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*Henriette Engelhardt & Jessica Schreyer*

## Timing of first birth and well-being in later life

### **Der Zeitpunkt der ersten Geburt und das Wohlbefinden im späteren Leben**

#### **Abstract:**

A large body of literature has documented a negative association between early childbearing and well-being in later life. The effects of late parenthood are mixed, due to different social and physiological mechanisms as well as selection processes for the timing of first birth. This article extends the literature by employing propensity score matching to estimate effects of birth timing on life satisfaction net of observed selectivity. A sensitivity analysis using Rosenbaum bounds provides hints on remaining unobserved selectivity. The analysis of data from the German Socio-Economic Panel shows that the timing of first birth has no effect on well-being in later life both for women and men. In the case of the naïve estimator, the negative effects of early births and positive effects of late births for women are caused by selection processes.

**Key words:** parenthood, age at first birth, life satisfaction, well-being, propensity score matching

#### **Zusammenfassung:**

In der Forschungsliteratur wird häufig ein negativer Zusammenhang zwischen einem frühen Zeitpunkt der ersten Geburt und dem Wohlbefinden im späteren Leben beobachtet. Die Effekte der späten Elternschaft werden durch eine Mischung aus unterschiedlichen sozialen und physiologischen Mechanismen sowie durch Selektionsprozesse für den Zeitpunkt der ersten Geburt bewirkt. Dieser Artikel erweitert bisherige Befunde durch Anwendung des Propensity Score Matching zur Schätzung der Effekte des Timings der ersten Elternschaft auf die Lebenszufriedenheit unter der Kontrolle beobachteter Selektivität. Durch eine Sensitivitätsanalyse mittels Rosenbaum Bounds werden Hinweise auf verbleibende unbeobachtete Selektivität gegeben. Die Analyse auf Basis der Daten des Sozio-oekonomischen Panels (GSOEP) zeigt, dass der Zeitpunkt der ersten Geburt keinen Einfluss auf das spätere Wohlbefinden von Frauen und Männer hat. Im Falle des naiven Schätzers sind die negativen Effekte früher Geburten und die positiven Effekte später Geburten für Frauen auf Selektionsprozesse zurückzuführen.

**Schlagwörter:** Elternschaft, Timing der ersten Geburt, Lebenszufriedenheit, Wohlbefinden, Propensity Score Matching

## Introduction

Beyond doubt, parenthood carries birth costs and benefits that change life in many ways. Children may be a source of joy, strengthen social ties within the family and create new social roles for adults. On the other hand, becoming a parent increases and often changes the division of labor in the household frequently decreases the quality of the parental partnership and may strain the parent's well-being (Nomaguchi/Milkie 2003; Margolis/Myrskylä 2011).

Thus, empirical evidence on the relation between fertility and well-being is mixed. Most papers find a negative association between children and well-being among individuals in childbearing years (Cleary/Mechanic 1983; Gore/Mangione 1983; Lovell-Troy 1983; McLanahan/Adams 1987). While, compared to young couples without children, young parents seem to be particularly unhappy around birth (Cleary/Mechanic 1983; Lovell-Troy 1983; McLanahan/Adams 1987), there is no difference in well-being between older parents and non-parents (Koropeckyi-Cox et al. 2007; Rempel 1985; Ross/Huber 1985).

However, the fertility and well-being nexus may change over the life cycle (Umberson et al. 2010; Margolis/Myrskylä 2011). Among the elderly, no relationship is found between parenthood and life satisfaction (Connidis/McMullin 1993; Koropeckyi-Cox et al. 2007; Rempel 1985; Ross/Huber 1985). Studying parental happiness trajectories, Myrskylä & Margolis (2012) show that well-being increases before birth, which has also been highlighted by Angeles (2010), Clark/Gerogellis (2013), Clark et al. (2008) and Frijters et al. (2011).

Less is known about the impact of the timing of birth on well-being in later life. For the child-rearing years, research suggests “that women who postpone childbearing are more ‘ready’ and less stressed by having children” (Myrskylä/Margolis 2012: 6), possibly because older mothers have more social capital and higher status at work allowing greater financial flexibility and options for childcare, all easing the transition to parenthood. From a life-course perspective, the question arises whether this effect persists in mid- and later life. In this paper, we aim to contribute to this question by studying the effect of the timing of first birth on subjective life satisfaction from age 50 onwards, using data from the German Socio-Economic Panel (SOEP). We use propensity score matching methods and Rosenbaum bounds which partially allow for controlling of unobserved heterogeneity and selection into parenthood.

## Background

Social scientists have increasingly drawn their attention to well-being measured by subjective indicators such as happiness, life satisfaction or subjective health. Most researchers now agree that it is crucial to take a life-course perspective when examining people's subjective well-being, and that subjective well-being often changes after an important life event such as the birth of a child (Plagnol 2010; Umberson et al. 2010). Early life-course experiences may have long-term implications for well-being throughout middle and later life (Ha et al. 2008).

From a life-course perspective, age at first birth is regarded as an important factor in the processes of cumulative advantage and disadvantage (Elder et al. 2004; Kuh/Ben-Schlomo 2004). An early transition to parenthood has been associated with truncated educational and occupational opportunities, economic hardship, and increased marital instability (Umberson et al. 2010). These factors may have enduring impact on well-being in the short and long run (Booth et al. 2008).

Research on the long-term consequences of childbearing on psychological well-being is rare and may benefit from studies on physical well-being which have largely focused on the effects of age at first birth and parity (Grundy/Kravdal 2008; Mirwosky 2005). The emerging health patterns suggest that early childbearing and high parity are disadvantageous for self-rated health in the long run. Early childbearing is, for example, associated with higher rates of mortality (Doblhammer 2000; Mirowsky 2005; Grundy 2009; Grundy/Kravdal 2008; Hank 2010), and an overall negative association between higher parity and mortality (Doblhammer/Oeppen 2003; Grundy 2009; Grundy/Kravdal 2008, 2010; Grundy/Tomassini 2005; Smith et al. 2002; Kington et al. 1997). Moreover, childbearing characteristics may have effects on other dimensions of physical as well as mental health at older ages (Waldron 1998; Henretta et al. 2008; Spence 2008; Read/Grundy 2011; Read et al. 2011; Taylor 2009).

The mechanisms linking fertility to self-rated health in later life are potentially numerous. Fertility may relate to later life well-being through distinct physiological and social processes (Spence 2008). For instance, early childbearing and high parity may impede educational attainment and occupational careers (McElroy 1996; Ermisch 2003), while late childbearing may trigger physical health problems (Cooper et al. 1999; Alonzo 2002; Myrskylä/Margolis 2012). Due to social support and care, the timing of births and number of children may also be related to well-being in later life (Smith et al. 2002). Additionally, spatial proximity of parents to their children is important for receiving support and care (Yi/Vaupel 2004).

Moreover, well-being seems to differ between fathers and mothers (Read/Grundy 2011). Usually, it is assumed that becoming a parent has a stronger effect for women than it has for men since, compared to fathers, mothers are more involved in housework and experience more stress in reconciling work and family life (Nomaguchi/Milkie 2003). However, several studies show a stronger increase in female well-being after birth compared to men (Clark et al. 2008; Kohler et al. 2005; Myrskylä/Margolis 2012).

### **Selection mechanisms**

Next to these potential mechanisms, the correlation between childbearing and well-being in later life may be a statistical artifact: Uncontrolled earlier life conditions may influence both fertility and well-being (Rich-Edwards 2002). For instance, socially deprived women may have a lower age at first birth and are also more prone to report lower well-being. “Some of the same social factors that may select young people into parenthood and/or result in large family size – such as low SES in childhood/adolescence and alternative [...] family structures – are shown to have an effect on health, psychological morbidity, and mortality later in the life course” (cf. Spence 2008: 3). Most studies have not taken into

consideration the role of life conditions before first birth; only a few studies account for selection mechanisms driving the relationship between parenthood and well-being (Grundy/Tomassini 2005, 2008, 2010).

### **Early parenthood**

Existing studies on the relation between early childbearing and later health outcomes suggest that early parenthood is negatively correlated with physical health in later life (Waldron 1998; Grundy/Holt 2000; Mirowsky 2002). Early childbearing has also been associated with higher rates of depression and worse mental health (Koropeckyj-Cox et al. 2007; Mirowsky/Ross 2002; Kalil/Kunz 2002; Henretta 2007).

Early childbearing has typically negative consequences for the mother's life course. A young age at first birth may lead to low educational attainment (McElroy 1996) and ensuing socioeconomic disadvantage (Hobcraft/Kiernan 2001). Lower educational attainment, sustained unemployment, higher parity and a lower standard of living may partly explain the association between early childbearing and physical health (Mirowsky 2002). However, the association seems to abide under control of key social and economic indicators (Grundy/Holt 2000). Higher levels in later life depression may be partly due to earlier marriages, lower educational attainment, higher risk of economic hardship, and worse physical health for young parents (Koropeckyj-Cox et al. 2003; Mirowsky/Ross 2002). Regarding selection effects, young women from disadvantaged families are at a greater risk for teenage childbearing (cf. Spence 2008: 4).

### **Late parenthood**

Empirical evidence regarding the relationship between late childbearing and well-being in later life is mixed (cf. Spence 2008: 4). Mirowsky (2002) calculates an optimal age at first birth for women at around 30 and a statistically significant downturn in expected health with delay of the first birth beyond that age. The health impact of age at first birth remained significant for women after adjustment for education, parity, unemployment history, and economic hardship. Yi/Vaupel (2004) demonstrate that oldest-old Chinese women with births after age 35 are less likely to have limitations in activities of daily living, being cognitively impaired and showing symptoms of depression, after adjustment for demographic characteristics, family support, social connection and health practice. Mirowsky and Ross (2002) showed that the lower depression rates among late mothers and fathers are attributable to later marriage, higher levels of socioeconomic resources, and better physical health of men and women who delay parenthood.

Mirroring the mixed empirical evidence, the mechanisms at work in the late childbearing and health nexus are ambiguous. "On one hand, postponed childbearing may allow a woman to attain her desired level of education, marry and establish a stable relationship and home environment, and improve financial security. Moreover, mothers (particularly late childbearers among whom offspring are relatively young and able to provide assistance) may be more likely to receive care in old age from their children (Yi/Vaupel

2004). However, having children late (ages 35 and older), particularly first births, is associated with negative health during the time of pregnancy, such as pre-eclampsia, pregnancy-induced hypertension, and gestational diabetes” (cf. Spence 2008: 5), which may result in long-term health problems. Regarding selection processes, Smith et al. (2002) and Yi and Vaupel (2004) stressed that more robust women may age more slowly and are therefore able to have children later in life.

This paper underscores both selection processes for the timing of first birth, as well as the importance of social and physiological mechanisms linking age at first birth and well-being. Potential confounding and mediating factors are socioeconomic status, family characteristics, and other individual attributes that may influence both the timing of the transition to parenthood and the well-being in later life. In the present study, we do not aim to contribute to the discussion of the underlying mechanisms of early and late parenthood on well-being. Instead, our focus is on the verification of a causal effect of the timing of childbirth on well-being, and the measurement of the relevance of underlying selection processes as suggested by Williams et al. (2011). In the spirit of experimental research as the gold standard for estimating causal effects, this study applies a counterfactual analysis with observational data using a propensity score matching approach (Morgan/Winship 2007).

## **Data, methods and variables**

The present study uses data from the German Socio-Economic Panel (SOEP). The SOEP is an annually collected longitudinal survey that covers a broad range of topics including household composition, employment, occupation, earnings, health, and satisfaction indicators. It was first conducted in 1984 for West Germany, with the new federal states of Germany added in 1991 after reunification. The data we use for our analyses were collected in 2011.

We take a gendered perspective in our analyses. The analytical sample consists of 3,806 women and 2,817 men aged 50-79 years in 2011, for whom valid data on evaluation of life satisfaction (1,065 missing values) and age at first parenthood (10 missing values) are available. Furthermore, we exclude respondents who are without German citizenship or childless.

## **Propensity score matching and Rosenbaum bounds**

Based on Rubin’s counterfactual account to causality with observational data, this study applies a propensity score matching approach (Morgan/Winship 2007). The idea is to find for each early/late parent (case) a matching observation from the group of ‘proper’ timers (control) with the same (or at least very similar) X values and to achieve balance on all pre-treatment assignment variables among matched cases and controls. However, if X contains several variables there is a large probability that no exact matches could be found. Rosenbaum and Rubin (1983) proved, that instead of X the propensity score (the probability of being a case) can be used in the matching algorithm. If the propensity score

is a consistent estimator, the matched pairs are balanced on both observed and unobserved preexisting characteristics.

In the following analysis, we first estimate a logit model to calculate the predicted probabilities of early (late) parenthood compared to ‘normal’ timing, which are used as the propensity scores (Caliendo/Kopeinig 2008). In this model, all observed covariates are measured prior to occurrence of parenthood. Second, we matched early (late) parents to those with ‘proper’ timing using the propensity scores. Among the control group, the matched cases include only those who are close enough to early (late) parents in terms of the propensity scores. Among a variety of matching algorithms, we consider nearest-neighbor, kernel and radius matching.<sup>1</sup> Third, we examine whether early (late) parents and their matched counterparts are balanced on observed covariates. If the propensity score estimation model is well specified, there should be little difference in the observed covariates between these two groups. We test whether the matching process achieves a significant reduction in absolute bias measured by the standardized percentage mean difference in each covariate between the case group and the control group (Lee 2010). Finally, we assess differences in well-being between early (late) parents and their matched counterparts by calculating average treatment effects on the treated (ATT).

In the matching procedure it could happen that a certain portion of early (late) parents cannot be matched to the control group due to extreme values on the propensity scores. If this common support problem appears, one can only estimate the causal effects of early (late) parenthood for the matched subset of the treated group (Heckman et al. 1998). As shown below, we do not find common support for 30 cases of early (late) parents.

Another crucial assumption of propensity score matching is ignorable treatment assignment assumption: conditional on observed covariates, timing of parenthood is independent of well-being in later life (Rubin 1977). Even if propensity score matching achieves a balance between early/late parents and their matched counterparts in terms of preexisting observed characteristics, the estimate of the ATT may be sensitive to unobserved characteristics that influence both birth timing and well-being. The sensitivity analysis developed by Rosenbaum (2002) addresses the strength of such an unobserved variable to evaluate the estimated causal effects from propensity score matching. The Rosenbaum bounds method allows to quantify the ‘hidden bias’ problem by assessing “how strongly an unmeasured confounding variable must affect selection into treatment in order to undermine the conclusions about the causal effect from a matching analysis” (DiPrete/Gangl 2004).

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1 Nearest neighbors (2) with replacement: Those respondents of the control group, whose propensity scores are closest to respondents of the treatment group (with two nearest neighbors in contrast to the default of only one comparison unit), are used for matching. Matching with replacement means that a control unit can be a best match for more than one treated unit. Epanechnikov kernel matching: All treated are matched with a weighted average of all controls with weights that are inversely proportional to the distance between the propensity scores of treated and controls each participant is matched to a weighted average of all respondents of the control group. Type Epanechnikov of kernel is default. Additional analyses with Gaussian kernel yield similar results. The bandwidth of 0.06 is default. Radius Matching (0.001): Respondents of the control group are matched to respondents of the treatment group if their propensity score is arranged in a predefined radius or caliper as neighborhood of the propensity score of the treated unit. We use 0.001 as a more rigorous caliper than default 0.005.

## Variables

*Dependent variable:* The analyses comprise the global current life satisfaction as the key outcome. Responses to the question ‘How satisfied are you with your life, all things considered?’ range from 0 (completely dissatisfied) to 10 (completely satisfied) and show how positively or negatively respondents evaluate their lives.

*Explanatory variables:* The main explanatory variable is the timing of the birth of the first child. By subtracting the age of the first-born child from the age of the respondents, their age at first parenthood is obtained (restricted to a minimum of 14 and a maximum of 58 years). Furthermore, three groups classify the age pattern, as we expect no linear effect but differences between those age groups. ‘Early’ indicates the age at which not more than roughly one quarter of the interviewed persons already had their first child, whereas ‘late’ indicates the last quarter in the age range of the respondents’ age at first parenthood. Because of variations in age range arising across the sexes and (however smaller) the birth cohort of the respondents, the dummies early and late timing account for both variables (see Table 1). A ‘normal’ timing – arranged between the maximum age of the early group and minimum age of the late group – operates as the reference category.

*Table 1:* Timing of first parenthood in years (minimum to maximum age), by sex and birth cohort (number of bases in parentheses)

Birth cohort	Women			Men		
	Early	Normal	Late	Early	Normal	Late
<b>Cohort 1952-1961</b>	14-21 (458)	22-27 (663)	28-42 (395)	16-24 (288)	25-30 (518)	31-51 (358)
<b>Cohort 1942-1951</b>	14-20 (431)	22-25 (402)	26-43 (374)	16-24 (234)	25-31 (460)	32-54 (254)
<b>Cohort 1932-1941</b>	15-21 (261)	22-26 (505)	27-48 (317)	17-24 (190)	25-30 (317)	31-58 (198)
<b>N</b>	1,150	1,570	1,086	712	1,295	810

*Source:* SOEP 2011, own calculations.

The comparisons between early (late) and normal timing of first parenthood show statistically significant differences in the average life satisfaction of women (via two-sample t-test with equal variances, see left part of Table 3). Early age at first motherhood is associated with lower life satisfaction, and a late timing with a higher satisfaction level. The t-test indicates differences in life satisfaction of men merely when contrasting early vs. normal timing, where a younger age at first fatherhood is associated with lower life satisfaction. It seems that timing of first parenthood and current life satisfaction are connected in some way. With this method however, it is neither possible to verify if there is a causal linkage, nor if selection effects produce the significant differences in the means.

Social background, socio-demographic and socio-economic factors and cultural norms regarding fertility decisions determine family formation and especially its timing. The following five *covariates* – which are available in the data and ideally placed at the time before or around the first birth – are statistically significant correlated with the timing of parenthood and current life satisfaction. This means that both comparison groups



originally differ in these covariates. We distinguish three different birth cohorts because the intercohort trend towards longer years of education (via educational expansion) may result in postponement of family formation and therefore higher ages at first birth. A good measure for life socio-economic status is the highest degree of education achieved (on the basis of ISCED 1997), which has normally already been obtained before the birth of the first child. In addition, marital status at the time of first parenthood is considered since marriage can be connected to familial and financial security. Besides, a religious denomination may influence the timing of the first birth as a result of religious and social conventions. Due to the fact that it reflects the status at the time of the interview, the data may underestimate the proportion of religious persons at the time of first parenthood, considering that the probability of leaving a religious denomination increases with age. Another variable accounts for respondents who lived in East Germany in 1989. This consequently enables to control for conditions of socialization as parenthood at early ages was exemplary for people in the German Democratic Republic (GDR).

## Results

The following Table 2 presents the result of logit models predicating early and late parenthood. Furthermore, it demonstrates the initial heterogeneity between early (late) parents and their counterparts. In many cases there are statistically significant effects which means, that respondents with early (late) parenthood compared to normal timing are different in that covariates. Particularly early mothers are statistically different from mothers with normal timing at the .05 level in terms of almost all preexisting observed covariates (except religious denomination).

*Table 2:* Odd ratios from logit model predicting timing of first parenthood status, by sex and birth cohort

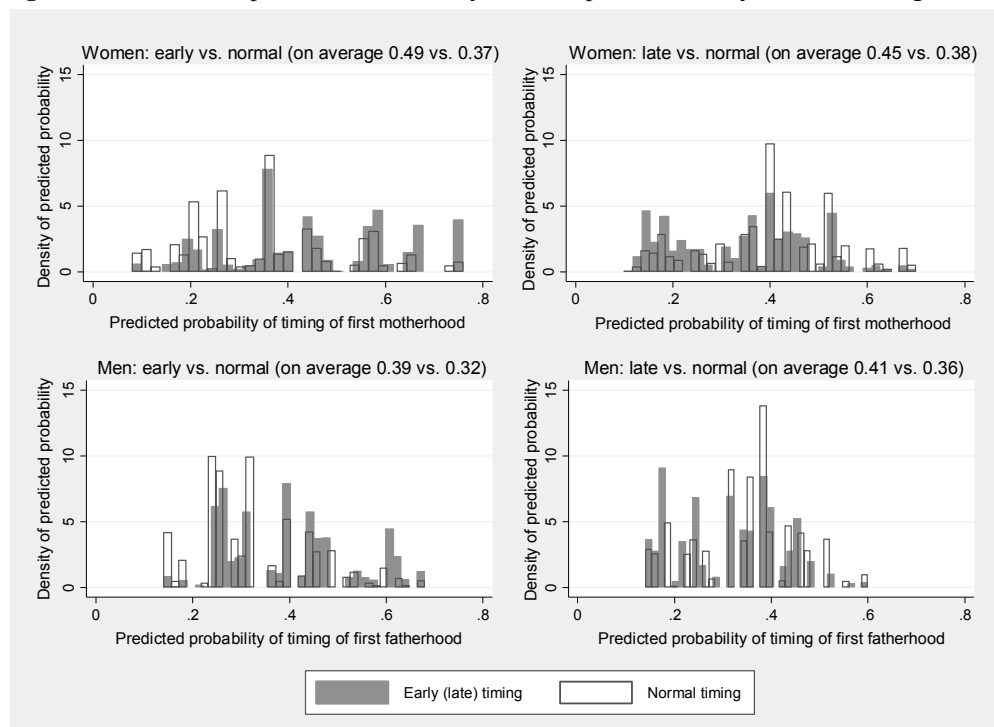
Covariates	Women		Men	
	Early	Late	Early	Late
Birth cohort				
Cohort 1942-1951	<b>1.646<sup>***</sup></b>	<b>1.653<sup>***</sup></b>	1.076	<b>0.754<sup>**</sup></b>
Cohort 1932-1941	<b>0.706<sup>**</sup></b>	1.151	<b>1.422<sup>**</sup></b>	0.896
Highest achieved degree of education				
Not yet or merely finished school	<b>2.186<sup>***</sup></b>	0.849	0.971	1.077
University degree	<b>0.347<sup>***</sup></b>	<b>2.001<sup>***</sup></b>	<b>0.504<sup>***</sup></b>	<b>1.694<sup>***</sup></b>
GDR	<b>2.223<sup>***</sup></b>	<b>0.297<sup>***</sup></b>	<b>1.979<sup>***</sup></b>	<b>0.355<sup>***</sup></b>
Religious denomination	0.908	0.913	0.818	1.004
Married at first parenthood	<b>0.438<sup>***</sup></b>	<b>1.308<sup>**</sup></b>	<b>0.516<sup>***</sup></b>	<b>0.718<sup>**</sup></b>
<b>N</b>	2,632	2,579	1,970	2,066
<b>Pseudo R<sup>2</sup></b>	0.093	0.054	0.057	0.040

*Note:* Reference categories: normal timing, birth cohort 1952-1961, vocational education, lived in West Germany in 1989, no religious denomination, have never/not yet or not anymore been married at time of first parenthood. Levels of significance: \* $p \leq 0.05$ , \*\* $p \leq 0.01$ , \*\*\* $p \leq 0.001$ .

*Source:* GSOEP 2011, own calculations.

Within the logit estimations the predicted probabilities of receiving treatment, which are used as the propensity scores, are calculated. Clearly, there is much discrepancy between the two groups regarding the probabilities to belong to the treatment group. The propensity scores shown in Figure 1 do mismatch in many classes of the propensity score and are on average higher for respondents of the treatment group. At the same time, in each class there are a certain number of non-treated individuals as well. This, we can assume that common support is given.

Figure 1: Predicted probabilities of early and late parenthood, by sex and timing

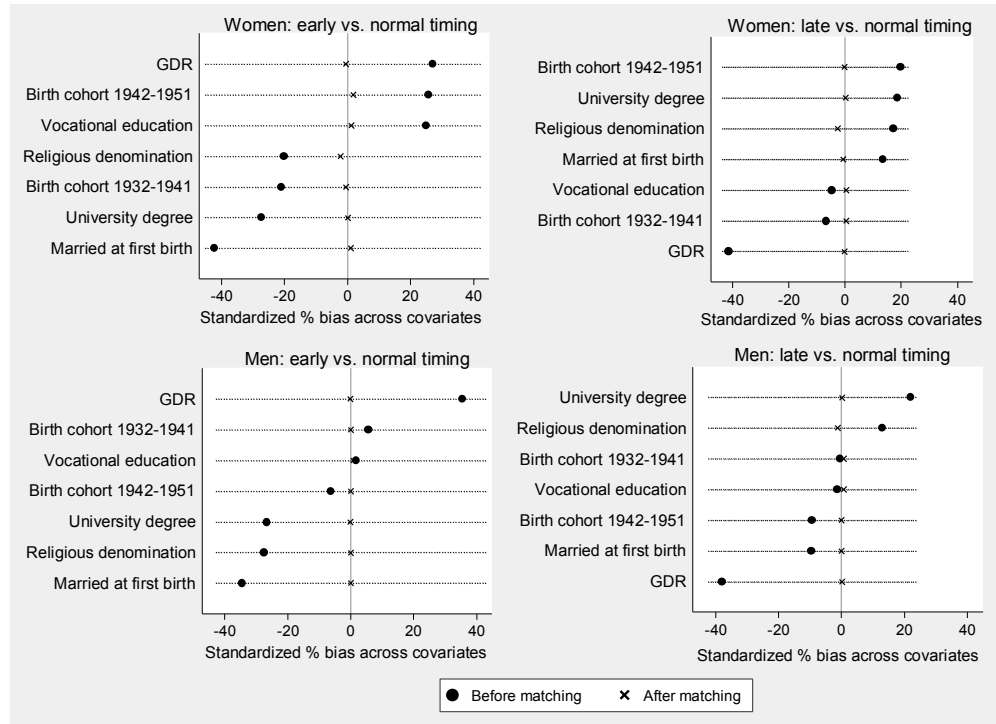


Source: SOEP 2011, own calculations.

Using these propensity scores, we generate a sample consisting of early (late) parenthood respondents and their matched cases whose propensity scores are sufficiently close to each other. Balance tests approve that the matching created a good balance quality with no systematic differences in the distribution of covariates between both groups. A t-test proves that the differences between the means in each covariate are no longer significant after matching. Relating to this, the dot charts in Figure 2 show the 'standardized bias' before and after matching as percentage heterogeneity between both groups regarding a specific variable. The closer the symbol to the zero-line, i.e. the smaller the percentage standardized bias, the better the matching balanced the treatment group and the control group. Every chart shows strong bias reductions (near to perfect homogeneity) in the covariates through matching. Consequently, all the mentioned tests prove that it was possible to gen-

erate an appropriate control group which is similar enough to the treatment group to be used for a reliable estimation of treatment effects.

*Figure 2:* Standardized percentage bias for each covariate before and after matching, by sex and timing



Source: SOEP 2011, own calculations.

Finally, we assess differences in well-being between early (late) parents and their matched counterparts. The average differences between the means of both groups are presented in Table 3 as average treatment effects on the treated (ATT) – in the first line before, and in the second line after matching. Despite different algorithms, the matching results are quite similar. This means that the results are robust regarding the type of matching.

*Table 3:* Propensity score matching estimates of the effects of timing of first parenthood, different algorithms, ATT before and after matching (t-statistic in parentheses)

Sex of respondent	Timing of first parenthood	Differences in the average life satisfaction (early/late vs. normal)	Matching algorithm		
			Nearest Neighbor	Kernel	Radius
Women	Early	6.7 vs. 6.9 (3.76)	-.25 (-3.48) -.19 (0.79)	-.25 (-3.48) .49 (1.29)	-.25 (-3.48) -.14 (-1.70)
	Late	7.1 vs. 6.9 (-3.11)	.21 (3.19) -.03 (0.09)	.21 (3.19) .47 (1.03)	.21 (3.19) -.01 (-0.11)
Men	Early	6.8 vs. 7.0 (1.97)	.15 (-1.85) -.07 (0.26)	-.15 (-1.85) .02 (0.06)	-.15 (-1.85) .02 (0.28)
	Late	7.1 vs. 7.0 (-1.11)	.08 (1.12) -.06 (-0.20)	.08 (1.12) -.11 (-0.26)	.08 (1.12) -.07 (-0.90)

Source: SOEP 2011; own calculations.

The average differences between the means of early timing and normal timing of first motherhood seems to indicate a significant negative treatment effect of early timing on the life satisfaction of female respondents in older ages. After matching and taking into account the covariates birth cohort, education, marital status, religious denomination and GDR (lived in East Germany in 1989) this treatment effect is definitely smaller and not statistically significant anymore. The comparison between late and normal timing of mothers, conversely, shows a significant positive treatment effect before matching, and a no longer significant treatment effect after matching. The treatment effect for male respondents is not significant right from the start, which means that the timing of first fatherhood produces no differences in the average life satisfaction between men with normal and divergent timing.

Table 4 presents the Rosenbaum bounds for the effect of early (late) parenthood in the presence of unobserved heterogeneity. This allows assessing how large the selection bias problem would need to be to completely wipe out propensity score matching estimates for the effect of timing of first parenthood. The indicator Gamma  $\Gamma$  shows the magnitude of selection bias on unobserved covariates that would predict the timing of parenthood status, expressed as an odds ratio. As  $\Gamma$  approaches 1.4, the effect of early motherhood on life satisfaction becomes statistically insignificant at the .05 level. This means that in order to challenge the matching estimate, an unobserved covariate should cause the odds ratio of early childbearing to differ between early mothers and their matched counterparts by a factor of 1.4. A selection bias with such magnitude is larger than the estimated effect of oldest birth cohort university degree, membership in a religious denomination or being married at first parenthood. The effect of late motherhood on life satisfaction does not become insignificant until  $\Gamma$  approaches 1.6. A selection bias with such magnitude is larger than the estimated effect of birth cohort, not having finished school yet, having lived in East Germany in 1989, membership in a religious denomination or being married at first parenthood. In contrast, the effects of timing of first fatherhood are very vulnerable to hidden bias, as a selection bias occurs for unobserved variables with a very small impact on timing of first fatherhood.

*Table 4:* A sensitivity analysis using the Rosenbaum bounds of the causal effects of timing of first parenthood, by sex and timing

Timing of first parenthood	$\Gamma$	<i>p</i> -critical
Early motherhood	1.0	<0.001
	1.1	<0.001
	1.2	<0.001
	1.3	<0.001
	1.4	0.130
Late motherhood	1.0	<0.001
	1.1	<0.001
	1.2	<0.001
	1.3	<0.001
	1.4	0.001
	1.5	0.020
	1.6	0.110
Early fatherhood	1.0	0.06
Late fatherhood	1.0	0.06

*Notes:*  $\Gamma$  is the odds ratio of differential treatment assignment due to an unobserved covariate; *p*-critical ( $p \leq 0.05$ ) from the Wilcoxon signed rank tests.

*Source:* SOEP 2011, own calculations.

## Summary

A large body of literature has documented a negative association between early childbearing and well-being in later life. The effects of late parenthood are mixed due to different social and physiological mechanisms as well as selection processes for the timing of first birth. This article extends the literature by employing propensity score matching with a sensitivity analysis using Rosenbaum bounds to estimate effects of birth timing on well-being net of observed selection effects.

The empirical analyses are based on data from the German Socio-Economic Panel. Applying a naïve estimator yields negative effects of early births and positive effects of late births for women. For men, there is no effect of early and late fatherhood. After matching on the propensity score, we did not find any significant effect of early or late parenthood on well-being for women and men. Therefore, not the age at first motherhood itself, but self-selection into a differing timing of first motherhood as predisposition produces the initial variations in life satisfaction. In summary, we suggest that there is no causal linkage between the timing of first parenthood and the evaluation of life satisfaction in later life for either females or males.

Several limitations of this study warrant mention. First, it should be recognized that the propensity score matching analysis combined with the Rosenbaum bounds method is not a solution to all issues regarding selectivity. Matching can only be done on observables and the Rosenbaum bounds give us a hint on the required strength of unobservables to chance the estimated causal effects. For males, the fit of the propensity scores of early (late) parenthood was less successful compared to females, and the Rosenbaum bounds

indicated a large potential of hidden bias. Second, this study addresses the effects of first birth timing on well-being in later life using observational data. An alternative approach would be using twin studies as a source of quasi-natural experiment report (Pudrovska/Carr 2007). Whether or not early or late first parenthood has long-term consequences, therefore, remains an important topic for future research. Third, it is likely that structural changes influence the association between timing of first birth and well-being later in life. This study does not contribute to this question. Research on fertility timing could benefit from comparisons of different age groups, and cohort data linking fertility timing to macro-level social changes. Fourth, since the relative importance of fertility history may depend on the institutional context (Aassve et al. 2010; Margolis/Myrskylä 2011), it would be worthwhile to replicate the findings for Germany with data from other countries. Finally, research on the fertility history and well-being nexus would benefit from more insights about the social and physiological consequences of early and late parenthood.

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