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The Effect of Teenage Motherhood on the Behavioural Outcomes of the Offspring

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Abstract

Using data from the Understanding Society Study, this study examines the relationship between being born to a teenage mother and several behavioural outcomes in young adulthood (e.g. truancy, smoking, alcohol consumption, internalising and externalising problems). Besides standard multivariate OLS and logistic regression estimates, also estimates accounting for unobserved family background factors through sibling fixed-effects are presented. This method compares siblings born to the same mother who gave birth to at least one child as a teenager, and to another child when she was older. Only accounting for observable factors, teenage motherhood was associated with worse behavioural outcomes. After accounting for unobserved family factors through sibling fixed-effects, statistically significant effects were no longer found. For the internalising and total difficulties scores, significant interaction effects were found between being born to a teenage mother and gender. This paper shows that the positive association of teenage motherhood with worse offspring behavioural outcomes seems to be driven by family background factors and not by young maternal age per se. Furthermore, the results suggest that gender is an important factor in explaining differences in internalising and externalising behaviour among young adults.

Keywords: Sibling fixed-effects, teenage motherhood, behavioural outcomes, internalising problems, externalising problems

The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.

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1. Introduction

Teenage motherhood is seen as a worldwide cause for concern. Adolescent motherhood is associated with health risks to child and mother, worse behavioural and cognitive performance of the offspring, poverty and lower labour participation (Wilson & Huntington, 2006). Although adolescent birth rates in developed countries have declined substantially in recent decades, reducing teenage motherhood remains a target of public policies (Singh & Darroch, 2000). Governments have designed and implemented intervention programmes to prevent teenage childbearing (Oyedele, Wright, & Maja, 2015). The goal of these teenage pregnancy prevention frameworks is to reduce unplanned teenage conceptions and to improve the outcomes for both parents and children. It seems like policymakers have broadly accepted that teenage motherhood has dire socioeconomic consequences.

Among academics, however, there is little consensus as to whether teenage motherhood leads to worse outcomes. Some researchers question whether adolescent childbearing, net of family background characteristics, adversely affects the outcomes of mothers and their children. It might be these background factors that account for the worse outcomes and not teenage parenthood per se. To date, the actual causal effect of teenage motherhood on subsequent outcomes of the mother and her offspring remains unclear. To be able to estimate the effect of teenage motherhood, an appropriate measure of the counterfactual is required. The main problem is that it is not possible to observe what would have happened to those mothers who gave birth as an adolescent, had they not experienced teenage childbearing. This fundamental problem of causal inference is a matter of constant concern to researchers in this field of study (Holland, 1986).

In the case of outcomes for the mother, some studies have tried to address this problem by applying instrumental variable approaches or fixed-effects methods (Fletcher & Wolfe, 2009; Geronimus & Korenman, 1992; Holmlund, 2005; Hotz, Mullin, & Sanders, 1997). The effect of teenage motherhood on the outcomes for young adults or children has, however, received less attention. Most studies focusing on the outcomes for these groups have estimated the consequences of teenage motherhood on the offspring with Ordinary Least Squares (OLS) regressions with some controls for background factors (Dahinten, Shapka, & Willms, 2007; Levine, Pollack, & Comfort, 2001; Pevalin, 2003; Pogarsky, Thornberry, & Lizotte, 2006; Shaw, Lawlor, & Najman, 2006). Although these studies do control for some background factors, unmeasured or omitted variables could still bias the results. Studies that account for unobserved background characteristics in estimating the effect of adolescent motherhood on outcomes for the young adult offspring are rare.

A notable exception is the paper by Francesconi (2008), which examines the relationship between teenage motherhood and the outcomes for the children in early adulthood. This study by Francesconi

(2008) applies a sibling fixed-effects method to account for unmeasured family background heterogeneity. This research is one of the few in the literature on teenage motherhood focusing on outcomes of the offspring that has successfully addressed the problem of unobserved heterogeneity. The endogeneity issue has thus been dealt with for later-life outcomes of children of teenage mothers like employment status, smoking, psychological distress and income. For behavioural outcomes of the children the endogeneity problem of teenage motherhood has not yet been addressed with family fixed-effects methods.

Studying the effect of teenage motherhood on behavioural outcomes is, however, of great importance. Problem behaviour during childhood might have long-term consequences for a person's life (Cunha & Heckman, 2007). The prevalence of disruptive behaviour problems during childhood, among others, has been linked to unemployment later in life (Caspi, Wright, Moffitt, & Silva, 1998). This paper contributes to the literature by addressing the question of whether several behavioural outcomes of young adults aged 10-15 are associated with being born to an adolescent mother. Although the results in the present paper are not causal, they address, at least partly, the endogeneity problem of teenage motherhood.

This paper uses data from the young people's part of the Understanding Society Study to examine a variety of behavioural outcomes. The fact that there are nine waves available of this survey is exploited. This longer time frame namely allows to study both children born to a mother before her 20th birthday and their siblings who were born when the mother was older. In an attempt to measure the counterfactual more precisely, not only standard OLS and logistic regression analyses but also sibling fixed-effects regressions are employed. The fact that siblings share many similarities can be used to overcome bias induced by unobserved family-specific factors.

Applying a logistic regression, I find that children of teenage mother have a higher probability of playing truant than children born to older mothers. I also find that children of teenage mothers are more likely to have smoked cigarettes or consumed an alcoholic drink. Simply applying OLS with some controls for observable factors children of teenage mothers are found to have, on average, higher externalising scores and total difficulties scores than children born to older mothers. After controlling for family background factors through sibling fixed-effects, however, the results were no longer significant. Furthermore, a significant interaction effect between teenage motherhood and gender was found on the internalising and total difficulties scores. These results point to the fact that the effect of teenage motherhood may depend on the gender of the young adult. Overall, the results suggest that the positive association of teenage motherhood with the offspring's behavioural outcomes is driven by background characteristics and not by young maternal age at birth as such.

This paper is organised as follows. The next section provides a brief discussion on previous research in this field of study. Section 3 describes the dataset and presents summary statistics from the samples. Section 4 presents the empirical strategy. In section 5, the main findings are reported. Section 6 offers several robustness checks. Section 7 discusses the main results and limitations. Lastly, section 8 will offer a conclusion.

2. Literature Review

2.1 Endogeneity of Teenage Motherhood

A large number of studies have been conducted on the consequences of teenage childbearing for the mothers themselves. However, the question of whether teenage parents experience worse later-life economic outcomes remains controversial. The main concern in estimating these effects is the endogeneity of teenage motherhood. It is likely that there are factors that influence both the chance that a woman will give birth as a teenager and the woman's later-life outcomes. Some of these factors, however, are not observed, resulting in omitted variable bias. Kiernan (1997) investigated the background characteristics of adolescent parents and found that young parents are more likely to come from economically disadvantaged families and to have lower academic achievements. It might be that these factors lead to lower academic achievements among teenage mothers, and not teenage childbearing per se.

Kearney and Levine (2014) explore why certain teenagers in the United States are more likely to be unwed and to give first birth as an adolescent. They show that women with a low socioeconomic status are more likely to experience young nonmarital childbearing if they are an inhabitant of a place with a larger lower-tail income inequality. This study points to the idea that disadvantageous socioeconomic backgrounds predispose young women to become adolescent mothers. These conditions alone could predict poor outcomes for the teenage mothers and their children even in absence of adolescent childbearing. The endogeneity of teenage motherhood issue is well-recognized in the literature (Rozenzweig & Wolpin, 1995). Due to this endogeneity, most results in this field of study merely provide evidence of associations rather than causal inferences.

2.2 Later-life Consequences for the Mother

There have been some studies that have attempted to address these endogeneity problems. Geronimus and Korenman (1992) have looked at the socioeconomic consequences of teenage motherhood by comparing sisters that have timed their first birth at different ages. They find that analyses that do not take background information into account lead to upward biased estimates of the effect of teenage childbearing on later-life economic results. Although this finding was confirmed by Holmlund (2005), she questioned the validity of within-family estimates. This study contributes to the literature on within-sisters estimates by pointing to the importance of controlling for factors that differ between sisters. Using

propensity score matching, Chevalier and Viitanen (2003) find that teenage motherhood has a negative effect on education, labour market attachment and pay. Accounting for unobserved individual factors considerably reduces but does not eliminate the adverse effect.

Hotz et al. (1997) investigate the causal effect of teenage motherhood on later-life outcomes by using miscarriages as an instrumental variable (IV) for teenage births. This study does not find that teenage childbearing reduces the chance of receiving a school diploma. In a related vein, Fletcher and Wolfe (2009) use miscarriages as an IV to estimate the economic consequences of teenage childbearing. However, they add community fixed-effects to their analysis to control for unobserved confounding. In contrast to the findings of Hotz et al. (1997), they find evidence that adolescent childbearing reduces the probability of receiving a high school diploma and reduces annual income as a young adult. Although these differences in results could arise due to the application of different methods and data sources, the dissimilarities in estimates remain remarkable. One could question, however, if miscarriages are random. Ashcraft, Fernández-Val and Lang (2013) argue that miscarriages are not socially random because abortions reduce the risk of having a miscarriage. Pregnant teenagers who have an abortion, on average, come from more favoured backgrounds than teenagers who do not have an abortion. Using miscarriages as an IV might therefore still lead to biased estimates.

2.3 Outcomes of the Offspring

Research that discusses the empirical link between adolescent childbearing and outcomes for the offspring is rather rare. A great deal of attention, however, has been devoted to the intergenerational cycle of teenage motherhood. Daughters of teen mothers are found to be more likely of giving first birth in their teens (Ermisch & Pevalin, 2003; Furstenberg, Levine, & Brooks-Gunn, 1990; Jaffee, Caspi, Moffit, Belsky, & Silva, 2001; Manlove, 1997; Meade, Kershaw, & Ickovics, 2008; Navarro Paniagua & Walker, 2012; Pevalin, 2003).

The cognitive development of the offspring has also underpinned recent work on the effects of teenage motherhood. Some studies find that children of teenage mothers have significantly lower cognitive scores than children from mothers who were older at the moment of birth (Baldwin & Cain, 1980; Keown, Woodward, & Field, 2001; Morinis, Carson, & Quigley, 2013). On the other hand, Geronimus, Korenman and Hillemeier (1994) do not find that children of teen mothers score worse on measures of development. Levine et al. (2001) have argued as well that the adverse effects of teenage motherhood on the offspring's educational achievements can be almost entirely explained by the mother's individual and family background.

A few studies have applied family fixed-effects to investigate the causal relationship between teenage motherhood and several outcomes for the children, thereby accounting for both observable and unobservable family background characteristics. Family fixed-effects studies can eliminate factors that are common for the family members studied. Using data from the British Household Panel Survey, Francesconi (2008) examines the relationship between being born to a teenage mother and adult outcomes for the offspring. This study accounts for unobservable family characteristics by using mother fixed-effects. Compared to children of non-teen mothers, this study finds that children of adolescent mothers have a lower chance of high educational attainment, greater risk of teenage childbearing and a higher probability of being in the bottom of the earnings distribution. Geronimus et al. (1994) employed the National Longitudinal Survey of Youth to provide cousin fixed-effect estimates. They do not find that children of teen mothers come off worse on developmental measures than the cousins of these children that have older mothers.

The educational and later-life consequences of teenage motherhood for the children have been repeatedly investigated. This has been the case to a lesser extent with regards to behavioural outcomes of the children. Nevertheless, investigating the link between teenage childbearing and the offspring behavioural outcomes is of great importance. Jencks (1979) was among the first to draw attention to the relevance of personal characteristics in explaining economic success. Heckman, Stixrud and Urzua (2006) find that non-cognitive abilities raise wages through their direct effect on productivity, as well as through their indirect effect on work experience. Furthermore, Kautz, Heckman, Diris, ter Weel and Borghans (2014) argue that the development of non-cognitive skills is a dynamic process, in which the childhood years determine the investment in skills in later-years. Caspi et al. (1998) have pointed out that children involved in antisocial behaviour, among others, have an increased risk of becoming unemployed. This literature stresses the need for empirical analysis concerning the link between maternal age and behavioural outcomes for the children, as childhood behaviour is a determinant of many economic outcomes.

A small but growing body of empirical research focuses on the association of maternal age with offspring behavioural characteristics. Levine et al. (2001) provide evidence that maternal age at first birth affects problem behaviours among adolescents, even when one controls for several background characteristics. These behavioural problems include fighting, truancy and early sexual activity. Harden et al. (2007) examine the relationship between adolescent motherhood and children's behaviour, substance use, and internalising problems in a twin study. They find that teenage childbearing is associated with offspring mental health problems, even when one controls for both genetic and environmental factors. The relationship between adolescent motherhood and behavioural problems and substance use of the children was, to a certain extent, confounded by family background factors.

Using a sample of 139 adolescent mothers with a partner, Black et al. (2010) show that more than one-third of the children had externalising scores in the clinical range. A similar conclusion emerges from the study by Spieker, Larson, Lewis, Keller and Gilchrist (1999) that concentrates on disruptive behaviour problems among preschool children of adolescent mothers. They find that 36% of the children born to adolescent mothers scored in the borderline clinical range of the externalising scale. The findings of Dahinten et al. (2007) also support the notion that maternal age is related to internalising and externalising disorders. Shaw et al. (2006) examined the association of maternal age with the offspring's psychological, behavioural and health characteristics when the child was 14 years old. Their results indicate that children of teenage mothers are more likely to have disturbed psychological behaviour, to smoke regularly, consume alcohol and to have committed criminal offences. Furthermore, Pevalin (2003) shows that teachers of children born to younger mothers were more likely to consider these children below average on knowledge, less popular with their peers, less co-operative and less able to concentrate.

Some studies provide evidence on a gender-gap in disruptive behaviour of children of teenage mothers. In this light, Spieker et al. (1999) find that boys of teenage mothers exhibited higher levels of disruptive behaviour. In support of this claim, Pogarsky et al. (2006) find that the adverse effects of maternal age at birth varies substantially in terms of gender. Where boys born to younger mothers had an elevated risk of externalising problems, such an effect was not observed for girls. These findings are in line with a recent study by Bertrand and Pan (2013) that points out that boys, in comparison with girls, fare worse in broken families. In this perspective, teenage motherhood can be seen as a special case of nonmarital childbearing (Coley and Chase-Landsdale, 1998).

Although there have been some studies that examined the relationship among teenage mothers and the behavioural outcomes of the offspring, most of these studies fail to address the endogeneity problems. There are likely family background characteristics that influence both the chance that a woman will become a teenage mother and the development of their child. Even though these studies control for observable family characteristics, this does not prevent unobservable family characteristics from influencing the estimates. The present paper's contribution to the literature on this topic is twofold: Firstly, the paper adds to the existing literature by using sibling fixed-effects to partly overcome the bias induced by unobserved characteristics. Secondly, this study complements a growing body of work that documents the link between maternal age at birth and young adult offspring behaviour. The present paper focuses on the behavioural outcomes of children aged-10-15 by exploiting the young people's part from the recent Understanding Society Study. Several behavioural outcomes are studied including truancy, smoking, alcohol consumption and the child's internalising and externalising scores. Where outcomes for adults have been frequently studied, the empirical literature covering the behavioural outcomes for young adults is rather scarce.

3. Description of the Data

3.1 Understanding Society Study

Data from the UK Understanding Society Study has been used, a longitudinal household panel survey which captures information on everyone in a household. The members of the household are followed across time with interviews conducted from 2009 onwards. The study interviewed around 40,000 households. Data from the first nine waves has been exploited in this paper. Information on adults as well as on young adults was available. The Understanding Society Study contains, among others, an adult self-completion questionnaire and a youth self-completion questionnaire for young people aged 10-15. As soon as the young-person turns 16, the adult survey will become applicable. This young-people part includes several questions on their friendships, social behaviours, risky behaviours and their aspirations. Furthermore, the survey includes a wide variety of other variables on demographic and economic circumstances. In the remainder of this paper, young adults will refer to children aged 10 to 15.

3.2 Sampling Strategy

To estimate the effects of teenage motherhood on the subsequent behavioural outcomes of the offspring, young adults were first matched to their biological mothers. The birth year of the mother and the child were then used to determine whether the mother gave birth as a teenager. Information regarding the young adults themselves was obtained from the young people questionnaire. Information with regards to the mother, on the other hand, was obtained directly from the adult survey. Not all the questions that appear in the young people part are identical across the nine waves. Several questions are only asked every other year. Therefore, two different samples were used. Whereas the first sample consists of information available for all the nine waves, the second sample covers information appearing only in the odd waves of the survey. The samples consist of young adults that had mothers from whom their educational background and year of birth were available. Furthermore, four young adults with inconsistent information over time with regards to their sex were dropped. One young adult whose mother was seven years old at birth was considered an outlier and was therefore dropped.

3.2.1 *Nine Waves Sample*

This sampling strategy yielded a sample of 12,233 individuals aged 10-15 using data available for all the nine waves. Of these 12,233 individuals, 6,181 are male, and 6,052 are female (see Table 3.1). Of the 12,233 individuals in the main sample, 7,944 individuals could be matched to their siblings in any of the waves. 653 individuals with siblings were born to 266 different mothers who have experienced teenage childbearing at least once.

Table 3.1 The nine waves sample of young adults by gender

	Men	Women	Total
Number of individuals	6,181	6,052	12,233
Number of observations	16,314	16,195	32,509

Source: Understanding Society Study, waves 1-9.

For the fixed-effects estimation, it is crucial that there are differences in the focal variable among the siblings. This implies that each mother needs to have at least one child appearing in the dataset that was born before her 20th birthday, and at least one child born after her 20th birthday. Therefore, only the siblings born to mothers who gave birth as a teenager that satisfied this condition were kept in the sample of siblings. 590 individuals, born to 236 different mothers, could be identified that were born to a mother who experienced teenage childbearing. Furthermore, these individuals satisfied the requirement of variance in maternal age at birth across siblings. Of these 236 mothers, 154 mothers have two children in the sample, 53 of these mothers have three children, 24 have four children, 4 have five children, and one mother has seven children. In this within-family sample, 254 individuals were born to a teenage mother. The remaining 336 individuals were born to a mother aged 20 years and older.

3.2.2 *Odd Waves Sample*

For the odd waves, the sampling strategy yielded a sample of 5,539 boys and 5,487 girls (a total of 11,026 individuals) who were aged 10-15 (see Table 3.2). 7,256 individuals could be matched to at least one sibling in the five waves under study. This sample can be further broken down into a group of young adults whose mothers had a child before the age of 20. 480 individuals could be derived that had a mother who gave birth as a teenager. Furthermore, these children fulfilled the requirement of the variation in maternal age at birth across siblings. 271 children of this sample of siblings were born to a mother aged less than 20. The remaining 209 children were born to a mother older than 20 at birth.

Table 3.2 The odd waves sample of young adults by gender

	Men	Women	Total
Number of individuals	5,539	5,487	11,026
Number of observations	8,951	8,923	17,874

Source: Understanding Society Study, waves 1,3,5,7 and 9.

3.3 Outcomes

In total, two main samples and two subsamples were used. The first sample contains information available for all the nine waves under study. This main sample was further divided into a sample that contains information for siblings of mothers who gave birth as a teenager. The second sample contains information that appeared only in the odd waves of the study. From the main sample of the odd waves, a siblings sample was derived as well.

3.3.1 Outcomes Nine Waves Sample

Descriptive statistics of the outcome variables can be found in Table 3.3. Furthermore, Table A1 shows the means of the outcome variables for both young adults whose mothers gave birth as a teenager, and for young adults whose mothers never had a child as a teenager. The subsample of young adults whose mothers experienced teenage childbearing can be divided into a group of young adults that were born to a teenage mother and their siblings who were born to a non-teen mother.

Truancy. The measure of truancy takes value one if the child has ever played truant in the 12 months preceding the moment of the interview, and zero otherwise. The first two columns of Table A1 show that the differences between families are large (approximately 7 percentage points). This difference can be for the most part explained by the children of teen mothers who were born when their mother was aged less than 20 (last column in Table A1).

Smoking. This measure of smoking describes whether a young adult has ever smoked cigarettes. Table 3.3 shows that 12.8% of the young adults in the main sample have smoked a cigarette before. The differences between families are again quite large (about 6 percentage points). This between-family difference in smoking is again mostly driven by young adults born to mothers before their 20th birthday (First and last columns of Table A1).

Table 3.3 Descriptive statistics of young adult outcomes

	%	N
Truancy	16.4%	32,049
Smoking	12.8%	32,199
Alcohol	46.5%	32,152

Note. N is the number of observations that are relevant for each outcome. Figures are computed on the main sample of individuals for the nine waves (N=12,233). For each respondent, it has been determined whether the respondent has reached a certain outcome in any of the available waves.

Alcohol. The measure of Alcohol consumption takes the value of one if the individual ever had a whole alcoholic drink, and zero otherwise. The Understanding Society Study also includes a measure for the alcohol consumption of the young adults in the four weeks preceding the interview. However, for the subsample of children born to a mother who gave birth as a teenager, the different categories contained only a few observations. Therefore, only the simple measure of alcohol is used, as the more extensive alcohol variable might be too sensitive to outliers in the data. Table 3.3 shows that 46.5% of the young adults have ever consumed an alcoholic drink. As for the previous measures, the difference in alcohol consumption between families of approximately three and a half percentage points is sizeable (see Table A1). The difference within families for alcohol consumption of approximately 16 percentage points is huge (last two columns of Table A1).

3.3.2 *Outcomes Odd Waves Sample*

For the waves indicated by an odd number, the youth questionnaire contains the Strengths and Difficulties Questionnaire (SDQ). The SDQ is a screening on the behaviours and emotions of young adults. The SDQ asks about 25 positive or negative traits and is considered to be a useful measure of the psychopathology of youths (Goodman, 2001). The young person is asked to classify the item as certainly true, somewhat true or not true. These 25 items are divided between the following five scales: emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and prosocial behaviour. For each of the five scales the score can range from 0 to 10 if all the items underlying that scale were completed. These scales are often combined into an internalising and externalising subscale (Goodman, Lamping, & Ploubidis, 2010). These broader internalising and externalising scales are frequently used in low-risk samples. The use of 5 separate scales are found to be more advantageous in high-risk samples. The sum of the categories included in the externalising and internalising scale form the total difficulties score. In this study, the broader internalising and externalising scale have been used.

Internalising Score. The internalising scale is a combination of the emotional symptoms and peer-relationship problems. The internalising score can take on values between 0 and 20. A higher score is indicative for a higher level of internalising problems. Table 3.4 shows that the mean internalising score for the main sample is approximately 4.6. For this measure, only small differences seem to exist between families (around 0.4 point; Table A2). The differences within-families are minor as well (around 0.2 point). Notably, the average internalising score within-families is lower for the children born to mothers aged less than 20 at birth, than for the children born to older mothers (last two columns of Table A2).

Table 3.4 Descriptive statistics for the SDQ scores

	N	Mean	Std. deviation	Min	Max
Internalising score	17,652	4.555	3.016	0	20
Externalising score	17,650	6.010	3.363	0	20
Total difficulties score	17,642	10.566	5.311	0	40

Note. Figures are computed on the main sample of individuals for the odd waves (N=11,026). N denotes the number of observations relevant for each outcome. For each respondent, the means of the outcomes are computed over all the available waves.

Externalising Score. The externalising scale is constructed by summing the conduct problems scores and the hyperactivity/inattention scores. The externalising score ranges from 0 to 20. A higher score is indicative for more externalising problems. For the main sample, the mean of this score is around 6 (see Table 3.4). The differences between families for children of mothers who ever had a child as a teenager and children of mothers who had not are larger for the externalising than for the internalising score (around 1 point; first two columns of Table A2). It should be noted that the mean externalising score is higher for children born to non-teen mothers, than for children born to teenage mothers (third and fourth column of Table A2).

Total Difficulties Score. This variable is obtained by summing scores from all the scales, excluding the prosocial behaviour scale. The total difficulties score ranges from 0 to 40. A higher score is related to more problem behaviours. The mean total difficulties score for the whole sample yields approximately 10.6 (see Table 3.4). The total difficulties score is again higher for children born when the mother was aged more than 20, than for the children born when the mother was aged less than 20. These differences, however, are small (around 0.5 points; third and fourth column of Table A2).

3.3.3 *Teen Mom*

The main independent variable of the empirical analysis is the variable teen mom, which indicates whether a child was born to an adolescent mother. This variable will take the value one if the maternal age was less than 20 at the child's birth, and zero otherwise. The variable is specified as the age of the mother at the child's birth. To be able to perform the fixed-effects analysis, it is crucial that the variable teen mom can take on different values across siblings. Specifying the variable teen mom as the age of the mother at birth of the specific child ensures that such differences in this variable across siblings are possible. The age of the mother at birth ranges between 14 and 57. Table A3 reports that the average age of the mother at birth is 29.3. The median of mother's age at birth is 29, slightly smaller than the average age of the mothers in the main sample. Ninety per cent of the young adults in the sample were born to mothers aged between 20 (5th percentile) and 39 (95th percentile). The variable of interest in this study is whether a child was born to a teenage mother or not. 4.2% of the young adults had been born to a mother who was aged less than 20 at birth (see Table A3). Around 13 per cent of the young adults

had been born to a mother aged 20-23 at the moment of birth, while over 35 per cent of the children had been born to a mother aged 31 or more.

3.3.4 Control Variables

The analysis includes several control variables related to the child's demographic and family background characteristics. A fundamental feature of the Understanding Society Study is that it allows to match the individual characteristics of mothers to their children. The set of variables incorporated in the analysis compares well with other studies on this topic (Francesconi, 2008; Levine et al., 2001). Several socioeconomic variables are included in the Understanding Society Study, but most of them are measured after the birth of the young adult respondents. These factors play an intermediating, and not a confounding role. Intermediating variables are variables through which teenage motherhood exerts influence on the behavioural outcomes of the offspring. Therefore, variables measured postpartum were not included in the analyses. In this respect, one could question the inclusion of the highest qualification ever obtained by the mother in the analyses. Some mothers might have obtained their highest qualification after they gave birth to their children. As many mothers do obtain their qualifications before they give birth, the decision was made to retain the measure of mother's highest qualification in the analyses.

The summary statistics of the control variables for the main samples of individuals can be found in Table 3.5. For the sample of the odd waves, the summary statistics of the other variables used in the analyses can be found in Table A4. The summary statistics are computed on the entire sample using only one observation per individual for the last available wave. Again, the summary statistics for the control variables are shown not only between families but also within-families (see Tables A5 and A6). Just over half of the young-individuals in the sample were men. The age of the young adults ranges between 10 and 15, with an average age of over 13. Table 3.5 shows that the young adults are not evenly spread across the five different age groups. As mentioned, the statistics reported in Table 3.5 are calculated for the last available observation for each individual. This, and the fact the young-people part of the survey is applicable till the age of 15, can explain the relatively high proportion of individuals in the age group 15. Just under 25 per cent of the mothers reported an academic degree as their highest qualification obtained. Approximately 10 per cent of the mothers in the sample had no qualification at all. The differences between families for the highest qualification ever obtained by the mother are extremely large. Mothers who did not give birth as an adolescent have higher qualifications than mothers who did experience adolescent childbearing (first two columns of Tables A5 and A6).

Furthermore, three different dummy variables are included indicating the birth order of the specific child. The birth order of each child is constructed in such a way that not only the children appearing in

the dataset, but also non-resident children of the mother were taken into account. The main reason to add birth order indicators to the analysis is that maternal age at birth and the order of birth may be correlated. Within families, firstborn children tend to have younger mothers than second- or higher-born children. Besides, a dummy variable indicating whether the young adult has an English or Irish ethnical background is included in the analyses. Table 3.5 shows that around 72 per cent of the young adults in the main sample have an English or Irish ethnic background. Moreover, a control for the number of children in the main sample associated with each mother is included. Around 60 per cent of the young adults in the main sample were firstborn. On average, these young adults have 1.9 siblings in the dataset. Children born to a mother who had a child as a teenager have, on average, more siblings than children from mothers who did not give birth as an adolescent (First and second column of Tables A5 and A6).

Table 3.5 Summary statistics of the other variables used in the analyses for the nine waves sample

Variable	Mean	Standard deviation
Male	0.505	
Age (years)	13.450	1.727
Age group:		
10 (base)	0.091	
11	0.097	
12	0.102	
13	0.117	
14	0.166	
15	0.427	
Mother's number of children	1.935	0.911
Mother's age at birth	29.061	5.751
English or Irish ethnic background	0.716	
Birth order:		
First born(base)	0.570	
Second-born	0.305	
Third- or higher-born	0.126	
Mother's highest qualification:		
Degree (base)	0.242	
Other higher qualification	0.147	
A-level (or equivalent)	0.180	
GCSE (or equivalent)	0.250	
Other qualification	0.086	
No qualification	0.095	
Number of young adults	12,233	

Note. Figures are means computed on the main sample of individuals (N=12,233). For each individual, only one observation for the last available wave has been used. The qualification A-level corresponds to education beyond high school, but lower than a university degree. The General Certificate of Secondary Education (GCSE) is an academic qualification taken in England, North Ireland and, Wales.

4. Empirical Strategy

One of the main problems of estimating the effect of adolescent motherhood on subsequent outcomes for the children is the endogeneity of teenage motherhood. There are observed and unobserved factors that are correlated with both teenage motherhood and the behavioural outcomes for the young adult offspring. The background characteristics of a woman may partly determine whether she becomes a teenage mother or not. The same factors might influence the development of her children. If one fails to control for these background factors adequately, estimates of teenage childbearing will be biased. Negative consequences could, in that case, not be driven by maternal age at birth per se, but by these background characteristics. Although one can quite easily control for observed characteristics, controlling for unobserved heterogeneity is not that straightforward. It is therefore hard to disentangle the effect of teenage childbearing from other characteristics in empirical studies. The fact that siblings share many similarities can be exploited to account for family influences. Siblings, for example, share environmental and genetic factors. Children born to the same mother are likely to grow up in the same family, neighbourhood and recreational environment.

Two different strategies are applied to estimate the effect of teenage childbearing on the behavioural outcomes of the children. First of all, multivariate analyses are used on the main samples to estimate the relationship between adolescent childbearing and the offspring's behavioural outcomes, including individual characteristics of the mother and child. For continuous outcomes, regressions are estimated by OLS. For dichotomous outcomes, logistic analyses are conducted. A conventional OLS formulation is shown in (1).

$$Y_i = \alpha + \rho T + \beta X + \varepsilon \quad (1)$$

In (1) Y_i represents one of the outcome variables, and T denotes the explanatory variable teen mom. In (1) X denotes a vector of other variables included in the analyses. The error term ε contains the factors that are not included in the analyses. These factors may bias the results when they are correlated with the explanatory variables included in the model. Secondly, fixed-effects analyses are performed on the samples containing siblings only. Controlling for sibling fixed-effects eliminates omitted factors such as family or neighbourhood factors common to siblings. Sibling fixed-effects regressions can even control for shared genetic endowments. With fixed-effect regressions, one can better estimate the counterfactual condition than with the traditional regression models. The sibling fixed-effects formulation is shown in (2).

$$Y_{im} = a_m + \rho T_{im} + \beta X_{im} + \varepsilon_{im} \quad (2)$$

In (2) Y_{im} denotes a certain outcome for an individual i born to a mother m . a_m is the sibling fixed-effect and captures all factors that are similar for children born to the same mother. T_{im} represents the main explanatory variable in the analyses and is specific for each individual born to a certain mother. The error term ε_{im} and the set of other explanatory variables denoted by X_{im} are specific to each individual as well. The essence of the sibling fixed-effects is the use of differences to eliminate the effect of unobserved family background characteristics. The elimination of the fixed-effects component is shown in (3).

$$Y_{im} - Y_{jm} = (a_m - a_m) + \rho(T_{im} - T_{jm}) + \beta(X_{im} - X_{jm}) + (\varepsilon_{im} - \varepsilon_{jm}) \quad (3)$$

Taking the differences across siblings i and j born to the same mother m , removes the sibling fixed-effects denoted by a_m . As differences are taken, siblings of mothers who were all born when their mother was a teenager or when their mother was older than 20 years, were omitted. The factors that are common among siblings cannot be identified. The fixed-effects model does not eliminate, however, factors that differ across siblings. In the sibling fixed-effects regression, therefore, control variables are included only for characteristics that may differ between siblings. If there are non-common constant factors included in the error term, that are correlated with the main independent variable in the analysis, the estimators might still be biased. One should note, however, that many factors that differ across siblings are intermediating and not confounding factors. Socioeconomic changes that occur within families, for example, can in this respect be seen as a channel through which the effect of teenage motherhood emerges.

The results obtained from the logistic regressions can be hard to comprehend. To ease the interpretation of the results from logistic regressions marginal effects are often presented. Marginal effects, however, cannot be computed for fixed-effects logistic models. In fixed-effects logistic models the constant group term is cancelled out making it impossible to compute marginal effects (Silva & Kemp, 2016). Hence, the STATA command `aextlogit` is used for the sibling fixed-effects analyses when the dependent variable is dichotomous (Silva, 2019). This command estimates the average (semi-) elasticities which are easier to interpret than the logistic coefficients or odds ratios (Kitazawa, 2012). This command has recently been employed in other studies in the field of economics (Aderogba, & Adegboye, 2019; Cao, Bai, & Zhang, 2020). The coefficients can be interpreted as “when the child was born to a teenage mother the average change that the child plays truant increases by x .” For the logistic model without sibling fixed-effects the marginal effects are presented. For the logistic models with sibling fixed-effects, on the other hand, the average (semi-) elasticities are presented. In case of continuous outcomes, the OLS coefficients are reported.

5. Results

5.1 Results for the Conventional Regressions

Tables 5.1 and 5.2 report the estimates of the main results for the traditional logistic and OLS regressions. The treatment-group contains individuals who were born before their mother's 20th birthday. The control-group, on the other hand, consists of individuals whose mothers were older than 20 at birth. Table 5.1 shows the marginal effects for the variables truancy, smoking and alcohol. These marginal effects were computed after controlling for other factors and were computed at their average values. Children born to teenage mothers have an increased probability of approximately 2 percentage points to play truant in comparison with children born to older mothers. Children of teenage mothers also have a higher probability to have smoked than children of non-teen mothers. They are 1.3 percentage points more likely to have smoked a cigarette than children whose mothers were older at birth.

With respect to the outcome alcohol consumption, a similar pattern was found. Children born to an adolescent mother are significantly more likely to have ever consumed an alcoholic drink, compared to children of non-teen mothers. Being born to an adolescent mother increases the probability of having consumed an alcoholic drink with around 4 percentage points. The literature points to a gender gap in disruptive behaviour. Boys often exhibit higher levels of disruptive behaviours than girls (Pogarsky et al., 2006). The results indicate that the respondent's gender has a significant effect on whether the individual plays truant. Boys are 1.2 percentage points more likely to have played truant than girls. For the outcomes smoking and alcohol, no significant results were obtained with respect to gender (see Table 5.1).

The result for the externalising score also provides evidence on a positive association of being born to a teen mom with worse behavioural outcomes (see Table 5.2). For the internalising score, however, no statistically significant result was found. Controlling for observables, children of teenage mothers score worse on the externalising scale than children of non-teen mothers. Children of adolescent mothers score on average about 0.36 point higher on the externalising scale than young adults born to mothers after their 20th birthday. The results indicate that boys have significantly lower internalising scores than girls. For the externalising score, the exact opposite seems to be true. Boys, on average, tend to have significantly higher externalising scores than girls (approximately 0.8 points; second column Table 5.2). The result for the total difficulties score is statistically significant as well. Children of adolescent mothers score approximately 0.5 points higher on the total difficulties score than young adults born to older mothers.

Table 5.1 Marginal effects from logistic regressions of the effect of being born to a teenage mother on young adult outcomes

	Truancy	Smoking	Alcohol
Teen mom	0.019*	0.013*	0.038**
	(0.007)	(0.005)	(0.014)
Mother's age at birth	-0.002**	-0.002**	-0.004**
	(0.000)	(0.000)	(0.001)
Male	0.012**	-0.001	0.003
	(0.003)	(0.002)	(0.005)
11 years old	-0.000	0.005	0.005
	(0.004)	(0.002)	(0.006)
12 years old	0.007	0.018**	0.062**
	(0.004)	(0.003)	(0.007)
13 years old	0.027**	0.038**	0.155**
	(0.005)	(0.003)	(0.008)
14 years old	0.054**	0.079**	0.306**
	(0.005)	(0.004)	(0.009)
15 years old	0.085**	0.124**	0.434**
	(0.006)	(0.006)	(0.010)
Year of birth	-0.003**	-0.003**	-0.022**
	(0.001)	(0.000)	(0.001)
Other higher qualification	0.014**	-0.001	0.027**
	(0.004)	(0.003)	(0.009)
A-level	0.004	-0.004	0.015
	(0.004)	(0.003)	(0.008)
GCSE	0.021**	0.003	0.005
	(0.004)	(0.003)	(0.007)
Other qualification	0.032**	0.011**	0.009
	(0.006)	(0.004)	(0.011)
No qualification	0.039**	0.009*	-0.052**
	(0.006)	(0.004)	(0.010)
Mother's number of children	-0.008**	-0.006**	-0.041**
	(0.002)	(0.001)	(0.003)
Second-born	0.014**	0.010**	0.053**
	(0.003)	(0.002)	(0.006)
Third- or higher-born	0.038**	0.023**	0.088**
	(0.005)	(0.003)	(0.010)
English or Irish ethnic background	-0.006*	0.020**	0.235**
	(0.003)	(0.002)	(0.007)
<i>N</i>	32,049	32,199	32,152

Note. The figures are the marginal effects from logistic regressions computed at average values of all variables used in estimation. *N* is the number of observations relevant for each outcome. Figures are computed on the main sample of individuals for the nine waves ($N=12,233$). Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table 5.2 OLS results for the effect of being born to a teenager mother on young adult SDQ scores

	Internalising score	Externalising Score	Total difficulties Score
Teen mom	0.151 (0.132)	0.355* (0.152)	0.505* (0.238)
Mother's age at birth	-0.026** (0.005)	-0.063** (0.006)	-0.088** (0.009)
Male	-0.812** (0.049)	0.778** (0.053)	-0.035 (0.085)
11 years old	-0.106 (0.086)	-0.236* (0.092)	-0.340* (0.152)
12 years old	-0.145 (0.087)	-0.124 (0.094)	-0.271 (0.152)
13 years old	0.098 (0.092)	-0.099 (0.096)	0.002 (0.158)
14 years old	0.269** (0.092)	-0.103 (0.099)	0.168 (0.160)
15 years old	0.492** (0.098)	-0.266* (0.104)	0.227 (0.169)
Year of birth	0.060** (0.009)	-0.052** (0.010)	0.007 (0.015)
Other higher qualification	0.116 (0.080)	0.309** (0.085)	0.421** (0.138)
A-level	0.148 (0.077)	0.176* (0.082)	0.325* (0.132)
GCSE	0.105 (0.071)	0.225** (0.076)	0.328** (0.123)
Other qualification	0.325** (0.100)	0.568** (0.111)	0.894** (0.176)
No qualification	0.157 (0.096)	0.197 (0.111)	0.359* (0.174)
Mother's number of children	-0.087** (0.031)	-0.105** (0.036)	-0.192** (0.056)
Second-born	0.106 (0.058)	0.451** (0.064)	0.557** (0.102)
Third- or higher-born	0.346** (0.094)	0.805** (0.104)	1.148** (0.166)
English or Irish ethnic background	0.444** (0.056)	0.691** (0.062)	1.134** (0.099)
<i>N</i>	17,652	17,650	17,642

Note. The figures are coefficients from the OLS regressions. *N* is the number of observations relevant for each outcome. Figures are computed on the main sample of individuals for the odd waves ($N=11,026$). The internalising and externalising scores range between 0 and 20. The total difficulties score ranges between 0 and 40. Robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$.

5.2 Results for the Sibling Fixed-Effects Regressions

Tables 5.3 and 5.4 report the main finding for the sibling fixed-effects regressions. Once family background factors are accounted for, no statistically significant effects of being born to a teenage mother on the offspring's behavioural outcomes were found. Furthermore, after controlling for unobservable factors through sibling fixed-effects, a strong significant effect of gender on the internalising and externalising scales was found (see Table 5.4). Boys, on average, score approximately 1.1 points higher on the externalising scale than girls. For the internalising scores, a different pattern was found. Boys, on average, score about 1 point lower on the internalising scores than girls. The results point to a gender gap in internalising and externalising behaviour. When controlling for observable factors only, significant effects were found for all behavioural outcomes under study except for internalising problems. Significant effects of teenage motherhood on young adult behavioural outcomes, however, were no longer present after controlling for family background factors through sibling fixed-effects.

Table 5.3 Sibling fixed-effects results of the effect of being born to a teenage mother on young adult outcomes

	Truancy	Smoking	Alcohol
Teen mom	-0.443 (0.517)	0.754 (0.655)	0.112 (0.365)
Mother's age at birth	-0.106 (0.078)	0.059 (0.085)	-0.145** (0.052)
Male	0.399 (0.229)	-0.000 (0.261)	0.160 (0.140)
11 years old	-0.182 (0.361)	0.098 (0.452)	-0.187 (0.200)
12 years old	0.237 (0.319)	0.429 (0.437)	0.283 (0.186)
13 years old	0.651* (0.330)	0.519 (0.440)	0.579** (0.186)
14 years old	1.212** (0.334)	1.877** (0.426)	1.132** (0.199)
15 years old	1.174** (0.345)	2.367** (0.441)	1.630** (0.217)
Second-born	-0.079 (0.466)	0.342 (0.613)	0.459 (0.347)
Third- or higher-born	0.045 (0.605)	-0.089 (0.758)	0.440 (0.447)
<i>N</i>	756	616	1,162

Note. The figures are the average (semi-) elasticities from the logistic sibling fixed-effects estimates. *N* is the number of observations relevant for each outcome. The figures are computed on the individuals from the nine waves siblings sample (*N*=590). Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table 5.4 OLS sibling fixed-effects results of the effect of being born to a teenage mother on young adult SDQ scores

	Internalising score	Externalising score	Total difficulties score
Teen mom	-0.352 (0.854)	-1.517 (0.852)	-1.869 (1.265)
Mother's age at birth	0.020 (0.085)	-0.218 (0.127)	-0.195 (0.182)
Male	-1.021** (0.339)	1.102** (0.386)	0.070 (0.598)
11 years old	0.338 (0.485)	-0.458 (0.501)	-0.134 (0.817)
12 years old	-0.094 (0.330)	-0.246 (0.352)	-0.361 (0.567)
13 years old	0.478 (0.484)	-0.158 (0.440)	0.307 (0.757)
14 years old	-0.002 (0.425)	-0.244 (0.403)	-0.263 (0.713)
15 years old	0.715 (0.503)	-0.450 (0.512)	0.256 (0.847)
Second-born	-0.181 (0.922)	-0.646 (0.794)	-0.826 (1.345)
Third- or higher-born	-0.009 (1.251)	-0.046 (1.161)	-0.066 (1.958)
<i>N</i>	787	786	786

Note. The figures are coefficients from the OLS fixed-effects estimates. *N* is the number of observations relevant for each outcome. The figures are computed on the individuals from the odd waves siblings sample ($N=480$). The internalising and externalising scores range between 0 and 20. The total difficulties score ranges between 0 and 40. Robust standard errors are in parentheses. Standard errors are also robust to within family-clustering. * $p < 0.05$, ** $p < 0.01$.

6. Robustness Analyses

6.1 Interaction Teen Mom and Gender

To investigate whether the effect of being born to a teenage mother on behavioural outcomes depends on the gender of the young adult, an interaction term between being born to a teenage mother and the respondent's gender is included in the models for the SDQ scores. The interaction term between the variables teenage motherhood and gender is only included for the models with continuous outcomes. For dichotomous outcomes, logistic models were estimated. The coefficient in logistic models, however, cannot be used to draw conclusions about the significance of statistical interactions (Mize, 2019). The statistical significance of the interaction term could be evaluated by looking at the marginal effects. However, as previously discussed, it is not possible to apply margins after the employment of a logistic fixed-effects model (Silva & Kemp, 2016). Therefore, only for the outcomes of the odd waves sample, a model was estimated containing an interaction term. As sibling fixed-effects models are known to cause a more credible causal identification strategy than models simply controlling for observables, the results will only be discussed for the sibling fixed-effects models.

The interaction term yielded a significant result for both the internalising score and the total difficulties score (see Table A7). These significant results of the interaction term for the internalising and total difficulties scores indicate that there is a gender gap in disruptive behaviour among the children of teenage mothers. The effect of teenage motherhood on internalising problems seems to vary with the gender of the young adult. Figure A1 shows that the estimated internalising score is higher for girls born to teenage mothers than for girls born older mothers. For boys, the opposite seems to be true. Boys of teenage mothers are estimated to score lower on the internalising scale than boys of non-teen mothers. For the total difficulties score, there seems to be a crossover interaction effect (see Figure A2). That is to say that there is no overall effect of either teenage motherhood or gender on the total difficulties score (see Table 5.4). The effect of gender on the total difficulties score appears to be opposite, depending on whether the child was born to an adolescent mother. The estimated total difficulties score is higher for boys than for girls born to mothers older than 20 at birth (see Figure A2). For children born to teenage mothers, on the other hand, the estimated total difficulties score is higher for girls than for boys.

6.2 Interaction Teen Mom and Age of the Mother at Birth

The effect of being born to a teenage mother may vary with the age of the mother at birth. It could be the case that the developmental consequences for the offspring are more substantial when the mother gives birth at, for example, age 16 than at age 19. Therefore, an interaction term between the age of the mother at birth and whether the child was born to a teenage mother was included in the models. The interaction term has been included in the sibling fixed-effects models for the SDQ scores. No significant effect of the interaction term on any of the SDQ scores was found (see Table A8). Hence, the data does not support an effect of teenage motherhood on the offspring's behavioural outcomes that varies with the age of the mother at birth.

6.3 Conceptualisation of Teen Mom

Whether or not an effect of being born to a teenage mother on the behavioural outcomes is found, depends, among others, on the conceptualisation of the focal variable. As a way of evaluating the role played by the conceptualisation of the main independent variable on the results, the models are re-estimated with a different definition of the teen mom variable. The teen mom variable now takes value 1 if the young adult was born to a mother aged less than 19, and zero otherwise. Table A9 shows the marginal effects for the outcomes truancy, smoking and alcohol. Table A10, on the other hand, reports the results for the SDQ scores. As under the specification of teenage motherhood as childbearing before the age of 20, the results have a positive sign (see Tables 5.1 and 5.2). The coefficients are, however, of larger magnitude and reach a higher level of significance than with the previously used specification of teen mom (see Tables A9 and A10).

For the sibling fixed-effects analyses, similar conclusions emerge from the models where the cut-off point for teenage motherhood has been set at respectively 19 and 20 years old (See Table A11 and A12). When comparing the results for the fixed-effects models, it is important to note that the results were computed on different samples. For the sibling fixed-effects, variation in the teen mom variable across siblings is required. Less sibling pairs meet this criterion when the threshold for adolescent motherhood is set at 19 instead of 20 years old. With respect to the externalising score, the effect of gender did not reach significance once the threshold was lowered by one year (see Table A12). The same conclusions, however, can be drawn from both models with sibling fixed-effects when it comes to the effect of teenage motherhood on the behavioural outcomes. That is, for neither of the models, significant results of the effect of adolescent childbearing on the behavioural outcomes of the offspring were found (See Tables 5.3 and A11; Tables 5.4 and A12). Overall, the results suggest that the findings are robust to different conceptualisations of the focal variable.

6.4 Exclusion of Young Adults Without Siblings

The robustness of the results may depend on the exclusion of young adults without siblings in the dataset from the sample that is used for the sibling fixed-effects analyses. Children without siblings in the dataset might be systematically different from young adults with siblings in the data. To test the extent to which the exclusion of this group of young adults influences the results, estimates computed on two different samples are compared. Estimates are computed on both a sample with and without the restriction on whether the young adult has siblings in the dataset. This comparison is only feasible for the models without sibling fixed-effects, as the employment of sibling fixed-effects requires by nature that young adults without any siblings are excluded from the sample.

Table A13 compares the marginal effects across these two different samples for the outcomes truancy, smoking and alcohol consumption. Looking at the magnitude, direction and statistical significance, the results for the outcomes truancy and smoking suggest that the results are robust to the exclusion of young adults without siblings in the data (see Table A13). The result for the outcome alcohol consumption, however, does not seem to be robust to the exclusion of children without siblings in the dataset. Computed on the unrestricted sample, the marginal effect of teenage motherhood on the outcome reached significance at the one per cent level. Once computed on the sample containing only individuals with siblings, no significant marginal effect of teenage motherhood on alcohol consumption was found (See Table A13).

Table A14 provides the coefficients for the SDQ scores computed on both the sample consisting of all young adults and the sample containing only young adults with siblings in the data. For the externalising score and the total difficulties score the results did not reach significance after the exclusion of the young

adults without siblings in the sample. This is in contrary to the results obtained from the unrestricted sample, where the coefficients of both scores did reach significance. In short, the results are robust to the exclusion of the young adults without siblings only for the outcomes truancy and smoking.

7. Discussion

7.1 Discussion of the Results

The findings of the sibling fixed-effects regressions indicate that the positive association of young maternal age with adverse behavioural outcomes for the children is driven by other factors than being born to a teenage mother. The results from the standard regressions without fixed-effects could be attributed to selection into teenage childbearing caused by family background, neighbourhood or community factors. For the internalising score and total difficulties score, significant effects of the interaction term between gender and being born to a teenage mother were found. These findings suggest that the effect of teenage motherhood on internalising behaviour may depend on the gender of the offspring.

The findings in this study diverge from the findings of Harden et al. (2007), which show that adolescent motherhood is associated with an increased risk for internalising problems in offspring. This study by Harden et al. (2007), is most closely aligned to the paper at hand, as they have used a children-of-twins design to control for environmental and genetic factors common among twin mothers. Where this study by Harden et al. (2007), does find a relationship between teenage motherhood and the offspring's internalising scores, no significant result for the internalising score was found in the present study. In both the models with and without sibling fixed-effects an effect of teenage motherhood on the internalising score could not be detected (see Tables 5.2 and 5.4). To some extent the discrepancy in results between the present study and the study by Harden et al. (2007), may be due to different measurements of internalising problems. Furthermore, while the present study focuses on the outcomes for children aged 10 to 15 years old, the aforementioned study focuses on offspring aged 14 to 29 years old. The results are, therefore, only comparable to a limited extent.

Another related study by Levine et al. (2001) does find, unlike this study, a statistically significant effect of being born to a teenage mother on truancy after controlling for the mother's family background. This effect, however, is only statistically significant for children whose mothers were younger than 19 at the moment of birth. Lowering the threshold to 19 years old in the present study did not lead to a significant effect of teenage motherhood on truancy in the model with sibling fixed-effects (see Table A11). It should be noted, however, that the sibling fixed-effect method applied in this study controls for unobservable factors in contrary to the OLS technique employed by Levine et al. (2001). Hence, the

empirical method employed in the present study might control for more factors than the study by Levine et al. (2001), possibly resulting in more reliable estimates.

At first sight, the results in this study seem to contradict the findings by Shaw et al. (2005), that children from teenage mothers are more likely to consume alcohol and smoke regularly at the age of 14. It is remarkable, however, that observable socioeconomic factors in the latter study, almost entirely explain the association of maternal age with the offspring's smoking and alcohol consumption. With regards to controlling for background factors, the present paper has taken it a step further by controlling for unobservable factors. Acknowledging the differences in empirical strategies, the results found in this paper do not necessarily collide with the findings by Shaw et al. (2005).

Significant interaction effects between gender and teenage motherhood on the internalising and total difficulties scores were found in the present paper for the models with sibling fixed-effects. These results point to different effects of teenage motherhood on SDQ scores for boys and girls (see Table A7). Furthermore, for the model with sibling fixed-effects, gender was identified as a significant predictor of the externalising score (see Table 5.4). The results in this paper thus compare well with the literature on gender differences in behavioural problems (Bertrand & Pan, 2013; Spieker et al., 1999; Pogarsky et al., 2006).

Where other studies have found statistically significant effects of young maternal age on truancy, internalising scores, smoking and alcohol consumption, significant relationships were not found in the present paper. However, the discrepancies in findings can, at least in part, be devoted to different conceptualisations of the variables and the employment of distinct empirical methods. The paper at hand has applied a sibling fixed-effects method, which might better capture the influence of confounds than the relatively simple OLS regressions with controls for observables applied in related studies (Levine et al., 2001; Shaw et al., 2005).

7.2 Limitations

By the nature of its data, this study can account for many observed and unobserved factors. Several caveats of this study nevertheless have to be pointed out. Although the Understanding Society Study can be seen as a high-quality dataset, it nonetheless may be subject to misreporting. This study relies on potentially unreliable self-reports. As the focus of this study was on sensitive behaviour like alcohol consumption and smoking, it is more likely that the young adults answered the questions dishonestly.

Another limitation of the usage of the Understanding Society Study is the lack of information regarding the mother's characteristics at the offspring's birth. There was no information available on the mother's

completed education, whether she was working, relationship status or other potentially relevant control variables at the moment of birth of the offspring. These characteristics of the mother may vary across siblings and could, when included in the model, capture additional bias in the sibling fixed-effects analyses. Future research on the effects of teenage motherhood could employ data from a cohort study with information on siblings, as in that case, characteristics of the children are available from birth onwards.

Another major limitation of this study is the sample size for the sibling fixed-effects analyses. The sibling fixed-effects are based on characteristics that differ among siblings, and therefore siblings with the same value for a specific outcome are omitted in the analytical estimation by design. The sample that is eventually used for the analyses is thus limited to siblings that have different values for a certain behavioural outcome. Especially for dichotomous outcomes, the exclusion of siblings with identical outcomes reduces the already small sample of children born to mothers who experienced teenage childbearing even further. The statistical power of the sibling fixed-effects estimates is therefore a cause for concern.

In addition, concerning the siblings sample, only children who had siblings in the dataset were included. Only looking at children of mothers with more than one child in the sample could over-represent young adults of larger families. The results may, therefore, apply to a selected-group only, resulting in a limited external validity. The results on the robustness of the estimates to the exclusion of young adults without siblings showed that the results were sensitive to this sampling strategy (See Tables A13 and A14). Only for the outcomes truancy and smoking the result seemed to be robust to the exclusion of children without siblings in the dataset.

The sibling fixed-effects estimates control for any factors shared by biological siblings, but variables that vary across siblings remain as uncontrolled confounding factors. Antenatal maternal health, physical or mental, could be a factor that induces bias into the estimates. In this respect, factors associated with the biological father could play an important role as well. Children might inherit a propensity for certain behavioural traits from their biological fathers. Siblings born to a mother who experienced teenage childbearing do not necessarily have the same father. Therefore, differences in behaviour among siblings born to the same mother could partially reflect different inherited genes. The problem, however, especially in the literature on teenage motherhood, is that information concerning fathers is often missing. In the study at hand, the limited available information for fathers was the main reason for not including father-related variables in the analyses.

The findings of this paper point to the general conclusion that background risk factors seem to play a crucial role in explaining the association of teenage motherhood with higher levels of behaviour

problems for the offspring. Future research should attempt to identify whether these background factors are of an environmental or a genetic nature. The sibling fixed-effect can account for all family background factors that are similar among siblings but is not able to identify where this within-family variation is coming from. Examining which underlying processes are responsible for the associations of teenage motherhood with several problem behaviours could be policy-relevant.

With respect to the internalising score and the total difficulties score, statistically significant interaction effects between gender and teenage motherhood were found. This implies that the effect of being born to a teenage mother may depend on the offspring's sex. These findings are based, however, on a small number of observations. Some caution is therefore required in the interpretation of the results. Future research on the relationship between teenage motherhood and offspring behaviour should consider the potential effects of gender more carefully.

8. Conclusion

Using the Understanding Society Study from the UK, this study investigates the relationship between several young adult behavioural outcomes and whether these young adults were born to a mother aged less than 20. By employing OLS and standard logistic techniques, I find, firstly, that being born to a teenage mother is associated with inferior behavioural outcomes when accounting for some observable individual and family background characteristics. Children of adolescent mothers are found more likely to play truant, drink alcohol and smoke cigarettes. Besides, I find that the young adults born to teenage mothers score significantly higher on both the externalising and total difficulties scales. Because of the concern that unobserved within-family heterogeneity might bias the conventional OLS and logistic estimates, sibling fixed-effects regressions were conducted as well.

Secondly, after controlling for unobserved family background factors, statistically significant effects of adolescent motherhood on the child's subsequent behavioural outcomes were no longer found. Allowing the effect of teenage motherhood on the internalising and the total difficulties scores to vary by gender did lead to significant results. The results suggest that the effect of being born to a teenage mother on the internalising and total difficulties scores may depend on whether the young adult is a boy or a girl.

Although not conclusive, these findings indicate that the initially significant association of young maternal age with worse behavioural outcomes is likely to be driven by family background factors and not necessarily by teenage motherhood. Furthermore, the results for the internalising and total difficulties scores suggest that there is no effect of teenage motherhood as such, but that the effect may depend on the offspring's gender. In conclusion, this paper contributes to the literature on examining the relationship between adolescent childbearing and the offspring's behavioural outcomes in two

important ways. First, where simple regressions with controls for observables are typically used to assess the relationship between teenage motherhood and the offspring's behavioural outcomes, this paper uses sibling fixed-effects to deal with unobserved family-related factors. Second, this study focuses on behavioural outcomes for young adults, a group and topic that have both systematically received less attention in the literature on teenage childbearing.

The results highlight the importance of family-specific background factors for the later-life development of children. This study suggests that policies aiming at improving circumstances for children of adolescent mothers should focus less on maternal age as such, and more on increasing the support among those from underprivileged backgrounds. Furthermore, the results indicate that more consideration should be given to a potential gender disparity in behaviour among children of teenage mothers.

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Appendix

Table A1 Child outcomes within and between families

	Between families		Within family (subsample of children whose mother gave birth as a teenager)	
	Children of mothers who never had a child as a teenager	Children of mothers who had a child as a teenager	Children born when the mother was aged 20 or more	Children born when the mother was aged less than 20
Truancy	0.159	0.226	0.202	0.264
Smoking	0.124	0.185	0.146	0.248
Alcohol	0.463	0.497	0.443	0.606
Number of children	11,310	923	336	254

Note. The between families figures are means computed on the main sample of individuals (N=12,233). The within family figures are means computed on the nine waves siblings sample (N=590). For each respondent, it has been determined whether the respondent has reached a certain outcome in any of the available waves.

Table A2 SDQ scores within and between families

	Between families		Within family (subsample of children whose mother gave birth as a teenager)	
	Children of mothers who never had a child as a teenager	Children of mothers who had a child as a teenager	Children born when the mother was aged 20 or more	Children born when the mother was aged less than 20
Internalising score	4.529	4.883	4.896	4.700
Externalising score	5.938	6.932	7.115	6.788
Total difficulties score	10.468	11.813	12.009	11.488
Number of children	10,220	806	271	209

Note. The between families figures are means computed on the main sample of individuals for the odd waves (N=11,026). The within family figures are means computed on the odd waves siblings sample (N=480). For each respondent, the means of the outcomes are computed over all the available waves.

Table A3 Summary statistics of mother's age at birth

Age of mother at birth	Mean	Percentile				
		5 th	25 th	50 th	75 th	90 th
Age (Years)	29.3	20	25	29	33	37
Proportion of young adults by mother-age-at-birth group (%)						
Less than 20	4.2					
20-23	13.1					
24-27	20.0					
28-31	26.2					
More than 31	36.5					

Note. Figures are computed on the main sample of individuals for the nine waves (N=12,233).

Table A4 Summary statistics of the other variables used in the analyses for the odd waves sample

Variable	Mean	Standard deviation
Male	0.502	
Age (years)	13.163	1.649
Age group:		
10 (base)	0.096	
11	0.109	
12	0.127	
13	0.134	
14	0.274	
15	0.260	
Mother's number of children	1.947	0.910
Mother's age at birth	29.128	5.738
English or Irish ethnic background	0.722	
Birth order:		
First born (base)	0.561	
Second-born	0.312	
Third- or higher-born	0.127	
Mother's highest qualification:		
Degree (base)	0.244	
Other higher qualification	0.150	
A-level (or equivalent)	0.180	
GCSE (or equivalent)	0.249	
Other qualification	0.084	
No qualification	0.094	
Number of young adults	11,026	

Note. Figures are means computed on the main sample of individuals for the odd waves (N=11,026). For each individual, only one observation for the last available wave has been used. The qualification A-level corresponds to education beyond high school, but lower than a university degree. The General Certificate of Secondary Education (GCSE) is an academic qualification taken in England, North Ireland and, Wales.

Table A5 Young adult characteristics between and within families for the nine waves sample

	Between families		Within family (subsample of children whose mother gave birth as a teenager)	
	Children of mothers who never had a child as a teenager	Children of mothers who had a child as a teenager	Children born when the mother was aged 20 or more	Children born when the mother was aged less than 20
Male	0.505	0.514	0.528	0.510
Age (years)	12.547	12.265	11.639	13.445
Mother's number of children	1.912	2.201	2.899	2.567
Mother's age at birth	29.813	19.860	22.884	18.240
English or Irish ethnic background	0.749	0.713	0.730	0.745
Birth order:				
First born (base)	0.570	0.572	0.000	0.917
Second-born	0.306	0.293	0.640	0.079
Third- or higher-born	0.125	0.135	0.360	0.004
Mother's highest qualification:				
Degree (base)	0.256	0.066	-	-
Other higher qualification	0.149	0.130	-	-
A-level (or equivalent)	0.181	0.171	-	-
GCSE (or equivalent)	0.241	0.365	-	-
Other qualification	0.085	0.093	-	-
No qualification	0.087	0.175	-	-
Number of young adults	11,310	923	336	254

Note. The between families figures are means computed on the main sample of individuals (N=12,233). The within family figures are means computed on the nine waves siblings sample (N=590). For each individual, the means of variables that are time varying are computed over all the available waves. The qualification A-level corresponds to education beyond high school, but lower than a university degree. The General Certificate of Secondary Education (GCSE) is an academic qualification taken in England, North Ireland and, Wales.

Table A6 Young adult characteristics between and within families for the odd waves samples

	Between families		Within family (subsample of children whose mother gave birth as a teenager)	
	Children of mothers who never had a child as a teenager	Children of mothers who had a child as a teenager	Children born when the mother was aged 20 or more	Children born when the mother was aged less than 20
Male	0.501	0.516	0.528	0.510
Age (years)	12.534	12.247	11.664	13.352
Mother's number of children	1.925	2.232	2.915	2.603
Mother's age at birth	29.855	19.911	22.884	18.240
English or Irish ethnic background	0.746	0.720	0.716	0.737
Birth order:				
First born (base)	0.561	0.561	0.000	0.909
Second-born	0.314	0.296	0.638	0.86
Third- or higher-born	0.125	0.143	0.361	0.005
Mother's highest qualification:				
Degree (base)	0.258	0.066		
Other higher qualification	0.150	0.134		
A-level (or equivalent)	0.181	0.166		
GCSE (or equivalent)	0.240	0.369		
Other qualification	0.084	0.089		
No qualification	0.087	0.176		
Number of young adults	10,220	806	271	209

Note. The between families figures are means computed on the main sample of individuals for the odd waves (N=11,026). The within family figures are means computed on the odd waves siblings sample (N=480). For each individual, the means of variables that are time varying are computed over all the available waves. The qualification A-level corresponds to education beyond high school, but lower than a university degree. The General Certificate of Secondary Education (GCSE) is an academic qualification taken in England, North Ireland and, Wales.

Table A7 OLS sibling fixed-effects results with interaction term of teen mom and gender of the effect of being born to a teenage mother on young adult SDQ scores

	Internalising score	Externalising score	Total difficulties score
Teen mom	0.542 (0.976)	-0.827 (1.015)	-0.280 (1.521)
Male	-0.517 (0.431)	1.490** (0.520)	0.965 (0.797)
Teen mom * male	-1.357* (0.588)	-1.047 (0.751)	-2.411* (1.154)
Mother's age at birth	0.037 (0.085)	-0.205 (0.125)	-0.166 (0.178)
11 years old	0.351 (0.480)	-0.449 (0.497)	-0.114 (0.804)
12 years old	-0.099 (0.329)	-0.250 (0.353)	-0.371 (0.567)
13 years old	0.533 (0.480)	-0.116 (0.438)	0.403 (0.748)
14 years old	0.006 (0.423)	-0.238 (0.402)	-0.249 (0.710)
15 years old	0.797 (0.499)	-0.387 (0.506)	0.401 (0.833)
Second-born	-0.035 (0.941)	-0.534 (0.785)	-0.568 (1.350)
Third- or higher-born	0.123 (1.243)	0.055 (1.140)	0.167 (1.915)
<i>N</i>	787	786	786

Note. The figures are coefficients from the OLS fixed-effects estimates. *N* is the number of observations relevant for each outcome. The figures are computed on the individuals from the odd waves siblings sample (*N*=480). The internalising and externalising scores range between 0 and 20. The total difficulties score ranges between 0 and 40. Robust standard errors are in parentheses. Standard errors are also robust to within family-clustering. * $p < 0.05$, ** $p < 0.01$.

Table A8 OLS sibling fixed-effects results with interaction term of teen mom and mother's age at birth of the effect of being born to a teenage mother on young adult SDQ scores

	Internalising score	Externalising score	Total difficulties score
Teen mom	-5.306 (5.340)	8.770 (6.683)	3.630 (10.730)
Mother's age at birth	0.001 (0.089)	-0.178 (0.131)	-0.174 (0.190)
Teen mom * mother's age at birth	0.257 (0.275)	-0.533 (0.339)	-0.285 (0.550)
Male	-1.036** (0.342)	1.132** (0.385)	0.086 (0.601)
11 years old	0.336 (0.486)	-0.455 (0.502)	-0.133 (0.817)
12 years old	-0.080 (0.330)	-0.280 (0.354)	-0.379 (0.573)
13 years old	0.479 (0.482)	-0.162 (0.439)	0.305 (0.759)
14 years old	0.009 (0.425)	-0.270 (0.406)	-0.277 (0.717)
15 years old	0.727 (0.505)	-0.477 (0.511)	0.241 (0.849)
Second-born	-0.391 (0.944)	-0.209 (0.840)	-0.593 (1.388)
Third- or higher-born	-0.181 (1.245)	0.309 (1.159)	0.124 (1.927)
<i>N</i>	787	786	786

Note. The figures are coefficients from the OLS fixed-effects estimates. *N* is the number of observations relevant for each outcome. The figures are computed on the individuals from the odd waves siblings sample (N=480). The internalising and externalising scores range between 0 and 20. The total difficulties score ranges between 0 and 40. Robust standard errors are in parentheses. Standard errors are also robust to within family-clustering. * $p < 0.05$, ** $p < 0.01$.

Table A9 Marginal effects from logistic regressions of the effect of being born to a mother aged less than 19 on young adult outcomes

	Truancy	Smoking	Alcohol
Teen mom (age<19)	0.030** (0.010)	0.019** (0.007)	0.054** (0.019)
Mother's age at birth	-0.002** (0.000)	-0.002** (0.000)	-0.004** (0.001)
Male	0.013** (0.003)	-0.001 (0.002)	0.003 (0.005)
11 years old	-0.000 (0.004)	0.005 (0.002)	0.005 (0.006)
12 years old	0.007 (0.004)	0.018** (0.003)	0.062** (0.007)
13 years old	0.027** (0.005)	0.038** (0.003)	0.155** (0.008)
14 years old	0.054** (0.005)	0.079** (0.004)	0.306** (0.009)
15 years old	0.085** (0.006)	0.124** (0.006)	0.433** (0.010)
Year of birth	-0.003** (0.001)	-0.003** (0.000)	-0.022** (0.001)
Other higher qualification	0.014** (0.004)	-0.001 (0.003)	0.027** (0.009)
A-level	0.004 (0.004)	-0.004 (0.003)	0.015 (0.008)
GCSE	0.021** (0.004)	0.003 (0.003)	0.005 (0.007)
Other qualification	0.032** (0.006)	0.011** (0.004)	0.010 (0.011)
No qualification	0.039** (0.006)	0.009* (0.004)	-0.052** (0.010)
Mother's number of children	-0.008** (0.002)	-0.006** (0.001)	-0.041** (0.003)
Second-born	0.014** (0.003)	0.010** (0.002)	0.053** (0.006)
Third- or higher-born	0.038** (0.005)	0.023** (0.003)	0.088** (0.010)
English or Irish ethnic background	-0.006* (0.003)	0.020** (0.002)	0.235** (0.007)
<i>N</i>	32,049	32,199	32,152

Note. The figures are the marginal effects from logistic regressions computed at average values of all variables used in estimation. *N* is the number of observations relevant for each outcome. Figures are computed on the main sample of individuals for the nine waves (N=12,233). Standard errors are in parentheses. * p <0.05, ** p <0.01.

Table A10 OLS results for the effect of being born to a mother aged less than 19 on the young adult SDQ scores

	Internalising score	Externalising Score	Total difficulties Score
Teen mom (age<19)	0.145 (0.170)	0.636** (0.200)	0.780* (0.312)
Mother's age at birth	-0.027** (0.005)	-0.062** (0.005)	-0.089** (0.009)
Male	-0.812** (0.049)	0.781** (0.053)	-0.031 (0.085)
11 years old	-0.106 (0.086)	-0.236* (0.092)	-0.341* (0.152)
12 years old	-0.145 (0.087)	-0.125 (0.094)	-0.272 (0.152)
13 years old	0.098 (0.092)	-0.098 (0.096)	0.003 (0.158)
14 years old	0.269** (0.092)	-0.104 (0.099)	0.167 (0.160)
15 years old	0.492** (0.098)	-0.264* (0.104)	0.229 (0.169)
Year of birth	0.060** (0.009)	-0.052** (0.010)	0.007 (0.015)
Other higher qualification	0.116 (0.080)	0.311** (0.085)	0.425** (0.138)
A-level	0.147 (0.077)	0.179* (0.082)	0.327* (0.132)
GCSE	0.105 (0.071)	0.227** (0.076)	0.330** (0.123)
Other qualification	0.325** (0.100)	0.569** (0.111)	0.895** (0.176)
No qualification	0.158 (0.096)	0.194 (0.111)	0.358* (0.173)
Mother's number of children	-0.088** (0.031)	-0.106** (0.036)	-0.193** (0.056)
Second-born	0.105 (0.058)	0.454** (0.064)	0.559** (0.102)
Third- or higher-born born	0.346** (0.094)	0.805** (0.104)	1.148** (0.166)
English or Irish ethnic background	0.446** (0.056)	0.689** (0.062)	1.133** (0.098)
<i>N</i>	17,652	17,650	17,642

Note. The figures are coefficients from the OLS regressions. *N* is the number of observations relevant for each outcome. Figures are computed on the main sample of individuals for the odd waves (*N*=11,026). The internalising and externalising scores range between 0 and 20. The total difficulties score ranges between 0 and 40. Robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A11 Sibling fixed-effects results of the effect of being born to a mother aged less than 19 on young adult outcomes

	Truancy	Smoking	Alcohol
Teen mom (age<19)	0.137 (0.651)	0.165 (0.887)	0.044 (0.620)
Mother's age at birth	-0.131 (0.095)	-0.240 (0.129)	-0.166** (0.062)
Male	0.489 (0.264)	-0.217 (0.339)	0.112 (0.171)
11 years old	-0.148 (0.405)	0.015 (0.526)	-0.203 (0.240)
12 years old	0.240 (0.360)	-0.232 (0.541)	0.289 (0.221)
13 years old	0.610 (0.370)	-0.070 (0.538)	0.640** (0.223)
14 years old	0.988* (0.385)	1.266* (0.510)	1.421** (0.248)
15 years old	1.191** (0.382)	2.107** 0.015	1.860** (0.264)
Second-born	0.583 (0.620)	0.972 (0.877)	0.527 (0.603)
Third- or higher-born	0.563 (0.760)	0.964 (1.039)	0.614 (0.676)
<i>N</i>	517	427	792

Note. The figures are the average (semi-) elasticities from the logistic sibling fixed-effects estimates. *N* is the number of observations relevant for each outcome. The figures are computed on a sample of siblings with mothers who experienced teenage childbearing before the age of nineteen (N=385). Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A12 OLS sibling fixed-effects results of the effect of being born to a mother aged less than 19 on young adult SDQ scores

	Internalising	Externalising	Total difficulties score
Teen mom (age<19)	0.020 (1.474)	-0.569 (2.162)	-0.549 (3.597)
Mother's age at birth	0.113 (0.143)	-0.324 (0.164)	-0.212 (0.270)
Male	-1.389** (0.416)	0.639 (0.493)	-0.751 (0.746)
11 years old	-0.929 (0.504)	-0.594 (0.624)	-1.522 (0.888)
12 years old	-1.081** (0.412)	-0.092 (0.451)	-1.173 (0.684)
13 years old	-0.587 (0.589)	-0.109 (0.569)	-0.696 (0.939)
14 years old	-0.676 (0.530)	-0.629 (0.515)	-1.306 (0.892)
15 years old	-0.280 (0.645)	-0.464 (0.649)	-0.744 (1.093)
Second-born	-0.318 (1.199)	0.427 (2.047)	0.109 (3.221)
Third- or higher-born	-0.105 (1.293)	1.527 (2.275)	1.423 (3.355)
<i>N</i>	503	503	503

Note. The figures are coefficients from the OLS fixed-effects estimates. *N* is the number of observations relevant for each outcome. The figures are computed on the individuals from the odd waves siblings sample with mother's who experienced teenage childbearing before the age of 19 (*N*=318). The internalising and externalising scores range between 0 and 20. The total difficulties score ranges between 0 and 40. Robust standard errors are in parentheses. Standard errors are also robust to within family-clustering. * $p < 0.05$, ** $p < 0.01$.

Table A13 marginal effects for sample with and without restriction on whether or not the young adult has siblings in the dataset

	Marginal effects excluding young adults without siblings in the dataset	Marginal effects including all young adults
Truancy	0.021* (0.009)	0.019* (0.007)
<i>N</i>	22,603	32,049
Smoking	0.013* (0.006)	0.013* (0.005)
<i>N</i>	22,720	32,199
Alcohol	0.025 (0.017)	0.038** (0.014)
<i>N</i>	22,684	32,152

Note. The figures are the marginal effects computed at average values of all variables used in the estimation of the logistic regressions. *N* is the number of observations relevant for each outcome. Figures excluding young adults without siblings are computed on a sample of individuals without any siblings appearing in the dataset (N=7,944). Figures including all young adults are computed on the main sample of individuals for the nine waves (N=12,233). Standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$.

Table A14 OLS results for sample with and without restriction on whether or not the young adult has siblings in the dataset

	OLS coefficients excluding young adults without siblings in the dataset	OLS coefficients including all young adults
Internalising score	-0.042 (0.174)	0.151 (0.132)
<i>N</i>	12,280	17,652
Externalising score	0.117 (0.197)	0.355* (0.152)
<i>N</i>	12,278	17,650
Total difficulties score	0.070 (0.307)	0.505* (0.238)
<i>N</i>	12,272	17,642

Note. The figures are coefficients from the OLS regressions. *N* is the number of observations relevant for each outcome. Figures excluding young adults without siblings are computed on a sample of individuals without any siblings appearing in the dataset for the odd waves (N= 7,256) Figures including all young adults are computed on the main sample of individuals for the odd waves (N=11,026). The internalising and externalising scores range between 0 and 20. The total difficulties score ranges between 0 and 40. Robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$.

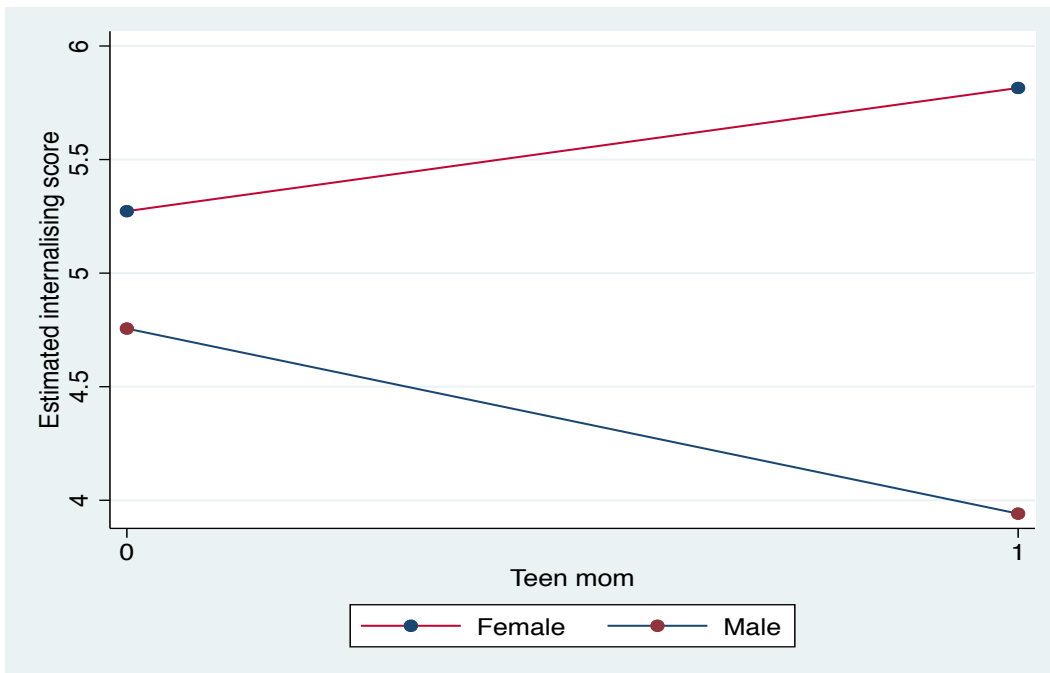


Figure A1. Estimated internalising score on teen mom by gender

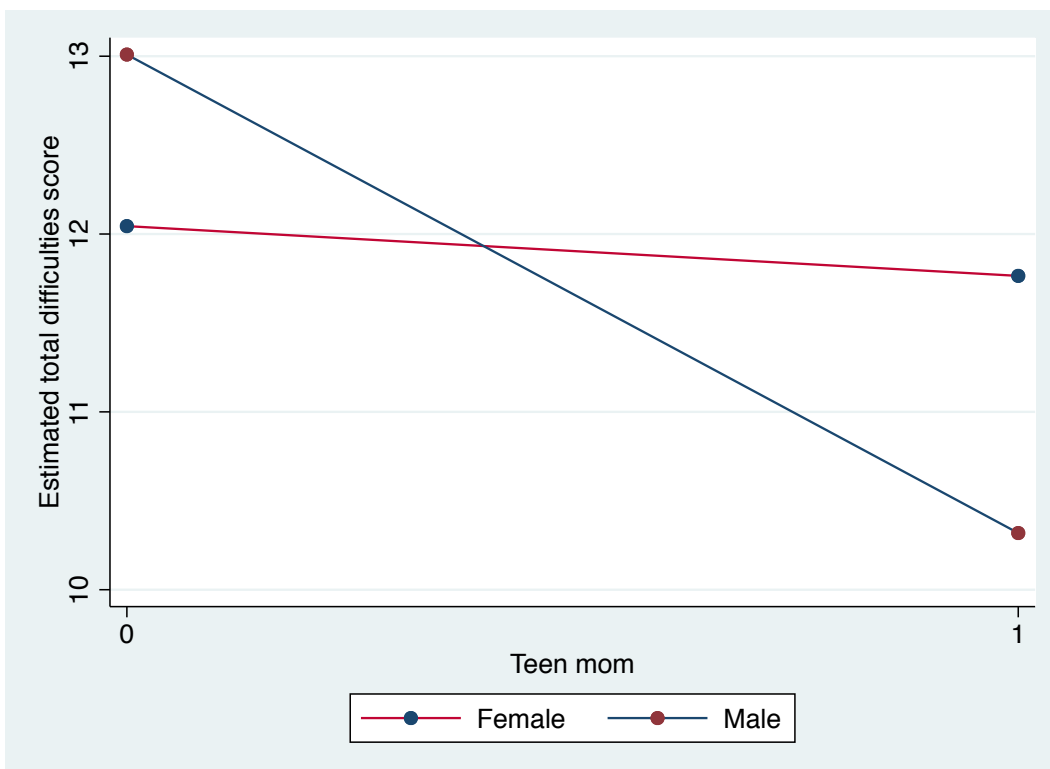


Figure A2. Estimated total difficulties score on teen mom by gender