546)
Father illiterate	-0.0593***	-0.0630**	-0.0591*	-0.0591***	-0.0631**	-0.0583*
	(0.0227)	(0.0320)	(0.0317)	(0.0227)	(0.0320)	(0.0317)
Mother illiterate	-0.0259	0.0178	-0.0645	-0.0259	0.0182	-0.0645
	(0.0320)	(0.0465)	(0.0433)	(0.0320)	(0.0466)	(0.0433)
Year 2011	-0.0823**	-0.0892*	-0.0749	-0.0821**	-0.0890*	-0.0747
	(0.0357)	(0.0486)	(0.0466)	(0.0357)	(0.0486)	(0.0466)
Observations	12,138	5,861	6,277	12,138	5,861	6,277
R-squared	0.0047	0.0038	0.0059	0.0048	0.0041	0.0060
Number of households	8307	5861	6277	8307	5861	6277
Log-likelihood	-12728.89	-5989.81	-6728.03	-12727.92	-5988.202	-6727.02
Wald test for the impact of losing a child on fathers and mothers						
p-value		0. 5222				
Wald test of the coefficient difference (Son(s) death = Daughter(s) death)						
p-value				0.6893	0.4194	0.1763

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the household level.

et al. (2017), we find no significant difference between the impact of child death on fathers and mothers. Moreover, the results indicate that the gender of the deceased child plays a crucial

role in parental health outcomes. Specifically, the death of a daughter has a significant negative impact on both maternal and paternal survival expectations. Although the death of a daughter has no significant effect on maternal mental health, self-rated health, and subjective wellbeing, losing a son has a significant impact on mothers. This may result from reduced bargaining power and intrahousehold resources of mothers following the death of a son. In addition, there is no evidence to show that the impact of losing a child on parents is heterogeneous by the duration since the children passed away and the number of children who died. Besides, several covariates show significant associations with parental health status. For example, high education levels are associated with higher survival expectations, fewer mental health problems, better self-rated health status, and a more positive attitude towards their current life.

4.5 Conclusions

In this chapter, we use the China Health and Retirement Longitudinal Survey (CHARLS) to examine the long-term health consequences of losing a child on parents. We find a strong negative effect of parental bereavement on both physical and mental health measures, including survival expectations, depression symptoms, self-rated health status, and subjective wellbeing. First, after controlling for a set of covariates that are predetermined, we find that a child's death decreases parental survival expectations. As subjective survival beliefs are an important determinant of individual economic decisions, this may further influence the economic conditions of bereaved parents. Second, on average, bereaved parents tend to have more severe depression symptoms than non-bereaved parents. Third, bereaved parents have a higher probability than non-bereaved parents of being in poor health, meaning that the death of a child harms parents' physical health status significantly. Forth, our results show that the death of a child leads to lower subjective wellbeing of parents. Finally, we find that the death of a son and the death of a daughter affect fathers and mothers differently. Mothers tend to have worse mental health conditions, more unsatisfactory self-rated health, and lower subjective wellbeing following the death of a son than the death of a daughter. This may be explained by the decrease in the bargaining power and intrahousehold resources of mothers following the death of a son, as in China mothers with a son receive more respect and play a greater role in household decision-making.

This chapter has important policy implications. With the rapid ageing of the population and the lack of a developed social security system in China, the adverse effect of parental bereavement can be substantial. In addition to the emotional grief, in China losing a child

reduces the financial support for older individuals, as children are still the primary source of support during retirement. Therefore, the death of a child not only affects parental health status but may also affect the economic conditions and welfare of older people. Considering that the impact of losing a child can persist in the long run, the growing concern for the welfare of bereaved older people and the social security system should be noticed.

Appendix

4.A Heterogeneous Effect of Losing a Child on Parents' Well-being

Table 4.A1. The impacts of the child death on parental survival expectations (Ordered probit model)

Variables	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female
Deceased children characteristics									
Child died within 5 years	-0.0508	-0.0138	-0.0918						
	(0.0909)	(0.1151)	(0.1361)						
Child died more than 5 years	-0.1795***	-0.1893***	-0.1685***						
	(0.0412)	(0.0553)	(0.0505)						
One child died				-0.1441***	-0.1448***	-0.1411***			
				(0.0402)	(0.0525)	(0.0498)			
Multiple children died				-0.2276***	-0.3325***	-0.1395			
				(0.0740)	(0.1027)	(0.0969)			
Had child died 0 years old							-0.2149***	-0.3353***	-0.1144
							(0.0668)	(0.0942)	(0.0843)
Had child died between 0 and 16 years old							-0.1639***	-0.1866**	-0.1387*
							(0.0628)	(0.0834)	(0.0784)
Had child died between 16 and 35 years old							-0.1247*	-0.1397	-0.1124
							(0.0678)	(0.0852)	(0.0857)
Had child died above 35 years old							0.0784	0.0651	0.0930
							(0.0950)	(0.1275)	(0.1211)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interaction between Age and Male	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,138	5,861	6,277	12,138	5,861	6,277	11,967	5,774	6,193
R-squared	0.0217	0.0214	0.0202	0.0217	0.0217	0.0201	0.0214	0.0212	0.0197
Number of id	8307	5861	6277	8307	5861	6277	8181	5774	6193
Log-likelihood	-17976.28	-8701.66	-9258.00	-17975.96	-8699.52	-9259.02	-17725.52	-8570.06	-9138.94
Wald test of the coefficient differences									
p-value	0.1870	0.1598	0.5913	0.3041	0.0929	0.9878	0.0733	0.0823	0.4048

Note: 1. We consider all the parents who have at least one biological child.
2. *Child died within 5 years* is a binary variable, which equals 1 if the parents report having a child died within 5 years at the time of the interview, and 0 otherwise. *Child died more than 5 years* is a dummy variable which equals 1 if the parents have child death experience but no child passed away within 5 years.

3. *One child died* is a binary variable which equals 1 if the parents report having only one child died, and 0 otherwise. *Multiple children died* equals 1 if the parents have more than one child passed away. In total, 614 respondents report they have more than one child who died: 405 respondents have 2 deceased children, 130 respondents have 3 children who died, 49 have 4 deceased children, 21 respondents have 5 children who died, 6 have 6 deceased children, 1 respondent report have 7 deceased children, and 2 respondents report have 8 deceased children.
4. *Had child died 0 years old* is a binary variable which equals 1 if the parents have a child died at the age of 0. *Had child died between 0 and 16 years old* equals 1 if the parents have a child passed away between 0 and 16 years old.
5. *Had son died* dummy equals 1 if the respondent has a son passed away and 0 otherwise.
6. Cohort dummies refer to respondents' cohort, which include a dummy for age above 80 years, a dummy for age between 75 and 79, a dummy for age between 70 and 74, a dummy for age between 65 and 69, and a dummy for age under 64 years.
7. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard errors clustered at the household level.

Table 4.A2. The impacts of the child death on parental depression symptoms (OLS)

Variables	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female
Deceased children characteristics									
Child died within 5 years	2.1007***	1.8567***	2.3668***						
	(0.6019)	(0.6588)	(0.8717)						
Child died more than 5 years	1.3744***	1.6362***	1.1610***						
	(0.2555)	(0.3201)	(0.3211)						
One child died				1.3305***	1.5524***	1.1496***			
				(0.2486)	(0.3071)	(0.3188)			
Multiple children died				1.5755***	1.6261***	1.5469**			
				(0.4575)	(0.5910)	(0.6009)			
Had child died 0 years old							0.8360*	1.1779**	0.5684
							(0.4444)	(0.5560)	(0.5400)
Had child died between 0 and 16 years old							1.2367***	1.7960***	0.7411
							(0.3882)	(0.4988)	(0.4961)
Had child died between 16 and 35 years old							1.8291***	1.5734***	2.0655***
							(0.4116)	(0.4954)	(0.5330)
Had child died above 35 years old							0.8680	1.4611*	0.4458
							(0.6381)	(0.7990)	(0.8212)
Constant	-2.2176	-3.9136	-2.1636	-2.2957	-4.1179*	-2.2130	-2.1481	-5.4291**	-1.1301
	(1.7625)	(2.4775)	(2.2295)	(1.7661)	(2.4688)	(2.2393)	(1.7939)	(2.4978)	(2.2718)
Observations	12,138	5,861	6,277	12,138	5,861	6,277	11,967	5,774	6,193
R-squared	0.0832	0.0658	0.0606	0.0830	0.0657	0.0601	0.0825	0.0656	0.0598
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald test of the coefficient differences									
p-value	0.2584	0.7593	0.1857	0.6273	0.9099	0.5428	0.3579	0.8906	0.1374

Note: 1. *Depressive symptom* measures parental mental health. A higher value of *Depressive symptom* is associated with worse mental health.

2. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the household level.

Table 4.A3. The impacts of the child death on parental poor health (OLS)

Variables	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female
Deceased children characteristics									
Child died within 5 years	0.0436	0.0179	0.0733						
	(0.0430)	(0.0553)	(0.0572)						
Child died more than 5 years	0.0531***	0.0618***	0.0485**						
	(0.0170)	(0.0232)	(0.0222)						
One child died				0.0471***	0.0436**	0.0527**			
				(0.0164)	(0.0221)	(0.0219)			
Multiple children died				0.0419	0.0843*	0.0128			
				(0.0339)	(0.0480)	(0.0432)			
Had child died 0 years old							-0.0075	0.0255	-0.0335
							(0.0275)	(0.0395)	(0.0350)
Had child died between 0 and 16 years old							0.0682**	0.0783**	0.0618*
							(0.0275)	(0.0362)	(0.0349)
Had child died between 16 and 35 years old							0.0502*	0.0703*	0.0363
							(0.0284)	(0.0384)	(0.0374)
Had child died above 35 years old							0.0605	0.0524	0.0757
							(0.0421)	(0.0604)	(0.0528)
Constant	-0.4985***	-0.7092***	-0.4436***	-0.5018***	-0.7263***	-0.4393***	-0.5266***	-0.7676***	-0.4606***
	(0.1160)	(0.1795)	(0.1477)	(0.1161)	(0.1791)	(0.1477)	(0.1178)	(0.1814)	(0.1510)
Observations	12,138	5,861	6,277	12,138	5,861	6,277	11,967	5,774	6,193
R-squared	0.0403	0.0388	0.0382	0.0402	0.0388	0.0381	0.0403	0.0395	0.0382
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald test of the coefficient differences									
p-value	0.8347	0.4572	0.6796	0.8861	0.4304	0.3914	0.2352	0.7866	0.1919

Note: 1. *Poor health* is a binary variable which equals 1 if the respondent has bad self-rated health and 0 otherwise.

2. *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the household level.

Table 4.A4. The impacts of the child death on parental subjective wellbeing (Ordered probit model)

Variables	(1) Full sample	(2) Male	(3) Female	(4) Full sample	(5) Male	(6) Female	(7) Full sample	(8) Male	(9) Female
Deceased children characteristics									
Child died within 5 years	-0.1878*	-0.1181	-0.2491*						
	(0.1071)	(0.1423)	(0.1430)						
Child died more than 5 years	-0.0664	-0.1137*	-0.0351						
	(0.0425)	(0.0582)	(0.0535)						
One child died				-0.0623	-0.0698	-0.0593			
				(0.0423)	(0.0561)	(0.0538)			
Multiple children died				-0.1331	-0.2415*	-0.0620			
				(0.0843)	(0.1260)	(0.0995)			
Had child died 0 years old							0.0136	-0.0805	0.0802
							(0.0715)	(0.0958)	(0.0894)
Had child died between 0 and 16 years old							-0.1816***	-0.2240**	-0.1504*
							(0.0698)	(0.0948)	(0.0851)
Had child died between 16 and 35 years old							-0.0946	-0.0904	-0.1043
							(0.0679)	(0.0984)	(0.0854)
Had child died above 35 years old							-0.0816	-0.0189	-0.1309
							(0.1002)	(0.1460)	(0.1317)
Observations	12,138	5,861	6,277	12,138	5,861	6,277	11,967	5,774	6,193
R-squared	0.0048	0.0039	0.0061	0.0048	0.0040	0.0059	0.0049	0.0041	0.0061
Number of id	8307	5861	6277	8307	5861	6277	8181	5774	6193
Log-likelihood	-12727.98	-5989.53	-6726.82	-12728.49	-5988.77	-6728.03	-12518.47	-5879.61	-6626.97
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald test for the coefficient difference									
p-value	0.2839	0.9772	0.1542	0.4400	0.2045	0.9801	0.3109	0.5933	0.2683

Note: 1. There are five categories of subjective wellbeing: 1) not at all satisfied, 2) not very satisfied, 3) somewhat satisfied, 4) very satisfied, and 5) completely satisfied with their current life. A higher score suggests that the respondent is more satisfied with their life.
2. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard errors clustered at the household level.

Chapter 5

5. Conclusions

Interactions between parents and children are important over the individual life cycle. In particular, it is well documented that parent-child interactions are critical at the beginning of the life cycle, when parental care and investment in children affects their human capital development, and at the end of the life cycle when children's care and support for parents is crucial to parents' wellbeing. Better parent-child interactions are not only important for families, but also linked to a wide range of welfare policies, such as early childhood interventions, pension systems, and long-term care. Moreover, existing evidence suggests that parent-child interactions have far-reaching implications for intergenerational social mobility. Understanding how parents interact with their children and the impact of parent-child interactions on family wellbeing is therefore a key issue. In this thesis, we focus on the effects of parent-child interactions on children's academic achievement, children's marriage outcomes, and parents' health consequences.

Although parent-child interactions vary across cultures and economies, they remain important. In this thesis, we examine parent-child interactions in two different contexts, China and the Netherlands. In general, China and the Netherlands are different in many ways, especially in terms of culture and social security systems. From the cultural aspect, unlike in the Netherlands and other European countries, Confucianism in China emphasizes the ties within the family, especially the close ties between parents and children. This leads to a more common practice of coresidence between parents and their adult children in China than in the Netherlands. The cultural difference is also reflected in the fact that informal child care provided by grandparents is more prevalent in China, while formal public child care is the most common child care in the Netherlands. In addition to cultural differences, China and the Netherlands differ in their social security systems. The Netherlands has a relatively comprehensive and well-developed social security system, while China lacks an adequate social security system, especially a social pension system for the older population. As a result, older people in China are more dependent on the informal care of their adult children than the older population in the Netherlands. In sum, although parent-child interactions are important in general, they are influenced by the cultural and institutional setting. To examine parent-child interactions in a broader context, this thesis investigates parent-child interactions in the Netherlands (Chapter 2) and China (Chapters 3 and 4). The main findings and policy implications are summarized in the following sections.

5.1 Summary of Findings

In Chapter 2, we estimate the effect of exposure at age 0-2 to formal daycare on children's abilities at age 8-9 in the Netherlands, by exploiting a Dutch 2005 child care reform that leads to a more generous daycare subsidy for parents and using data from the COOL study. We find that daycare use at age 0-2 has a negative effect on children's task orientation and reading comprehension scores, and a positive impact on children's word decoding scores. We do not find significant effects on children's vocabulary, mathematics, and non-school cognitive capacities test scores. One possible explanation for the negative effects is that the effects of daycare on children are heterogeneous and depend on the family background (Cornelissen et al., 2018). By dividing the sample into children with high-educated fathers and children with low-educated fathers, our study investigates the heterogeneous effect of daycare use. We show that the negative effect is concentrated in children from advantaged families, which may explain the negative effects we report in the main analysis. Additionally, the decline in the quality of Dutch daycare centers after 2005 may also explain our findings.

In Chapter 3, we employ the China Health and Retirement Longitudinal Survey (CHARLS) to investigate the effect of parental housing wealth on children's marriage outcomes. We focus on unmarried children in 2011 and track their marriage outcomes in 2015. We find that parental housing wealth plays a critical role in children's probability of marriage. First, the better the parental housing wealth, the greater the probability of marriage for males. Second, the effect of parental housing wealth varies with children's gender and *hukou* status. And housing wealth is particularly important for males with rural *hukou*. This is in line with our hypothesis and suggests that parental housing wealth serves as a signal for rural males in the marriage market. Third, in contrast to housing wealth, there is no evidence that non-housing wealth affects young people's marriage transitions.

Different from Chapters 2 and 3, we focus on the impact of children on parents' wellbeing in Chapter 4. We use the China Health and Retirement Longitudinal Survey (CHARLS) to examine the long-term health consequences of the loss of a child on parents. We find that the loss of a child has a wide range of negative effects on parents' physical and mental health. First, we find that a child's death is associated with a deterioration in parental survival expectations. Since subjective survival beliefs are an important determinant of individual economic decisions, this may further affect the economic conditions of bereaved parents. Second, bereaved parents have, on average, more severe depression symptoms than non-bereaved parents. Third, bereaved parents have a higher probability of being in poor health. Forth, we report that the death of a child leads to lower subjective wellbeing among parents. Finally, we find that the

loss of a son and the loss of a daughter affect fathers and mothers differently. In particular, mothers have worse mental health conditions, more unsatisfactory self-rated health, and lower subjective wellbeing after the death of a son than the death of a daughter. This may be due to the reduced bargaining power and intra-household resources of mothers after the death of a son, as mothers with sons in China receive more respect and play a greater role in family decision-making.

5.2 Implications and Recommendations

The results of this thesis emphasize that investigating parent-child interactions over the life cycle is crucial. Parent-child interactions not only affect family well-being, but also have long-term effects on inequality. To improve family wellbeing and reduce inequalities, governments should take into account parent-child interactions when implementing interventions (Chapters 2,3,4). It should be noted that parent-child interactions are critical not only at the early childhood stage (Chapter 2) and the end of the life cycle (Chapter 4), but also in adulthood (Chapter 3). In this section, we discuss implications and recommendations based on the settings we studied (China and The Netherlands). We acknowledge that China and the Netherlands are different in many ways, especially in their culture and social security system. For example, compared to the Netherlands, there is a stronger parent-child bond due to Confucianism in China, which leads to higher parent-child coresidence rates, more significant parental investment in their children's marriage, and more prevalent informal child care provided by grandparents. This makes it difficult to make uniform recommendations for parent-child interactions in China and the Netherlands. We believe that the role of parent-child interactions is essentially equally important across settings and that our findings can provide insights into understanding parent-child interactions in a broader range of settings.

More importantly, this discussion of parent-child interactions is particularly important during the Covid-19 pandemic. To minimize the spread of the pandemic, many countries have implemented lockdowns, school closures, and stay-at-home measures. Children are challenged by school closures, adults are challenged by huge stress related to the changing labour market situation, and older generations are experiencing disproportionate greater negative effects on wellbeing. In this context, the importance of good parent-child interaction cannot be overemphasized.

Chapter 2 suggests that using daycare at age 0-2 has an undesirable effect on relatively more affluent children. The result has important policy implications, especially for the discussion on the quality of early childhood care. With an increasing labour force participation among

females, most countries have invested heavily in child care. The negative effects detected from Chapter 2 are possibly owing to the quality of daycare centers. As opposed to Germany and Norway (Drange and Havnes, 2019; Felfe and Lalive, 2018), where the teacher-child ratio in daycare centers is 1:3, the teacher-child ratio in Dutch daycare centers was 1:4 for children aged 0-2. Moreover, in the Dutch context, advantaged households are more likely to use daycare. Those children could have received better parental care at home. Consequently, the low quality of daycare centers may be more pronounced for them. Thus, policy makers should focus on child care quality when implementing childhood care programs. Besides, the results of Chapter 2 also relate to the hot discussion on the inequality caused by the school closures during the current pandemic as children from affluent households are more likely to receive better parental care at home than children from socioeconomically disadvantaged households (Van de Werfhorst, 2021).

Chapter 3 shows that parental housing wealth acts as a signal for males in China's marriage market, which is characterized by a strongly unbalanced sex ratio. The finding has important policy implications. First, it suggests that China's rising sex ratios and the twisted marriage market are likely to contribute to the competition in parental housing wealth, which further leads to an increase in housing prices. In fact, competing in housing wealth may impose financial constraints on young individuals and their parents and depress their consumption of other goods (Wrenn et al., 2019). Nevertheless, the aggregate number of males getting married is not affected by housing wealth. These effects combined imply that some of the increases in house costs resulted from the competition are socially inefficient (Wei et al., 2017). Second, in the long run, considering the assortative mating in the marriage market (Sun and Zhang, 2020), competing in owing high-value houses may also contribute to wealth inequality and the intergenerational transmission of this inequality. Therefore, for policy makers, when implementing housing market regulations, it is important to take the marriage market into consideration. Although we focus on the context of China in Chapter 3, it could also shed light on other economies, especially other countries with unbalanced sex ratios (e.g., India and Singapore).

Chapter 4 reveals that the death of a child has a negative and significant impact on a variety of parental health conditions. To improve the wellbeing of the parents who lost their children, policy makers should first consider providing mental health support to them, as poor mental health is likely to lead to an unhealthy lifestyle and thus to deteriorated physical health and financial conditions. Moreover, with the rapid aging of the population and the lack of a developed social security system in China, the adverse effect of parental bereavement can be

amplified. In China, children are the primary source of support for older individuals and losing a child reduces financial support at older ages. Therefore, the death of a child not only affects parental health status but may also affect the economic conditions and welfare of older people. The government has tried to improve the welfare of households with special difficulties. For example, the Notice on further improving support for the family with special difficulties during family planning put forward the regulation on supporting those parents who lost their only child. In 2014, the special subsidy for urban families and rural families who lost their only child was 340 CNY and 170 CNY per person per month, respectively.29 This support, however, could be insufficient. Considering that the impact of losing a child can persist in the long run, the growing concern for the welfare of the bereaved elderly and the social security system should be noticed. In addition to the welfare, it should be noted that professional care for bereaved parents is crucial for the mental health of parents. For example, in the Netherlands, parents who lost their child can seek professional support (e.g., primary care and secondary care). Moreover, the Dutch Preventive Child Healthcare proposed a guideline for counselling grieving parents (Gijzen et al., 2016). However, in China, bereaved parents are less likely to consult professional help, and a guideline for them does not exist. Therefore, appropriate interventions and professional support are needed to help bereaved parents in China.

[29] 1 EUR was approximately 8 CNY in 2014.

Bibliography

Akgunduz, E., Jongen, E., Leseman, P. P., & Plantenga, J. (2015). *Quasi-experimental Evidence on the Relation between Child Care Subsidies and Child Care Quality* (No. 310. rdf). CPB Netherlands Bureau for Economic Policy Analysis.

Akgunduz, Y. E., & Plantenga, J. (2014). Equal Access to High-Quality Childcare in the Netherlands. In L. Gambaro, K. Stewart & J. Waldfogel (Eds.), *An Equal Start? Providing Quality Early Education and Care for Disadvantaged Children* (pp. 101–120). Bristol: Policy Press.

Alessie, R., Angelini, V., Mierau, J. O., & Viluma, L. (2018). Economic Downturns and Infant Health. *Economics & Human Biology*, 30, 162-171.

Almond, D., Currie, J., & Duque, V. (2018). Childhood Circumstances and Adult Outcomes: Act II. *Journal of Economic Literature*, 56(4), 1360-1446.

Angrist, J. (2002). How Do Sex Ratios Affect Marriage and Labor Markets? Evidence from America's Second Generation. *The Quarterly Journal of Economics*, 117(3), 997-1038.

Baker, M., Gruber, J., & Milligan, K. (2008). Universal Child Care, Maternal Labor Supply, and Family Well-being. *Journal of Political Economy*, 116(4), 709-745.

Baker, M., Gruber, J., & Milligan, K. (2019). The Long-run Impacts of a Universal Child Care Program. *American Economic Journal: Economic Policy*, 11(3), 1-26.

Bernal, R., & Keane, M. P. (2011). Child Care Choices and Children's Cognitive Achievement: The Case of Single Mothers. *Journal of Labor Economics*, 29(3), 459-512.

Bettendorf, L. J., Jongen, E. L., & Muller, P. (2015). Childcare Subsidies and Labour Supply—Evidence from a Large Dutch Reform. *Labour Economics*, 36, 112-123.

Black, S. E., Devereux, P. J., Løken, K. V., & Salvanes, K. G. (2014). Care or Cash? The Effect of Child Care Subsidies on Student Performance. *Review of Economics and Statistics*, 96(5), 824-837.

Böhme, M. H., Persian, R., & Stöhr, T. (2015). Alone But Better Off? Adult Child Migration and Health of Elderly Parents in Moldova. *Journal of Health Economics*, 39, 211-227.

Brown, P. H., Bulte, E., & Zhang, X. (2011). Positional Spending and Status Seeking in Rural China. *Journal of Development Economics*, 96(1), 139-149.

Bucciol, A., & Zarri, L. (2015). The Shadow of the Past: Financial Risk Taking and Negative Life Events. *Journal of Economic Psychology*, 48, 1-16.

Buckley, T., McKinley, S., Tofler, G., & Bartrop, R. (2010). Cardiovascular Risk in Early Bereavement: A Literature Review and Proposed Mechanisms. *International Journal of Nursing Studies*, 47(2), 229-238.

Carneiro, P., Garcia, I. L., Salvanes, K. G., & Tominey, E. (2021). Intergenerational mobility and the timing of parental income. *Journal of Political Economy*, 129(3), 757-788.

CBS, Kinderopvang in Kaart ('Mapping Childcare'), The Hague: CPB, 2011.

Chang, S., & Zhang, X. (2015). Mating Competition and Entrepreneurship. *Journal of Economic Behavior & Organization*, 116, 292-309.

Chen, Y., & Fang, H. (2018). The Long-term Consequences of Having Fewer Children in Old Age: Evidence from China's "Later, Longer, Fewer" Campaign (No. w25041). National Bureau of Economic Research.

Chu, C. C., Lin, J. C., & Tsay, W. J. (2020). Males' Housing Wealth and Their Marriage Market Advantage. *Journal of Population Economics*, 33(3), 1005-1023.

Conti, G., Heckman, J. J., & Pinto, R. (2016). The Effects of Two Influential Early Childhood Interventions on Health and Healthy Behaviour. *The Economic Journal*, 126(596), F28-F65.

Cornelissen, T., Dustmann, C., Raute, A., & Schönberg, U. (2018). Who Benefits from Universal Child Care? Estimating Marginal Returns to Early Child Care Attendance. *Journal of Political Economy*, 126(6), 2356-2409.

Currie, J., & Almond, D. (2011). Human Capital Development before Age Five. In *Handbook of Labor Economics* (Vol. 4, pp. 1315-1486). Elsevier.

Currie, J., Mueller-Smith, M., & Rossin-Slater, M. (2018). Violence while in utero: The impact of assaults during pregnancy on birth outcomes. *Review of Economics and Statistics*, 1-46.

De Kruif, R.E.L., Riksen-Walraven, J.M.A., Gevers Deynoot-Schaub, M.J.J.M., Helmerhorst, K.O.W., Tavecchio, L.W.C., & Fukkink, R.G. (2009). Pedagogische kwaliteit van de opvang voor 0- tot 4-jarigen in Nederlandse kinderdagverblijven in 2008. Amsterdam/Nijmegen: NCKO.

Deynoot-Schaub, M. J. G., & Riksen-Walraven, J. M. (2005). Child care under pressure: The quality of Dutch centers in 1995 and in 2001. *The journal of genetic psychology*, 166(3), 280-296.

Drange, N., & Havnes, T. (2019). Early Childcare and Cognitive Development: Evidence from an Assignment Lottery. *Journal of Labor Economics*, 37(2), 581-620.

Driessen, G., Mulder, L., & Roeleveld, J. (2012). Cohortonderzoek COOL5-18 Technisch rapport basisonderwijs, tweede meting 2010/11. [Sl]: Nijmegen: ITS.

Edlund, L., Li, H., Yi, J., & Zhang, J. (2013). Sex Ratios and Crime: Evidence from China. *Review of Economics and Statistics*, 95(5), 1520-1534.

Engzell, P., Frey, A., & Verhagen, M. D. (2021). Learning Loss due to School Closures during the COVID-19 Pandemic. *Proceedings of the National Academy of Sciences*, 118(17).

Espinosa, J., & Evans, W. N. (2013). Maternal Bereavement: The Heightened Mortality of Mothers after the Death of a Child. *Economics & Human Biology*, 11(3), 371-381.

European Commission, EACEA, and Eurydice. (2015). Early Childhood Education and Care Systems in Europe. National Information Sheets–2014/15. Eurydice Facts and Figures.

Fan, Y., Yi, J., Yuan, Y., & Zhang, J. (2018). The Glorified Mothers of Sons: Evidence from Child Sex Composition and Parental Time Allocation in Rural China. *Journal of Economic Behavior & Organization*, 145, 249-260.

Fang, L., & Tian, C. (2018). Housing and Marital Matching: A Signaling Perspective. *China Economic Review*, 47, 27-46.

Felfe, C., & Lalive, R. (2018). Does Early Child Care Affect Children's Development?. *Journal of Public Economics*, 159, 33-53.

Felfe, C., Nollenberger, N., & Rodríguez-Planas, N. (2015). Can't Buy Mommy's Love? Universal Childcare and Children's Long-term Cognitive Development. *Journal of Population Economics*, 28(2), 393-422.

Fort, M., Ichino, A., & Zanella, G. (2020). Cognitive and Noncognitive Costs of Day Care at Age 0–2 for Children in Advantaged Families. *Journal of Political Economy*, 128(1), 158-205.

Francesconi, M., & Heckman, J. J. (2016). Child Development and Parental Investment: Introduction. *The Economic Journal*, 126(596), F1-F27.

Galatzer-Levy, I. R., & Bonanno, G. A. (2012). Beyond Normality in the Study of Bereavement: Heterogeneity in Depression Outcomes Following Loss in Older Adults. *Social Science & Medicine*, 74(12), 1987-1994.

Gan L, Yin Z, Tan J. (2016). *Report on the Development of Household Finance in Rural China* (2014). Springer, Singapore.

Gao, Y. (2021). Does child care affect children's ability? Evidence from the Netherlands. *Working paper*.

Gao, Y., Alessie, R., Angelini, V. (2021). Parental Housing Wealth and Children's Marriage Prospects in China. *Working paper*.

Gao, Y., Alessie, R., Angelini, V. (2021). Parental Bereavement and Health: Evidence from China. *Working paper*.

Gijzen, S., L'Hoir, M. P., Boere-Boonekamp, M. M., Need, A. (2016). How Do Parents Experience Support after the Death of Their Child?. *BMC Pediatrics*, 16(1), 1-10.

Ginther, D. K., & Pollak, R. A. (2004). Family Structure and Children's Educational Outcomes: Blended Families, Stylized Facts, and Descriptive Regressions. *Demography*, 41(4), 671-696.

Gough, P. B., & Tunmer, W. E. (1986). Decoding, Reading, and Reading Disability. *Remedial and Special Education*, 7(1), 6-10.

Grevenbrock, N., Groneck, M., Ludwig, A., & Zimper, A. (2021). Cognition, Optimism and the Formation of Age-dependent Survival Beliefs. *International Economic Review*, 62(2), 887-918.

Grier, K. B., Hicks, D. L., & Yuan, W. (2016). Marriage Market Matching and Conspicuous Consumption in China. *Economic Inquiry*, 54(2), 1251-1262.

Grönqvist, E., Öckert, B., & Vlachos, J. (2017). The intergenerational transmission of cognitive and noncognitive abilities. *Journal of Human Resources*, 52(4), 887-918.

Guo, M., Aranda, M. P., & Silverstein, M. (2009). The Impact of Out-migration on the Inter-generational Support and Psychological Wellbeing of Older Adults in Rural China. *Ageing & Society*, 29(7), 1085-1104.

Haelermans, C., Korthals, R., Jacobs, M., de Leeuw, S., Vermeulen, S., van Vugt, L., ... & de Wolf, I. (2022). Sharp Increase in Inequality in Education in Times of the COVID-19-Pandemic. *PloS One*, 17(2), e0261114.

Havnes, T., & Mogstad, M. (2011). No Child Left Behind: Subsidized Child Care and Children's Long-run Outcomes. *American Economic Journal: Economic Policy*, 3(2), 97-129.

Havnes, T., & Mogstad, M. (2015). Is Universal Child Care Leveling the Playing Field?. *Journal of Public Economics*, 127, 100-114.

Heckman, J., Moon, S. H., Pinto, R., Savelyev, P., & Yavitz, A. (2010). Analyzing Social Experiments as Implemented: A Reexamination of the Evidence from the HighScope Perry Preschool Program. *Quantitative economics*, 1(1), 1-46.

Heckman, J., Pinto, R., & Savelyev, P. (2013). Understanding the Mechanisms through which an Influential Early Childhood Program Boosted Adult Outcomes. *American Economic Review*, 103(6), 2052-86.

Helmerhorst, K. O., Riksen-Walraven, J. M. A., Gevers Deynoot-Schaub, M. J., Tavecchio, L. W., & Fukkink, R. G. (2015). Child care quality in the Netherlands over the years: A closer look. *Early Education and Development*, 26(1), 89-105.

Herbst, C. M., & Tekin, E. (2010). Child Care Subsidies and Child Development. *Economics of Education Review*, 29(4), 618-638.

Herbst, C. M., & Tekin, E. (2016). The Impact of Child‐care Subsidies on Child Development: Evidence from Geographic Variation in the Distance to Social Service Agencies. *Journal of Policy Analysis and Management,* 35(1), 94-116.

Ho, C. (2019). Child's Gender, Parental Monetary Investments and Care of Elderly Parents in China. *Review of Economics of the Household*, 17(3), 741-774.

Hoover, W. A., & Gough, P. B. (1990). The Simple View of Reading. *Reading and Writing*, 2(2), 127-160.

Hu, M., & Wang, X. (2020). Homeownership and Household Formation: No House, No Marriage?. *Journal of Housing and the Built Environment,* 35:763-781

Huang, W., Lei, X., Ridder, G., Strauss, J., & Zhao, Y. (2013). Health, Height, Height Shrinkage, and SES at Older Ages: Evidence from China. *American Economic Journal: Applied Economics*, 5(2), 86-121.

Hurd, M. D., & McGarry, K. (1995). Evaluation of the Subjective Probabilities of Survival in the Health and Retirement Study. *Journal of Human Resources*, S268-S292.

Knudsen, E. I., Heckman, J. J., Cameron, J. L., & Shonkoff, J. P. (2006). Economic, Neurobiological, and Behavioral Perspectives on Building America's Future Workforce. *Proceedings of the National Academy of Sciences*, 103(27), 10155-10162.

Lafortune, J., & Low, C. (2017a). Betting the House: How Assets Influence Marriage Selection, Marital Dtability, and Child Investments. IZA DP No. 11176.

Lafortune, J., & Low, C. (2017b). Tying the Double-knot: The Role of Assets in Marriage Commitment. *American Economic Review*, 107(5), 163-67.

Lee, C., Glei, D. A., Weinstein, M., & Goldman, N. (2014). Death of a Child and Parental Wellbeing in Old Age: Evidence from Taiwan. *Social Science & Medicine*, 101, 166-173.

Leeuwen, van, B. (2019). Individual Consumption, Time Use and their Distribution for the Dutch Population. [Groningen]: University of Groningen, SOM research school. https://doi.org/10.33612/diss.102593753

Lei, X., Shen, Y., Smith, J. P., & Zhou, G. (2017). Sibling Gender Composition's Effect on Education: Evidence from China. *Journal of Population Economics*, 30(2), 569-590.

Lei, X., Strauss, J., Tian, M., & Zhao, Y. (2015). Living Arrangements of the Elderly in China: Evidence from the CHARLS National Baseline. *China Economic Journal*, 8(3), 191-214.

Lei, X., Sun, X., Strauss, J., Zhang, P., & Zhao, Y. (2014). Depressive Symptoms and SES among the Mid-aged and Elderly in China: Evidence from the China Health and Retirement Longitudinal Study National Baseline. *Social Science & Medicine*, 120, 224-232.

Li, L., & Wu, X. (2017). The Consequences of Having a Son on Family Wealth in Urban China. *Review of Income and Wealth*, 63(2), 378-393.

Li, L., & Wu, X. (2019). Housing Price and Intergenerational Co-residence in Urban China. *Journal of Housing Economics*, 45, 101596.

Li, W., Song, C., Xu, S., & Yi, J. (2020). High Sex Ratios and Household Portfolio Choice in China. *Journal of Human Resources*, 1217-9245R2.

Li, J., Laursen, T. M., Precht, D. H., Olsen, J., & Mortensen, P. B. (2005). Hospitalization for Mental Illness among Parents after the Death of a Child. *New England Journal of Medicine*, 352(12), 1190-1196.

Li, L., & Wu, X. (2011). Gender of Children, Bargaining Power, and Intrahousehold Resource Allocation in China. *Journal of Human Resources*, 46(2), 295-316.s

Li, Q., & An, L. (2015). Intergenerational health consequences of the 1959–1961 Great Famine on children in rural China. *Economics & Human Biology*, 18, 27-40.

Lindeboom, M., Portrait, F., & Van den Berg, G. J. (2002). An Econometric Analysis of the Mental-health Effects of Major Events in the Life of Older Individuals. *Health Economics*, 11(6), 505-520.

Ma, M. (2019). Does Children's Education Matter for Parents' Health and Cognition? Evidence from China. *Journal of Health Economics*, 66, 222-240.

Merens, A., Van den Brakel, M., & Sociaal en Cultureel Planbureau & Centraal Bureau voor de Statistiek. (2014). Emancipatiemonitor 2012. The Hague: Sociaal en Cultureel Planbureau.

Middleton, P., & Slikkerveer, L. (Eds.). (2011). Key Figures 2006-2010: Education, Culture and Science. Ministry of Education, Culture and Science.

Midgley, C., Maehr, M.L., Hruda, L.Z., Anderman, E., Anderman, L., Freeman, K.E., Gheen, M., Kaplan, A., Kumar, R., Middleton, M.J., Nelson, J., Roeser, R., & Urdan, T. (2000). Manual for the Patterns of Adaptive Learning Scales (PALS). Ann Arbor, MI: University of Michigan.

Möller, J., Björkenstam, E., Ljung, R., & Åberg Yngwe, M. (2011). Widowhood and the Risk of Psychiatric Care, Psychotropic Medication and All-cause Mortality: A Cohort Study of 658,022 Elderly People in Sweden. *Aging & Mental Health*, 15(2), 259-266.

Naumann, I., McLean, C., Koslowski, A., Tisdall, K., & Lloyd, E. (2013). Early Childhood Education and Care Provision: International Review of Policy, Delivery and Funding. Scottish Government.

NICHD Early Child Care Research Network. (2002). Early Child Care and Children's Development prior to School Entry: Results from the NICHD Study of Early Child Care. American Educational Research Journal, 39(1), 133-164.

Nystedt, P. (2006). Marital Life Course Events and Smoking Behaviour in Sweden 1980–2000. *Social Science & Medicine*, 62(6), 1427-1442.

OECD (2017). Starting Strong 2017: Key OECD Indicators on Early Childhood Education and Care. Paris: OECD.

OECD (2020). OECD Family Database, OECD, Paris, www.oecd.org/els/family/database.htm.

Oliveira, J. (2016). The Value of Children: Inter-generational Support, Fertility, and Human CAapital. *Journal of Development Economics*, 120, 1-16.

Peracchi, F., & Perotti, V. (2010). Subjective Survival Probabilities and Life Tables: Evidence from Europe. Einaudi Institute for Economics and Finance (EIEF) *Working Paper*, 10, 16.

Plantenga, J., Wever, Y., Rijkers, B., & De Haan, P. (2005). Arbeidsmarktparticipatie en de kosten van kinderopvang. *Economisch Statistische Berichten*, 4455, 115.

Plantinga, M., Plantenga, J., & Siegers, J. (2010). The Relation between Market Forces and Employee Motivation: Consequences of the Introduction of Market Forces in the Dutch Childcare Sector. *European Sociological Review*, 26(4), 401-414.

Price, J. (2008). Parent-child Quality Time Does Birth Order Matter?. *Journal of Human Resources*, 43(1), 240-265.

Puri, M., & Robinson, D. T. (2007). Optimism and Economic Choice. *Journal of Financial Economics*, 86(1), 71-99.

Ren, Q., & Ye, M. (2017). Losing Children and Mental Well-being: Evidence from China. *Applied Economics Letters*, 24(12), 868-877.

Rogers, C. H., Floyd, F. J., Seltzer, M. M., Greenberg, J., & Hong, J. (2008). Long-term Effects of the Death of A Child on Parents' Adjustment in Midlife. *Journal of Family Psychology*, 22(2), 203.

Rostila, M., Saarela, J., & Kawachi, I. (2012). Mortality in Parents Following the Death of A Child: A Nationwide Follow-up Study from Sweden. *J Epidemiol Community Health*, 66(10), 927-933.

Scheffel, J., & Zhang, Y. (2019). How Does Internal Migration Affect the Emotional Health of Elderly Parents Left-behind?. *Journal of Population Economics*, 32(3), 953-980.

Scholte, R. S., Van Den Berg, G. J., & Lindeboom, M. (2015). Long-run Effects of Gestation during the Dutch Hunger Winter Famine on Labor Market and Hospitalization Outcomes. *Journal of Health Economics, 39, 17-30.*

Schreyer, I., & Oberhuemer, P. (2017). "The Netherlands - Key Contextual Data". In Workforce Profiles in Systems of Early Childhood Education and Care in Europe, edited by P. Oberhuemer and I. Schreyer. www.seepro.eu/English/Country_Reports.htm

Simeonova, E. (2013). Marriage, Bereavement and Mortality: The Role of Health Care Utilization. *Journal of Health Economics*, 32(1), 33-50.

Singhal, S. (2018). Early Life Shocks and Mental Health: The Long-term Effect of War in Vietnam. *Journal of Development Economics*, 141, 102244.

Song, J., Floyd, F. J., Seltzer, M. M., Greenberg, J. S., & Hong, J. (2010). Long-Term Effects of Child Death on Parents' Health-Related Quality of Life: A Dyadic Analysis. *Family Relations*, 59(3), 269-282.

Song, J., Mailick, M. R., Greenberg, J. S., & Floyd, F. J. (2019). Mortality in Parents after the Death of A Child. *Social Science & Medicine*, 112522.

Stopnitzky, Y. (2017). No Toilet No Bride? Intrahousehold Bargaining in Male-skewed Marriage Markets in India. *Journal of Development Economics*, 127, 269-282.

Stroebe, M., Stroebe, W., & Abakoumkin, G. (2005). The Broken Heart: Suicidal Ideation in Bereavement. *American Journal of Psychiatry*, 162(11), 2178-2180.

Sun, A., & Zhang, Q. (2020). Who Marries Whom in a Surging Housing Market?. *Journal of Development Economics*, 146, 102492.

Tseng, F. M., Petrie, D., & Leon-Gonzalez, R. (2017). The Impact of Spousal Bereavement on Subjective Wellbeing: Evidence from the Taiwanese Elderly Population. *Economics & Human Biology*, 26, 1-12.

Van Batenburg, T., & Van der Werf, M. (2004). NSCCT. Niet Schoolse Cognitieve Capaciteiten Test, Voor groep 4, 6 en 8 van het basisonderwijs. Verantwoording, normering en handleiding.

Van de Werfhorst, H. G. (2021). Inequality in Learning is a Major Concern after School Closures. *Proceedings of the National Academy of Sciences*, 118(20).

Van den Berg, G. J., & Siflinger, B. M. (2020). The Effects of Day Care on Health during Childhood: Evidence by Age.

Van den Berg, G. J., Lindeboom, M., & Portrait, F. (2011). Conjugal Bereavement Effects on Health and Mortality at Advanced Ages. *Journal of Health Economics*, 30(4), 774-794.

Van den Berg, G. J., Lundborg, P., & Vikström, J. (2017). The Economics of Grief. *The Economic Journal*, 127(604), 1794-1832.

Van Huizen, T. (2018). The Evolution of Achievement Gaps from Early Childhood to Adolescence in the Netherlands. In: G. Passaretta and J. Skopek (eds.), Roots and Development of Achievement Gaps. A Longitudinal Assessment in Selected European Countries, pp. 50-87, ISOTIS Report (D 1.3), Trinity College Dublin.

Van Huizen, T., & Plantenga, J. (2018). Do Children Benefit from Universal Early Childhood Education and Care? A Meta-analysis of Evidence from Natural Experiments. *Economics of Education Review*, 66, 206-222.

Vance, J. C., Najman, J. M., Boyle, F. M., Embelton, G., Foster, W. J., & Thearle, M. J. (1994). Alcohol and Drug Usage in Parents Soon after Stillbirth, Neonatal Death or SIDS. *Journal of Paediatrics and Child Health*, 30(3), 269-272.

Veen, A. N. N. E. M. I. E. K., Heurter, A. N. N. A., & Van der Veen, I. N. E. K. E. (2012). De pedagogische kwaliteit van peuterspeelzalen. Gegevens uit het pre-COOL cohortonderzoek in.

Verhoeven, L., & Van Leeuwe, J. (2008). Prediction of the Development of Reading Comprehension: A Longitudinal Study. Applied Cognitive Psychology: *The Official Journal of the Society for Applied Research in Memory and Cognitio*n, 22(3), 407-423.

Verhoeven, L., van Leeuwe, J., & Vermeer, A. (2011). Vocabulary Growth and Reading Development Across the Elementary School Years. *Scientific Studies of Reading*, 15(1), 8-25.

Vermeer, H. J., Van Ijzendoorn, M. H., De Kruif, R. E., Fukkink, R. G., Tavecchio, L. W., Riksen-Walraven, J. M., & Van Zeijl, J. (2008). Child care in the Netherlands: Trends in quality over the years 1995-2005. *The Journal of genetic psychology*, 169(4), 360-385.

Wei, S. J., & Zhang, X. (2011). The Competitive Saving Motive: Evidence from Rising Sex Ratios and Savings Rates in China. *Journal of Political Economy*, 119(3), 511-564.

Wei, S. J., Zhang, X., & Liu, Y. (2017). Home Ownership as Status Competition: Some Theory and Evidence. *Journal of Development Economics*, 127, 169-186.

Wei, Y., Jiang, Q., & Gietel-Basten, S. (2016). The Well-being of Bereaved Parents in An Only-child Society. *Death studies*, 40(1), 22-31.

Wrenn, D. H., Yi, J., & Zhang, B. (2019). House Prices and Marriage Entry in China. *Regional Science and Urban Economics*, 74, 118-130.

Xie, Y., & Jin, Y. (2015). Household Wealth in China. *Chinese Sociological Review*, 47(3), 203-229.

Yi, F., Liu, C., & Xu, Z. (2019). Identifying the Effects of Migration on Parental Health: Evidence from Left-behind Elders in China. *China Economic Review*, 54, 218-236.

Yu, J., & Xie, Y. (2015). Changes in the Determinants of Marriage Entry in Post-reform Urban China. *Demography*, 52(6), 1869-1892.

Samenvatting (Dutch Summary)

Ouders spelen een belangrijke rol in allerlei aspecten van het leven van hun kinderen. Gedurende het gehele leven van een kind hebben de ouders invloed. Dat begint al in de baarmoeder (Currie et al., 2018; Scholte et al., 2015), als baby (Alessie et al., 2018) en in de schoolgaande leeftijd (Grönqvist et al., 2017), en werkt nog door tot het kind volwassen is (Carneiro et al., 2021; Almond et al., 2018) en ouder wordt (Li en An, 2015). Andersom hebben kinderen ook invloed op het welzijn van hun ouders, bijvoorbeeld in de vorm van financiële, emotionele en functionele ondersteuning op latere leeftijd. Ouder-kindinteracties hebben niet alleen invloed op het welzijn van het gezin, maar hebben op de lange termijn ook effect op ongelijkheid. Daarom is het van belang om deze interacties over de gehele levenscyclus te analyseren.

Opmerkelijk is dat ouder-kindinteracties in verschillende culturen en economieën even belangrijk zijn, hoewel ze wel verschillende kenmerken lijken te vertonen die passen bij de setting waarin ze plaatsvinden. In dit paper onderzoek ik de invloed van ouder-kindinteracties in China en Nederland, twee landen die sterk verschillen qua cultuur en sociale voorzieningen. Dit proefschrift richt zich met name op twee aspecten van ouder-kindinteracties. Eerst bekijk ik welke invloed ouders hebben op de ontwikkeling van hun kinderen als baby (Hoofdstuk 2) en als volwassene (Hoofdstuk 3). Vervolgens onderzoek ik welke invloed kinderen op hun beurt op latere leeftijd op het welzijn van hun ouders hebben (Hoofdstuk 4).

In Hoofdstuk 2 onderzoek ik het effect van crèchebezoek in de leeftijd 0-2 op de cognitieve vaardigheden en zelfbeoordeelde eigenschappen van achtjarige kinderen in Nederland. Er is veel literatuur die erop wijst dat kinderen in de leeftijd 3-6, en dan met name kinderen in achterstandssituaties, op verschillende gebieden baat hebben bij naar de crèche gaan (Heckman et al., 2013; Havnes en Mogstad, 2015; Felfe et al., 2015). Naar de leeftijdsgroep 0-2 is echter minder onderzoek gedaan. Aangenomen wordt dat de eerste levensjaren van een kind cruciaal zijn voor zijn ontwikkeling. De hersenen zijn in deze fase immers het meest ontvankelijk, en de ervaringen die een kind nu heeft kunnen de basis leggen voor cognitieve en non-cognitieve ontwikkeling in de toekomst (Knudsen et al., 2006). Volgens de OECD Family Database (OESO, 2020) is Nederland een van de OESO-lidstaten met de hoogste aantallen deelnemers aan opvang en onderwijs voor kinderen in de leeftijdsgroep 0-3. Het is daarom belangrijk om te begrijpen welk effect opvang heeft op de ontwikkeling van kinderen in Nederland.

Om dit effect te schatten, heb ik gebruikgemaakt van gegevens uit de CohortOnderzoek OnderwijsLoopbanen van 5-18 jaar (COOL) en van een beleidshervorming in Nederland in 2005 waardoor de subsidies voor kinderopvang stegen. Mijn bevinding is dat dagopvang in de leeftijdsgroep 0-2 een negatief effect heeft op de scores van kinderen op het gebied van taakgerichtheid en begrijpend lezen, en een positief effect op hun vaardigheid in het technisch lezen. Bij kinderen met hoogopgeleide vaders is het negatieve effect nog sterker. Dit is in lijn met eerdere resultaten over de negatieve invloed van kinderopvang op welgestelde kinderen (zie bijv. Fort et al., 2020).

In Hoofdstuk 3 bekijken we binnen de Chinese context welk effect het vastgoedvermogen van ouders heeft op de huwelijkskansen van hun kinderen. Aangenomen wordt dat de huwelijkskansen van mensen samenhangt met hun vastgoedvermogen (zie bijv. Chu et al., 2020; Lafortune en Low, 2017b; Wei en Zhang, 2011), vooral in ontwikkelingslanden als China, waar vastgoedvermogen vaak wordt gezien als een statusgoed (Wei et al., 2017; Chu et al., 2020). Vastgoedvermogen speelt een belangrijkere rol op de huwelijksmarkt dan ander financieel vermogen (bijvoorbeeld in de vorm van aandelen en spaargeld) omdat het zichtbaarder is (Wei et al., 2017). Vooral als gevolg van de toenemende scheefgroei in de geslachtsverhouding in China (het overaanbod aan mannen op de huwelijksmarkt) lijkt vastgoedvermogen voor huwbare mannen een sterkere signaalwaarde te hebben dan voor vrouwen. De hypothese is dat jonge mannen met meer vastgoedvermogen een betere kans hebben om een partner te vinden en te trouwen. Deze hypothese wordt ondersteund door onderzoeksresultaten uit China, die erop wijzen dat vastgoedvermogen de huwelijkskansen van mannen verhoogt (bijv. Wei et al., 2017; Wei en Zhang, 2011).

Om de invloed van het vastgoedvermogen van ouders op de huwelijkssituatie van hun kinderen empirisch te onderzoeken, hebben we gebruikgemaakt van gegevens uit de jaargangen 2011, 2013 en 2015 van de China Health and Retirement Longitudinal Survey (CHARLS). De resultaten tonen aan dat het vastgoedvermogen van ouders een cruciale rol speelt in hoe hun kinderen de weg naar het huwelijk bewandelen. Dit is met name het geval voor mannen die volgens hun *hukou* als plattelandsbewoner geregistreerd staan. Voor vrouwen is het effect niet significant. Als de ouders van een mannelijke plattelandsbewoner bijvoorbeeld een duur huis hebben, heeft hij 10,77 procentpunt meer kans om een echtgenote te vinden. In tegenstelling tot vastgoedvermogen heeft ander vermogen geen invloed op de huwelijkskansen van jongeren. Dit is in lijn met de hypothese dat vastgoedvermogen een belangrijkere rol speelt op de huwelijksmarkt dan ander vermogen, omdat het in feite de meest zichtbare vorm van vermogen is. Ander vermogen is veel moeilijker na te gaan (Wei et al. 2017).

In Hoofdstuk 4 onderzoeken we welk effect het verlies van een kind heeft op de fysieke en mentale gezondheid en het welzijn van de ouders later in het leven. Nare levensgebeurtenissen kunnen het welzijn van ouderen negatief beïnvloeden. Het overlijden van een kind in het bijzonder heeft een grote invloed op het welzijn van ouderen, waaronder hun fysieke gezondheid (Rogers et al., 2008), mentale gezondheid (Li et al., 2005; Galatzer-Levy en Bonanno, 2012) en sociaal-economische status (Bucciol en Zarri, 2015; Van den Berg et al., 2017). Het negatieve effect van het verlies van een kind op het welzijn van de ouders is in veel ontwikkelde landen uitgebreid gedocumenteerd. Over China zijn echter minder gegevens bekend, terwijl de negatieve effecten hier sterker zouden kunnen zijn.

Voor deze onderzoeksvraag hebben we gegevens bekeken uit de jaargangen 2011 en 2013 van de China Health and Retirement Longitudinal Survey (CHARLS). Hieruit concluderen we dat ouders die een kind hebben verloren pessimistischer zijn over hun eigen overlevingskansen, meer symptomen van depressie vertonen, een lager subjectief welzijn hebben en meer geneigd zijn over zichzelf te zeggen dat ze een slechte gezondheid hebben dan ouders die dit nooit hebben meegemaakt. Belangrijk om te melden is dat voor moeders het verlies van een zoon een groter negatief effect heeft op de mentale gezondheid en zelfgescoorde gezondheid dan het verlies van een dochter.