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LATE-LIFE HEALTH EFFECTS OF TEENAGE MOTHERHOOD[1]

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ABSTRACT

We study the impact of teenage motherhood on late-life health, using a retrospective survey of almost 12,000 women from 13 European countries containing detailed information on early-life circumstances. We find that teenage mothers experience substantially lower late-life health and are more likely to display depressive symptoms. This effect is robust to controlling for early-life factors, parametrically and through propensity score matching. We show that our results are unlikely to be driven by selection on unobservables and we derive consistent lower bound estimates for our main effects. Studying potential transmission mechanisms highlights the importance of life-cycle socio-economic conditions and societal values.

KEYWORDS: Teenage Motherhood, Self-Reported Health, Depression, Europe.
JEL-CODES: I31, J13, J14

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1. Introduction

In an ageing society, the health of older people is an important policy issue from an individual as well as a collective perspective. From an individual point of view, good late-life health ensures that the increase in longevity experienced around the world over the last sixty years translates into healthy life years. From a collective point of view, healthy ageing ensures that longevity does not put undue pressure on the welfare state. Hence, most countries affected by population ageing engage in policy debates aimed at understanding the drivers of healthy ageing. Hereby often focusing on events during childhood and adolescence that are related to late-life health outcomes so that at-risk groups can be targeted before the health risk has materialized.

In this paper we analyze one such group in detail. In particular, we study the impact of teenage motherhood on late-life health outcomes among women aged 50 years and older from thirteen European countries. Seeing the long timespan between teenage motherhood and late-life health outcomes, we complement our analysis by studying some of the potential mechanisms connecting the two events.

The impact of teenage motherhood on a host of outcomes has been in the mainstay of economic, sociological and demographic research for much of the last 30 years (see Section 2 for an overview). To some extent, this interest can be attributed to the fact that the identification of the causal relationship is hampered by numerous confounding factors. Such factors include parental background as well as women's pre-motherhood characteristics, both of which are known to be important predictors of teenage motherhood as well as later outcomes. Indeed, much of the discussion in the literature has dealt with what the best way is to identify the true underlying relationship between early childbearing and later outcomes.

The challenge of any parametric identification strategy is to find a sufficiently broad set of background characteristics such that the impact of teenage motherhood on the outcome of interest can be identified. Only in the absence of such background characteristics researchers turned to alternative identification strategies, such as matching and instrumental variable estimation. Therefore, we use some of the innovative features of a European retrospective survey, SHARELIFE, to control for a broad set of relevant background characteristics. As our identification strategy is based on selection on observables, we follow Altonji *et al.* (2005), and Bellows and Miguel (2009) to assess the role of unobservables on the impact of teenage motherhood on late-life health and also use the methods of Oster (2015) to calculate a consistent lower bound estimate. Essentially, this approach allows us to consider the potential impact of relevant background characteristics which, although not directly observed, are correlated with the characteristics that we do observe. Moreover, to compare our results to alternative identification techniques we also employ Propensity Score Matching, which – in the current context – was championed by Levine and Painter (2003).

Despite the prominence of teenage motherhood in economic research, only little is known about its consequences at later stages of the life-cycle. Indeed, as we discuss in Section 2, a lion's share of the extant literature focuses on the consequences of teenage motherhood on outcomes such as educational attainment, labor market performance and health during early adulthood. Webbink *et al.* (2008) and Hotz *et al.* (2005) form welcome exceptions to this pattern by focusing on, respectively, health and labor market outcomes during adulthood. The former show that beyond the age of 40 teenage mothers are more likely to be overweight and the latter show that socioeconomic consequences of early childbearing tend to be short-lived due to the off-setting behavior by teenage mothers. We innovate upon these studies by looking further

down the life-cycle by focusing on the consequences of teenage motherhood on women currently aged 50 and older.

Hence, while the extant literature has focused predominantly on outcomes relatively early in adulthood, we focus on outcomes late in life. To this end, we employ two indicators of late-life health: self-reported health and mental health as assessed by using the EURO-D scale for depressive symptoms (Prince *et al.,* 1999a & 1999b). The latter outcome indicator stands out as depression is the leading cause of increases in disability adjusted life years worldwide (Institute for Health Metrics and Evaluation, 2010). To take into account the long period between teenage motherhood and late-life health outcomes we extend our main analysis by considering some of the potential transmission mechanisms connecting the two. In particular, we highlight the role of life-cycle socioeconomic conditions and societal values as potential transmission channels.

Our paper extends the current state of the literature on teenage motherhood in four directions. First, earlier research has mainly focused on short and medium-term consequences of teenage motherhood. We focus on the long-term consequences of teenage motherhood, in particular its impact on late-life general and mental health. Second, the innovative feature of our retrospective data allows us to control for a broad set of pre-motherhood characteristics. Although our approach relies on selection on observables, we show that selection on unobservable is unlikely to drive the results in the sense that the impact of unobservables would have to be roughly 4 times as large as the impact of observables to nullify our results. Third, we focus on a cross-national sample of almost 12,000 women, which contrasts the currently dominant focus on national or regional samples. Finally, in addition to establishing the direct relationship between teenage motherhood and late-life outcomes we also focus on the transmission mechanisms between the two, hereby enhancing the current literature which

typically focuses on assessing the direct relationship. In passing, the analysis of the transmission mechanisms provides an indication of the impact of teenage motherhood on education, income and relationship stability. While these factors have been addressed in the earlier literature, our analysis is the first to show these effects using the extensive cross-national sample provided by SHARELIFE.

The remainder of the paper is set up as follows. The next section provides an overview of the main literature. Section 3 introduces the data. Section 4 discusses the empirical results. Section 5 provides an analysis of the transmission mechanisms and Section 6 concludes.

2. Earlier Literature[2]

The literature on the drivers of teenage motherhood suggests characteristics of the parental household as well as early educational attainment as potential determinants of early childbearing (Imamura *et al.* (2007) and Kearney and Levine (2014)). From a rational choice perspective, both factors can be seen as indicative of the economic costs associated with early childbearing. Be that as it may, it is important to observe that these same factors have been identified as drivers of late-life outcomes as well (see, Currie (2009) for a review). The fact that these factors drive late-life outcomes as well as early childbearing hence beg the question: Does an observed impact of teenage motherhood on late(r)-life outcomes simply reflect the conditions in which the woman grew up or does it have an effect in its own right?

Until the seminal study of Geronimus and Korenman (1992) much of the literature focused on cross-sectional estimates, albeit with controls for potential confounding factors, and

[2] The literature on the consequences of early childbearing is so vast that it is neither possible nor desirable to provide a full account of even the most recent literature. Therefore, this review is aimed at providing a general impression of the main empirical approaches in this literature and does not make any claim to completeness. Readers looking for a more complete account are referred to Kane *et al.* (2013)'s skillful review.

found quite substantial negative effects of early childbearing on a host of later-life outcomes. Geronimus and Korenman (1992) took stock of these contributions and showed that if parental background is controlled for by focusing on siblings, the previously identified negative impact of early childbearing on the socioeconomic status of the women becomes less prevalent. Holmlund (2005) extended the siblings approach by controlling for pre-motherhood educational outcomes, which is a factor that is unique to each sibling. Using this approach she finds that controlling for sibling-specific factors further reduces the impact of early childbearing on later-life outcomes – educational attainment in her case. To address the problem of sibling-specific effects Webbink *et al.* (2008) focus on twin sisters and study how teenage pregnancy affects medium-term health behavior such as smoking and obesity. A potential caveat of the sibling approach is that it requires relatively large families – those with at least two (twin) sisters – that may not be representative of the population at large.

An alternative identification strategy has been to use Instrumental Variables (IV). Hotz *et al.* (1997), for instance, use miscarriages as an IV for early childbearing. In accordance with the findings from the siblings approach, they show that the impact of early childbearing is much less pronounced if the potential endogeneity of early child bearing is ignored. In fact, they find that teenage mothers have *higher* earnings and hours worked than mothers who delayed childbearing. In a recent contribution, Ashcraft *et al.* (2013) show that this approach entails some problems of itself as miscarriage may not be random due to the social dimension of abortion choice. Controlling for such effects, they show that there is a negative impact of teenage motherhood on, amongst others, educational attainment, hours worked and earnings. Other important IV strategies include Ribar (1994) who uses age at menarche and Klepinger *et al.* (1999) who use, amongst others, proximity to abortion facilities. While for our sample we do not have

information for the latter, we may note that the former suffers from potential endogeneity itself as age at menarche has been found to be driven by socio-economic factors (Reagan *et al.*, 2012).

The third dominant approach in the literature is to focus on Propensity Score Matching (PSM), which aims at constructing a synthetic control group to which the treated group (*i.e.,* teenage mothers) can be compared. Levine and Painter (2003) pioneered this approach and showed that, as with the sibling and IV approach, the pure impact of early childbearing on educational attainment is negative but substantially smaller than a casual reading of cross-sectional evidence would suggest.

In sum, the extant literature on the impact of teenage motherhood has typically, albeit with some exceptions, reported a negative impact on a variety of outcomes with the most dominant focus being on educational attainment and labor market outcomes. Complementing these studies, in what follows we will analyze the impact of teenage motherhood on health outcomes late in life employing two common identification strategies – parametric and matching – as well as one that is new to this literature – selection on unobservables and its associated determination of consistent lower bound estimates. In addition, in order to understand the link between the two we will focus on whether previously identified consequences of teenage motherhood as well as societal values act as potential pathways toward late-life health outcomes.

3. Data and Descriptive Statistics

For our empirical analysis we use SHARELIFE, which is a retrospective study conducted as part of the Survey of Health, Aging and Retirement in Europe (SHARE). SHARE is a longitudinal survey that collects an elaborate series of indicators of, amongst others, current health and social-economic status for a representative sample of European individuals aged 50+ and their partners. In 2008 and 2009, the third wave of data collection invited respondents to

provide retrospective information on their life histories instead of their current situation. This, so-called, SHARELIFE survey interviewed 28,836 (male and female) respondents from thirteen European countries.[3] Life histories provide information on early life conditions and were collected using a so-called Event History Calendar (Blane (1996) and Belli (1998)). In the EHC the respondent's life is represented graphically by a grid that is filled automatically in the course of the interview, starting with life events that are easily remembered accurately, such as the birth of the children. To assess the quality of the responses Havari and Mazzonna (2015) provide a comprehensive treatment of the validity of the self-reported questions in SHARELIFE. They conclude that respondents remember their early-life conditions well.In our empirical analysis we rely only on the female respondents and we drop all respondents who have missing values for at least one of the variables used in our estimation.[4] Thus, the final sample consists of 11,748 respondents who were born between 1920 and 1957.[5] SHARE and SHARELIFE have been used extensively to study the impact of circumstances during childhood and adolescence on various late(r)-life outcomes. For instance, in a paper related to ours, Avendano *et al.* (2015) analyze the effects of maternity leave policies on the mental health of women in old age. However, to the best of our knowledge, we are the first to use this rich source of data to study the long-run impact of teenage motherhood.[6]

[3] Austria, Belgium, the Czech Republic, Denmark, France, Italy, Germany, Greece, the Netherlands, Poland, Spain, Sweden and Switzerland.

[4] This sample also includes women who never had a child. Restricting the sample to include only mothers (regardless of when they had the first child) does not change the results. Available on request.

[5] As this period covers the Second World War we have also performed our empirical analysis dropping the cohort aged 13 to 19 during the war. This does not change our results. Available on request.

[6] For other topics see, for instance, Angelini and Mierau (2014), Doblhammer *et al.* (2011) and Kesternich *et al.* (2014) for studies on childhood health, old-age cognitive abilities and the effects of World War II, respectively.

Teenage Motherhood Our main *independent* variable of interest is whether or not the respondent had children at a young age. Following much of the literature we define a respondent as a teenage mother if she had her first child before the age of twenty. As indicated in Table 1, about 8% of our sample can be considered as teenage mothers. In terms of numbers this translates into 911 women.[7]

[TABLE 1 ABOUT HERE]

Late-Life Health Outcomes Following the literature on late-life health outcomes (e.g., Avendano *et al.* (2015)) we select two health outcomes as our *dependent* variables of interest. The first, self-reported general health, is assessed by asking the respondents how they would consider their current health status. Using this indicator we construct a variable that equals 1 if the respondent was in very good or excellent health and 0 otherwise. The second, mental health, is assessed using the EURO-D depression scale (Prince *et al.* 1999a, 1999b). From this scale we construct a variable that equals 1 if the respondent scored less than 4 points on the scale – indicating an *absence* of depressive symptoms – and 0 otherwise. This cut-point has been validated across the Europe, against a variety of clinically relevant indicators (Prince *et al.* 1999a, 1999b). Our choice for focusing on depression is driven by the fact that it is the leading cause of an increase in disability adjusted life years worldwide (Institute for Health Metrics and

[7] Including teenage mothers, the average age at first birth in our sample ranges from 23 in Poland to 26 in Switzerland.

Evaluation, 2010) but that effective treatment is hampered by a lack of recognition of its symptoms and causes (Alexopoulos, 2005).[8]

Table 1 provides descriptive statistics for both of the late-life health outcomes. As can be seen, a bit more than a quarter of the population report having very good or excellent health and roughly 70% of the population are not currently suffering from depressive symptoms. To provide some preliminary evidence on the relationship between teenage motherhood and late-life outcomes we split the sample and indicate sub-sample averages for the group of teen mothers and all other women in the sample. This reveals that women who had a child at a young age have significantly lower self-reported health and report having depressive symptoms more frequently.[9]

Pre-Motherhood Controls As outlined above, a key challenge in studying the relationship between early childbearing and late-life health outcomes is the presence of confounding factors that are potentially driving both the process behind having children early and late-life health. As suggested by the literature these can be classified into three main groups. First of all, the characteristics of the parental household. For this we use the following indicators (measured when the woman was aged 10): the rooms per person in the household, the number of facilities (such as bathroom, kitchen etc.), the number of books in the household (ranging from 1 if there are no books to 5 if there are more than 200) and whether or not the house was owned by the parents. Second, the characteristics of the parents. These are measured by whether the main breadwinner had a low-skill occupation or not, by whether either parent smoked or drank, and by

[8] A potential bias affecting our results is that teenage mothers may display systematically higher mortality than other women. Assuming that the relatively healthy teenage mothers are those who survive sufficiently long to be included in our sample, our population of teenage mothers is potentially a healthy sub-sample of all teenage mothers. In that sense, the negative health findings we report throughout our paper are lower bounds, the true effect may well be larger.

[9] In a further analysis we also considered the impact of teenage motherhood on grip strength – an objectively observable health indicator – this reveals the same pattern as for self-reported health and mental health used in our main analysis. Results available on request.

whether either the father or the mother was missing in the household when the woman was 10. Third of all, individual characteristics of the woman before she became a mother. For this we rely on educational scores for language and mathematics as well as the self-reported health status at age 10. The data and their summary statistics are presented in Table 1 alongside the remaining variables. As above, we also display the subgroup averages of the childhood controls.

Although the evidence is just descriptive, a number of interesting conclusions arise. First of all, we observe that women who had children at a young age on average showed worse performance in language as well as math abilities well before they had their first child. Second, teenage mothers on average come from quite disadvantaged backgrounds. In particular, they grew up in households where there were few books, scarce facilities, with parents who were in low-skilled occupations and drank and, quite regularly, the father was not present in the household. As each of these factors is also known to adversely affect outcomes later in life,[10] it is not clear from these descriptive statistics whether the negative relationship between early childbearing and worse health later in life is, in fact, a causal one or whether early childbearing is just one pathway by which a disadvantaged background translates into worse health later in life.

Transmission Mechanisms As our analysis focuses especially on the late-life outcomes of early childbearing, it will be interesting to assess the mechanisms by which the two are linked. To this end we focus on three pathways: educational attainment, income and relationship stability. Each of these has been associated with teenage motherhood in its own right and has also been shown to be related to late-life health, suggesting that they are likely candidates in the transmission from teenage motherhood to late-life health outcomes. Table 1 shows that teenage mothers, on

[10] To appreciate some within sample evidence of such relationships note that daughters of parents who drank experience worse late-life health. Similarly, daughters who grew up in households with few books or few facilities also are much more prone to develop bad late-life health. Results not shown, but available on request.

average, have lower completed educational attainment, are more likely to have experienced divorce and have lower income. Such preliminary bivariate results suggest that these factors may be potential pathways from teenage motherhood to late-life health outcomes.

To investigate the dispersion of the main effect over different subgroups of the sample we assess the role of social values by using the Ingelhart-Welzel cultural map of Europe (see, Ingelhart and Welzel (2010)). This approach stratifies the countries in our sample into Protestant Europe (Denmark, Germany, the Netherlands, Sweden and Switzerland), Catholic Europe (Austria, Belgium, France, Greece, Spain and Italy) and Ex-Communist countries (Czech Republic and Poland). This stratification captures different societal values and in our context potentially conveys information on the degree of social stigmatization associated to early motherhood.[11]

4. Empirical Results

Our approach in this paper is to return to the cross-sectional analysis of teenage motherhood and to employ the richness of the SHARELIFE data in order to control for potential confounding factors. However, in spite of the quality and range of the control variables that we have access to there may still be a residual amount of selection that is unaccounted for. To assess the extent of the bias created by such selection on unobservables we employ the methods of Altonji *et al.* (2005) in the implementation of Bellows and Miguel (2009) and the extension thereof by Oster (2015). To contrast our results with the rest of the literature we also employ an identification strategy based on Propensity Score Matching as suggested by Levine and Painter

[11] In a similar analysis we have found that the marital status at the time a teenage mother's child does not affect the impact that teenage motherhood has on late-life health outcomes. Results are available on request.

(2003). Having established the relationship between teenage motherhood and late-life health we then turn to the potential mechanisms linking the two.

4.1 Parametric Identification

Our main estimation results are presented in Table 2. To highlight the importance of controlling for individual pre-motherhood background characteristics we start in column 1 with a logit specification that only includes age, age squared and country dummies.[12] Essentially, in this set-up the estimated parameter of the teenage motherhood indicator represents the cross-sectional correlation (after controlling for a quadratic term in age and country of origin). The results show that early childbearing has a statistically significant negative impact on the probability of being in very good or excellent health and on not having depressive symptoms later in life.

As discussed at length above, this result does not coincide with the causal effect of early childbearing because many of the factors driving teenage motherhood may also drive the health outcomes. Therefore, in column 2 we add a series of pre-motherhood characteristics which are known to affect early childbearing *and* late-life health. While the impact of early childbearing on self-reported health remains negative, its magnitude decreases substantially. In column 3 we add additional indicators of parental behavior (whether they drank or smoked). We see that the impact of early childbearing on self-reported health declines further, albeit by substantially less than it declined before.

In Table 2b we repeat the same exercise but using the absence of depression as an alternative indicator. The table reveals the same pattern in the sense that consistently controlling for additional factors reduces but not nullifies the negative impact of teenage motherhood on the probability of not being depressed.

[12] Alternatively, we performed our analysis using birth year dummies. This did not materially affect the results. Available on request.

[TABLE 2 ABOUT HERE]

To appreciate the magnitude of the effect of teenage motherhood on late life health, in Table 3 we present average marginal effects. As in Table 2a and 2b, we see that the cross-sectional correlation is substantially higher than the true effect. Indeed, the negative average marginal effect of teenage motherhood drops from 8.5 percentage points to 6.2 percentage points and from 8.4 percentage points to 6.4 percentage points for self-reported health and the absence of depression respectively. Interpreting the lower values we can say that, after controlling for a host of childhood characteristics, teenage mothers are 6.2 (6.4) percentage points less likely to report very good or excellent health (not having depressive symptoms).

[TABLE 3 ABOUT HERE]

4.2 Selection on Unobservables

Although we include a broad set of control variables, our results could still be biased by the presence of unobservable factors that influence both the probability of being a teenage mother and late-life health. Such factors include, but are not limited to, interesting items such as neighborhood characteristics, peers and school quality. Importantly, whilst not observed in the SHARELIFE survey, such items are likely to be correlated with the background characteristics that we do observe. Therefore, to measure the potential bias arising from unobservables, we follow the methodology proposed by Altonji *et al.* (2005). First in the implementation of Bellows

and Miguel (2009).[13] Second, we take into account the more recent suggestions to implement this method by Oster (2015) and Gonzalez and Miguel (2015).

To implement the Bellows and Miguel method we need to estimate two regressions: one with a restricted set of controls and one with the full set of controls. Let $\hat{\beta}^F$ be the coefficient of teenage motherhood estimated from the full model and let $\hat{\beta}^R$ be the estimated coefficient from the restricted model. The *Altonji* ratio $\hat{\beta}^R/(\hat{\beta}^R - \hat{\beta}^F)$ then tells us how much stronger the selection on unobservables must be with respect to the selection on observables to explain away the entire effect of teenage motherhood on late-life health.

Turning to Table 2 once more allows us to implement the above method in our context. In particular, focusing on self-reported health, the Altonji ratio becomes: $0.557/(0.557 - 0.406) = 3.69$. Similarly, the Altonji ratio for the absence of depression is 4.62. These values compare favorably to the value of Altonji *et al.* (2005) who interpret a value of 3.55 as evidence that unobservable are not likely to drive their core result. More importantly, when, where possible, we revisit the earlier literature on teenage motherhood and calculate the Altonji ratios for parametric estimation results reported in Levine and Painter (2003), Holmlund (2005) and Kane *et al.* (2013) we find values of 1.73, 1.33, and 2.13, respectively.[14] This indicates that, compared to the earlier literature, selection on unobservables would have to be much higher in our case to explain away the effect of teenage motherhood on late-life health. With the benefit of hindsight such low values for the Altonji ratio justify very well why these selected previous contributions opted for the use of identification methods other than parametric.

[13] Nunn and Wantchekon (2011) use a slight variation of this method.
[14] The above values were derived from Table 2 of Levine and Painter, Table 2 of Holmlund and Table S1 of Kane e*t al.*. Where multiple ratios could be calculated, we used the most conservative (i.e., highest one).

As noted by, inter alia, Gonzaléz and Miguel (2015) an important, yet untestable, assumption underlying the bounding exercise above is that the variance of the observable control variables equals the variance of the unobservable control variables. As a possibility, to circumvent this issue, Oster (2015) suggests that a lower bound of, in our case, the impact of teenage motherhood on late-life health can be derived using the following formula:

$$\hat{\beta}^{*} = \hat{\beta}^{F} - \left(\hat{\beta}^{R} - \hat{\beta}^{F}\right) \times \frac{R^{MAX} - R^{F}}{R^{F} - R^{R}}, \tag{1}$$

where $\hat{\beta}^{F}$ and $\hat{\beta}^{R}$ are defined as above, R^{R} is the R^2 of the restricted model, R^{F} of the full model and R^{MAX} is the maximum R^2. While R^{R} and R^{F} are straightforward to obtain, R^{MAX} is more contentious. To this end we consider two options. First, following Bellows and Miguel (2009) we let $R^{MAX} = R^{F} + (R^{F} - R^{R})$, implying that: $\hat{\beta}^{*} = 2\hat{\beta}^{F} - \hat{\beta}^{R}$, so that the R^2 and their movement become irrelevant.[15] Second, as suggested by Oster (2015) we set $R^{MAX} = \min(1.3R^{F}, 1)$, where she derived the 1.3 multiplication factor through an analysis of randomized control trials published in leading economics journals over the period 2008 – 2013.

Considering self-reported health and using the pseudo-R^2 associated to the first and third column of Table 2 provides a $\hat{\beta}^{*} = -.255$ using the Bellows and Miguel approach and a $\hat{\beta}^{*} = -.186$ using the Oster approach. Applying the same technique to the absence of depression provides $\hat{\beta}^{*} = -.228$ and $\hat{\beta}^{*} = -.186$, for the two respective alternatives. Using the – more conservative – Oster correction and focusing on the marginal effects implies that teenage mothers are at least 2.8 (3.4) percentage points less likely to report very good or excellent health

[15] This is not necessarily a disadvantage as the ensuing formula – $\hat{\beta}^{*} = 2\hat{\beta}^{F} - \hat{\beta}^{R}$ – serves as a quick test for assessing a consistent estimate that does not require knowledge of the underlying R^2.

(not having depressive symptoms).[16] Importantly, we observe that the lower bounds for the marginal effects are substantially larger than zero.

4.3 Propensity Score Matching

An alternative strategy with which the impact of early childbearing on late-life health outcomes can be assessed is the Propensity Score Matching (PSM) approach, which was popularized in the current context by Levine and Painter (2003). The intuition behind the PSM approach is to construct a synthetic control group and to compare the late-life health outcomes of this group to the treatment group.[17] This approach consists of four steps. First of all, a prediction model is estimated to identify the relevant factors driving the process by which some women become teenage mothers and others do not. Second, using the outcome of the first step a control group is identified consisting of women who are equivalent to teenage mothers in all aspects besides the early childbearing itself. Third, every treated woman is matched to a control woman hereby taking into account that the two are as alike as possible. Fourth, the women in the treatment and the control group are compared with each other in terms of their late-life health outcome. In this regard it may be noted that the objective is not so much to find the best prediction model of teenage motherhood but to have a prediction model with which a control group can be constructed that is as similar as possible to the treatment group. Hence, between step one and two, the latter is more important.

In order to maintain comparability between the parametric identification approach and the matching approach, we use the control variables (including the country fixed effects) of the

[16] Strictly speaking Equation (1) applies to a linear model. If we re-estimate the specifications in Table 2 using a linear probability model we obtain, after the Oster correction, marginal effects of 2.2 and 3.6 percentage points for, respectively, health and depression.
[17] Using caliper and radius matching as alternatives to propensity score matching does not change the results. Available on request.

previous section to predict whether the woman turned out to be a teenage mother. Using this model we then match each teenage mother to a woman that is as similar as possible to her in all respects besides being a teenage mother. In the final column of Table 1 we display mean of the matched sample for all relevant variables. This reveals that by employing the matching approach there is no difference anymore between the sample means of teenage mother and non-teenage mothers (see Rosenbaum and Rubin (1985) for additional discussion on this point). As suggested by Sianesi (2004), an alternative way of determining the quality of the matches is to focus on the (pseudo) R^2 of repeating the initial prediction model on the matched sample. In our case that is 0.00, indicating that the matching was successful. Finally, in Figure 1 we visualize the quality of the match by comparing the predicted probability of teenage motherhood for the treatment and the control group in the full sample and in the matched sample. While there are large differences between teen mothers and non-teen mothers in the full sample, the propensity score distributions overlap substantially with each other in the matched sample, indicating that the two groups are well matched.

[FIGURE 1 ABOUT HERE]

Using the matched sample we compare the treatment and control group in terms of our outcome variables. We display the average treatment effects in Table 4. Teenage mothers are 5.1 percentage points less likely to report very good or excellent health than women who were not teenage mother. Similarly, they are 5.5 percentage points less likely to report not having depressive symptoms. Interestingly, these marginal effects lie between the ones derived from the full model in Table 3 and those calculated using the correction presented in the previous section.

The fact that the marginal effects lie above the corrected marginal effects is not necessarily surprising as the previous studies have shown that matching tends to be the weakest methods in terms of reducing the association between teenage motherhood and a variety of mother's outcomes. Be that as it may, we observe that the corrected marginal effects provide the most conservative (i.e., lowest) estimate of the impact of teenage motherhood on late-life health. Hence, for the purpose of the analysis of potential transmission mechanisms we return to the parametric analysis.

[TABLE 4 ABOUT HERE]

5. Transmission Mechanisms

The analysis until now reveals that teenage mothers are less likely to report very good or excellent health and are less likely to report no depressive symptoms. There is, however, a long period between these two observations. In order to tackle this issue, we assess potential factors that affect the transmission of the impact of teenage motherhood on late-life health outcomes.

Life-Cycle Factors Following the earlier literature, we focus on three potential life-cycle factors as pathways between teenage motherhood and late-life health: education, income and relationship stability. In order to evaluate their importance, we add indicators of them to our parametric specifications and then assess how the parameter estimate (or the marginal effect) of the teenage motherhood indicator changes. If its value is reduced in the wake of the inclusion of a pathway, we can infer that some of the impact of early childbearing on late-life health goes through that life-cycle factor. Following Baron and Kenny (1986) (or its modern representation in MacKinnon *et al.* (2007)) we observe that in order to count as a pathway, teenage motherhood must have a statistically significant impact on the pathway itself if the two are regressed on each

other. While Webbink *et al.* (2008) follow a similar strategy to assess the pathways from teenage motherhood to health behavior in adulthood, we caution that the pathways themselves may be endogenous. In particular, when considering education as a pathway we are confronted with the general problem of endogeneity of human capital related variables. Hence, the results that follow are indicative of potential pathways but do not necessarily identify the exact causal path.

As first step of the pathway analysis, we regress the three pathways on teenage motherhood using the same specification as in column 3 of Table 2 and display the ensuing marginal effects in Table 5. This exercise highlights that teenage mothers have lower educational attainment, are more likely to have experienced divorce and have lower incomes. Viewing the marginal effects reveals that teenage mothers are 9.8 percentage points less likely to enjoy high educational attainment, have 13.3% less income and are 9.1 percentage points more likely to experience divorce. Moreover, we have also focused on years of education outcome variable because it allows for a closer comparison to the results documented in the earlier literature. This provides an estimated 1.1 year reduction in educational attainment due to teenage motherhood.[18]

Focusing on the three pathways separately, we observe that the estimated impact of teenage motherhood on education is consistent with the 0.7 to 1.9 years reduction in educational attainment documented by Kane *et al.* (2013) using a multimethod approach relying on various identification strategies. The estimated effect for divorce is substantially higher than that reported in, for instance, Ashcraft *et al.* (2013). A likely explanation for this discrepancy is that our sample consists of substantially older individuals than focused on in earlier work so that life events such has divorce have had more time to materialize. Similarly, while the estimated impact

[18] For the remainder of our analysis focusing on education levels is preferable because they are based on the International Standard Classification of Education (ISCED), while years of education are harder to compare consistently due to, for instance, alternative school entry ages.

on income is consistent with the analysis of Chevalier and Viitanen (2001), it is toward the higher end of the effects typically found in the literature. As with divorce, this may very well be reconciled by the fact that due to the average age of our sample, differences in income have had more time to grow.

[TABLE 5 ABOUT HERE]

In Table 6 we display the results from adding the pathways to our preferred specification from column 3 of Table 2. In the successive columns we include each of the pathways separately and in the final column we include them all at once. In the top half of table we focus on self-reported health and in the bottom half on the absence of depression. Each of the potential pathways reduces the impact that early childbearing has on self-reported health and the absence of depression. The largest effect is due to education, which reduces the impact of teenage motherhood on self-reported health (absence of depression) by 1 (0.7) percentage points starting from a base rate of 6.2 (6.4) percentage points. This indicates that reduced educational attainment is an important pathway from teenage motherhood to adverse late-life health outcomes. Relationship stability and income also play a role in the transmission. Finally, taking all pathways into account jointly does not nullify the impact of teenage motherhood on either of the two late-life health outcomes. Thus, additional pathways may be at play and/or teenage motherhood can have a direct effect on late-life health outcomes due to, for instance, scarring effects of early motherhood.

[TABLE 6 ABOUT HERE]

Societal Values To close our analysis we assess how the impact of teenage motherhood on late-life health outcomes differs over respondents from societies with different dominant societal values. As outlined above we rely on the Ingelhart and Welzel (2010) method of dividing Europe into a protestant part, a catholic part and an ex-communist part. To see how our main effect differs between these societal values we split the sample into the three groups and perform the estimation on each group separately. The results are displayed in Table 7 and clearly show that teenage mothers in protestant countries show the strongest negative impact on late-life health outcomes. Teenage mothers in catholic countries are significantly less affected and those from ex-communist countries are not affected at all.[19] One reason for this result could be that teenage motherhood carries a stronger social stigma in protestant cultures than it does in other countries.

[TABLE 7 ABOUT HERE]

6. Conclusion

In this paper we have studied the late-life health consequences of teenage motherhood using a sample of almost 12,000 women from thirteen European countries. We have found that – regardless of whether we control parametrically or employ matching estimators – teenage mothers are less likely to report very good or excellent health and are more likely to suffer from symptoms of depression late in life. These results are unlikely to be driven by selection on unobservables. The found effects are both statistically and practically significant in the sense that teenage motherhood leads to a statistically significant reduction in the probability of reporting

[19] The marginal effects of teenage motherhood displayed in Table 7 are all significantly different from each other. Test not shown but available on request.

very good or excellent health or of not displaying depressive symptoms in late life, with a lower bound of three percentage points. Focusing on the transmission channels linking the two, our results suggest that low educational attainment, income and relationship instability might be important potential pathways from teenage motherhood to adverse late-life health outcomes. Finally, the negative impact of teenage motherhood on late-life health outcomes is particularly pronounced in countries with a predominantly protestant culture.

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Tables

TABLE 1
Descriptive Statistics (N = 11,748)

Name	Min.	Max.	Mean (All)	Mean (TM=1)	Mean (TM=0)	Matched
Individual Characteristics						
Teenage Mother	0	1	0.077	1	0***	N/A
Age	49	87	64.414	62.869	64.544***	62.682
Health Status						
Absence of Depression	0	1	0.687	0.615	0.693***	N/A
Self-Reported Very Good or Excellent Health	0	1	0.264	0.195	0.269***	N/A
Childhood Characteristics						
Math Performance Above Average	0	1	0.305	0.241	0.311***	0.250
Language Performance Above Average	0	1	0.392	0.299	0.399***	0.322
Self-Reported Very Good or Excellent Health	0	1	0.670	0.688	0.668	0.668
Rooms per person	0	8.75	0.710	0.610	0.719***	0.590
Facilities	0	5	1.956	1.608	1.985***	1.554
Books	1	5	2.098	1.828	2.120***	1.755
Low Parental Occupation	0	1	0.803	0.889	0.795***	0.890
Parent Drinks	0	1	0.082	0.131	0.078***	0.617
Parent Smokes	0	1	0.610	0.605	0.611	0.123
Missing Father	0	1	0.090	0.155	0.084***	0.130
Missing Mother	0	1	0.038	0.048	0.037*	0.048
Parent Homeowner	0	1	0.539	0.482	0.543***	0.489
Living in Rural Area	0	1	0.464	0.466	0.463	0.460
Pathways						
Medium Education	0	1	0.283	0.246	0.286**	N/A
Higher Education	0	1	0.195	0.077	0.205***	N/A
Divorce	0	1	0.135	0.228	0.127***	N/A
Logarithm of Income	2.83	13.81	9.848	9.667	9.864***	N/A

Note: */**/*** indicate significant differences at the 10%/5%/1% level based on Student's t-tests of group mean comparisons.

TABLE 2
Late-life Health Consequences of Early Childbearing

	Logit Model					
Dependent Variable:	Self-Reported Health			Absence of Depression		
	(1)	(2)	(3)	(4)	(5)	(6)
Teenage Mother	-0.557***	-0.409***	-0.406***	-0.402***	-0.333***	-0.315***
	(0.092)	(0.094)	(0.094)	(0.075)	(0.076)	(0.076)
Age	-0.106***	-0.063*	-0.062*	0.168***	0.205***	0.201***
	(0.036)	(0.036)	(0.036)	(0.030)	(0.031)	(0.031)
Age^2	0.000	0.000	0.000	-0.001***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Math Performance		0.103*	0.101*		0.224***	0.222***
		(0.054)	(0.054)		(0.052)	(0.053)
Language Performance		0.220***	0.220***		-0.040	-0.039
		(0.053)	(0.053)		(0.050)	(0.050)
Self-Reported Health (At 10)		0.665***	0.665***		0.390***	0.383***
		(0.054)	(0.054)		(0.045)	(0.045)
Rooms per person		0.149**	0.144**		0.235***	0.205***
		(0.066)	(0.066)		(0.065)	(0.065)
Facilities		0.050***	0.049***		0.025	0.021
		(0.018)	(0.018)		(0.017)	(0.017)
Books		0.119***	0.119***		0.073***	0.068***
		(0.024)	(0.024)		(0.024)	(0.024)
Low Parental Occupation		-0.257***	-0.257***		0.028	0.032
		(0.061)	(0.061)		(0.061)	(0.061)
Missing Father		-0.083	-0.102		-0.137*	-0.160**
		(0.094)	(0.094)		(0.077)	(0.078)
Missing Mother		-0.152	-0.147		-0.091	-0.078
		(0.136)	(0.136)		(0.113)	(0.113)
Parents Homeowner		0.009	-0.003		0.003	-0.019
		(0.052)	(0.052)		(0.047)	(0.047)
Living in Rural Area		-0.011	-0.011		0.074	0.069
		(0.053)	(0.053)		(0.048)	(0.048)
Parent Drinks			-0.101**			-0.107**
			(0.050)			(0.045)
Parent Smokes			-0.060			-0.483***
			(0.087)			(0.073)
Country Fixed Effects	YES	YES	YES	YES	YES	YES
Pseudo R^2	0.116	0.145	0.146	0.058	0.069	0.073
Observations	11,748	11,748	11,748	11,748	11,748	11,748

Notes: */**/*** indicate statistical significance at the 10%/5%/1% level, standard errors between brackets

TABLE 3
Average Marginal Effects

	Dependent Variable: Self-Reported Health		
	(1)	(2)	(3)
Teenage Mother	-0.085***	-0.062***	-0.062***
	(0.013)	(0.013)	(0.013)
	Dependent Variable: Absence of Depression		
	(4)	(5)	(6)
Teenage Mother	-0.084***	-0.068***	-0.064***
	(0.016)	(0.016)	(0.016)

Notes: Estimation and specification is as in Table 2. */**/*** indicate statistical significance at the 10%/5%/1% level, standard errors between brackets.

TABLE 4
Average Treatment Effects

	Self-Reported Health	Absence of Depression
Teenage Mother	-0.051**	-0.055***
	(0.022)	(0.027)

Notes: */**/*** indicate statistical significance at the 10%/5%/1% level.

TABLE 5
Life-cycle factors

	High Education	Divorce	Log(Income)
Teenage Mother	-0.098***	0.091***	-0.133***
	(0.011)	(0.013)	(0.030)

Notes: */**/*** indicate statistical significance at the 10%/5%/1% level. Estimation as in column 3 of Table 2 but with alternative dependent variable. Average marginal effects are reported.

TABLE 6
Pathways

	High Education	Divorce	Log(Income)	All
	Dependent Variable: Self-Reported Health			
Teenage Mother	-0.052***	-0.059***	-0.058***	-0.047***
	(0.014)	(0.013)	(0.013)	(0.014)
High Education	0.086***			0.079***
	(0.013)			(0.013)
Divorce		-0.035***		-0.029***
		(0.011)		(0.011)
Log(Income)			0.027***	0.021***
			(0.005)	(0.005)
	Dependent Variable: Absence of Depression			
Teenage Mother	-0.057***	-0.059***	-0.061***	-0.051***
	(0.016)	(0.016)	(0.016)	(0.016)
High Education	0.047***			0.041***
	(0.013)	-0.052***		(0.013)
Divorce		(0.012)		-0.047***
				(0.012)
Log(Income)			0.022***	0.018***
			(0.005)	(0.005)

Notes: */**/*** indicate statistical significance at the 10%/5%/1% level. Remaining specification as in column 3 of Table 2. Average marginal effects are reported.

TABLE 7
Societal Values

	Protestant	Catholic	Ex-Communist
Teenage Mother	-0.097***	-0.064***	0.008
	(0.026)	(0.018)	(0.025)

Notes: Estimation and specification is as in column 3 of Table 2. */**/*** indicate statistical significance at the 10%/5%/1% level, standard errors between brackets. Average marginal effects are reported.

Figure

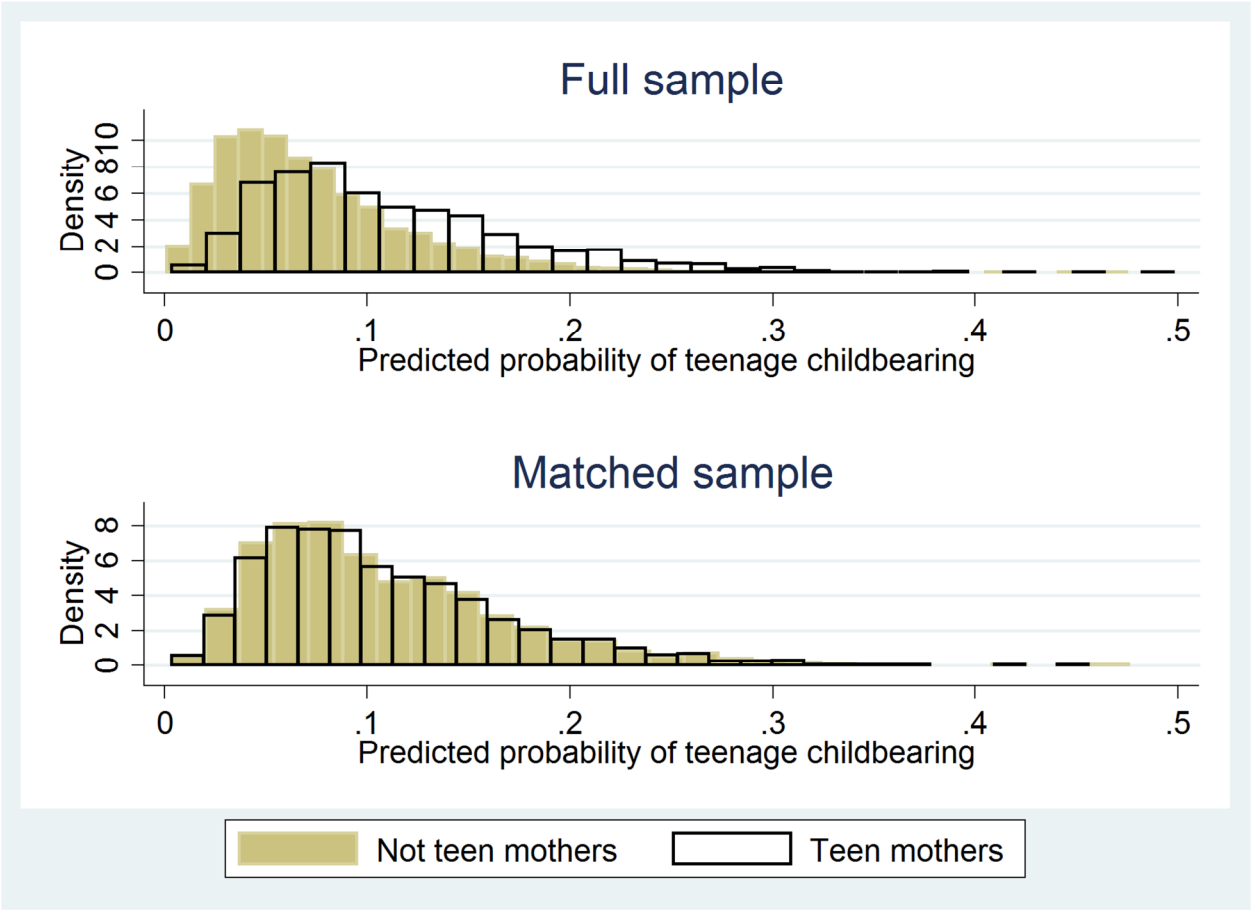

Figure 1: Predicted probabilities of teenage motherhood for the full and matched sample

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