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Tobias Putz & Henriette Engelhardt

The effects of the first birth timing on women's wages: A longitudinal analysis based on the German Socio-Economic Panel

Die Einkommensseffekte des Zeitpunkts der ersten Geburt: Eine Längsschnittanalyse auf Basis des Sozio-oekonomischen Panels

Abstract:
While the wage effects of a birth, the so-called "motherhood wage gap", have already been analyzed in more detail, studies exploring the timing of this life event still tend to be rare. Moreover, the large majority of existing evidence on this topic is based on data from the United States. Research using other data sources, for example research based on German data, is almost completely missing. By focusing on the causal effects of the timing of the first birth on women's wages in their subsequent life time (up to age 45), this paper seeks to contribute to this research gap. Based on longitudinal data of the German Socio-Economic Panel (SOEP), estimated fixed-effects panel models indicate that the negative wage effects of a first birth can primarily be observed for those women, who bear their first child relatively late. Furthermore, the estimated models provide evidence that the negative wage effects related to late motherhood can especially be observed for women with a low and intermediate level of education as well as for women who were married at first birth. Moreover, it seems that only young mothers experience an increase in their wages as the time since the first birth elapses. At last, yet for late mothers only, the negative effects of childbirth increase with the length of the work interruption around first birth. Overall, in contrast to the existing literature, these results indicate negative wage effects of a delayed first birth. Thus, according to the well-established "motherhood wage gap", these results can be considered as indication for a "late motherhood wage gap".

Zusammenfassung:
Während der Effekt einer Geburt auf das Einkommen unter dem Stichwort „motherhood wage gap" bereits eingehend untersucht wurde, existieren bisher nur vereinzelt Arbeiten, die die Effekte des Zeitpunkts dieses Ereignisses analysieren. Die große Mehrheit bestehender Befunde basiert darüber hinaus auf amerikanischen Daten. Untersuchungen, die andere Datenquellen nutzen, wie zum Beispiel Studien auf Basis deutscher Daten, fehlen bisher fast vollständig. Der vorliegende Beitrag versucht diese Lücke zu schließen. Im Mittelpunkt steht dabei die Untersuchung des kausalen Effekts des Geburtszeitpunkts auf das Einkommen im weiteren Lebenslauf (bis zum 45. Lebensjahr). Die Schätzungen von Fixed-Effects-Panel-Modellen mit Längsschnittdaten des Sozio-oekonomischen Panels (SOEP) deuten darauf hin, dass die negativen Einkommenseffekte, die durch die Geburt des ersten Kindes entstehen, vor allem für solche Frauen beobachtet werden können, die ihr Kind zu einem relativ späten Zeitpunkt zur Welt bringen. Die negativen Effekte des Geburtstimings zeigen sich insbesondere für niedrig- und mittelgebildete Frauen sowie für verheiratete Frauen und verlieren für frühe Mütter mit dem Abstand vom Geburtsereignis an Einfluss. Darüber hinaus nehmen die negativen Effekte einer Geburt für späte Mütter mit der Länge der kindesbedingten Erwerbsunterbrechung zu. Im Gegensatz zur vorliegenden Literatur deuten die Befunde damit auf negative Einkommenseffekte durch eine späte Mutterschaft hin, so dass in Anlehnung an die bereits bekannte „motherhood wage gap" eher von einer „late motherhood wage gap" gesprochen werden kann.

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Key words: motherhood wage gap, first birth, birth timing, wage, labor market

Schlagwörter: motherhood wage gap, Erstgeburt, Geburtszeitpunkt, Einkommen, Arbeitsmarkt

1. Introduction

In the past decades, the majority of the industrial countries faced profound changes in their labor markets and family lives (Goldin 2006; Sobotka 2008; van de Kaa 1997, 2002). According to this, many countries experienced growing labor force participation rates of women (U.S. Bureau of Labor Statistics 2013) and a dramatic decline in their fertility rates, which in most countries dropped below the replacement level (OECD 2012a). Closely related to the declining fertility rates, many countries also faced a considerable increase in the age of mothers at their first birth (OECD 2012b). These profound changes can also be observed for West Germany: looking at the time period from 1960 to 2011, the total fertility rate fell from approximately 2.4 to 1.4 (Bundesinstitut für Bevölkerungsforschung 2013a), while at the same time the labor force participation rate of women increased from approximately 48% to 71% (Statistisches Bundesamt 2013a) and the average age of mothers at their first birth rose by approximately 3 years (Bundesinstitut für Bevölkerungsforschung 2013b).

Facing these changes, previous research mainly examined how fertility affects employment (Matysiak/Vignoli 2008; Schröder/Pforr 2009; van der Lippe/van Dijk 2002) and how employment affects fertility (Balbo et al. 2013; Bhaumik/Nugent 2005; Kreyenfeld 2004; Schröder/Brüderl 2008). With regard to the declining birth rates, research primarily investigated the social and individual reasons of this development (Billari 2008; Caldwell/Schindlmayr 2003; Lutz et al. 2006; Morgan 2003). Lastly, looking at mothers' rising age at first birth, research especially explored the consequences (Sobotka 2004, 2010) as well as the reasons for this development (Bloemen/Kalwij 2001; Caucutt et al. 2002; Gutiérrez-Domènech 2008; Kreyenfeld 2008; Mills et al. 2011). Thus, research has mainly been focused on mother's age at first birth as a dependent variable. Only few studies have systematically analyzed the timing of the first birth as an independent variable. This is especially surprising, since theories, like the life course theory and the human capital theory, suggest an enormous influence of the first birth timing on numerous areas of life (Elder 1994; Kohli 1985; Mincer 1974; Mincer/Ofek 1982; Mincer/Polachek 1974).

By analyzing the effects of the first birth timing on women's wages, this paper seeks to contribute to this field of research. Thus, the present study can be seen as a complement and supplement to the debate on a "motherhood wage gap" or a "motherhood wage penalty" (Budig/England 2001; Gamboa/Zuluaga 2013). The underlying research question can be stated as the following: Does the timing of the first birth have a causal effect on the wages of West German women?

By focusing on this issue, the present study may contribute to a better understanding of the mechanisms underlying the continuous delay of the first birth to later life stages in the last decades. Given the high importance of a woman's age for her fecundity (ASRM 2006; Balasch 2010; Ng/Ho 2007) as well as the strong correlation between a woman's age and the risk of miscarriages (Coste et al. 1991; Fretts et al. 1995), this development has often been associated with the decreasing total fertility rates of the last decades (Kohler et al. 2002). Moreover, the birth of a child can also be seen as an important factor

for the "gender pay gap" (Ziefle 2004: 229). For this reason, this paper can also contribute to a better understanding of an important factor for social inequality and thereby help to derive recommendations for political interventions.

The remainder of this paper is structured as follows. Section 2 provides a brief summary of the existing literature and outlines its weaknesses. In section 3, the theoretical background is discussed and the hypotheses for the empirical analysis are introduced. Following this, section 4 describes the methodological approach and the data basis used for the empirical analyses. Section 5 provides the results of the descriptive and multivariate analysis. A discussion of the empirical findings is provided in Section 6. Finally, in section 7, the limitations of this paper are highlighted and suggestions for future research are made.

2. Review of the literature

Studies focusing on the employment effects or the economic consequences of a birth for women are well-established in the social sciences (Anderson et al. 2002; Anderson et al. 2003; Angrist/Evans 1998; Avellar/Smock 2003; Bender et al. 2003; Cristia 2008; Fitzenberger et al. 2013; Gangl/Ziefle 2009; Gash 2009; Jacobsen et al. 1999; Matysiak/Vignoli 2008; Petersen et al. 2010; Schröder/Pforr 2009; Trappe/Rosenfeld 2000; Ziefle 2004). Although there are large differences between the existing investigations, the majority of analyses points in one direction: comparing mothers with childless women, the birth of a child has negative employment effects – with regard to wages, this result is often called the "motherhood wage gap" (Anderson et al. 2003; Gamboa/Zuluaga 2013). Substantially less attention has been given to the employment effects of the first birth timing. For instance Brewster and Rindfuss (2000: 291) note (but see also Troske/Voicu 2013: 485; Zerle et al. 2012: 47): „Investigators have focused on the decision to have children or not and the number of children, but additional aspects of fertility are likely to be relevant. Birth timing and spacing, for example, may comprise key components of strategies to balance work and family responsibilities." Although the number of studies contributing to this research field has increased in recent years, "the implications of first birth timing on career outcomes are not yet fully understood." (Karimi 2014: 56)

One of the first research areas investigating the effects of the first birth timing on employment has been the research on teenage childbearing. Most of these studies indicate positive employment effects with a delayed birth (Fletcher/Wolfe 2009; Hofferth/Moore 1979; Lee 2010). Apart from these findings, which probably can only difficultly be applied to other stages of life, a new research area has emerged, analyzing the employment effects of the first birth timing for a wider range of ages. Some of these analyses especially focus on the effects of the first birth timing on women's wages.

The majority of these analyses indicate that a delayed first birth has a positive impact on women's financial situation (Amuedo-Dorantes/Kimmel 2005; Blackburn et al. 1993; Buckles 2008; Chandler et al. 1994; Drolet 2002; Ellwood et al. 2004; Herr 2007, 2012; Kind/Kleibrink 2012; Miller 2011; Taniguchi 1999). Miller (2011: 1071) for instance states: "Motherhood delay leads to a substantial increase in earnings of 9% per year of delay [*and to*] (…) an increase in wages of 3% (…)". The positive effects of a delayed first birth are of-

ten explained with regard to the human capital of the observed women (Herr 2007; Taniguchi 1999). Herr (2007: 5), for example, concludes that the two factors "hours worked" and "longest labor force exit" provide the strongest explanatory power for the effects of the first birth timing observed in her study. Yet, she also shows that, depending on the educational background of the observed women, these human capital related factors are only able to explain half of the wage effects connected to the first birth timing (Herr 2007: 4f.). Beblo and Wolf (2002), as well as for example Boll (2011), analyze the effects of the timing of (child-related) work interruptions on wages by using simulations based on the human capital theory, and thereby follow a different methodological procedure. While Beblo and Wolf (2002: 91) conclude that later work interruptions have more negative wage effects, a finding that can at least partially be applied to late births as well, Boll's (2011: 173ff.) findings suggest a more varied picture. However, overall and consistent with the majority of the previously presented studies, Boll's (2011: 185ff.) analysis likewise indicates positive effects of delayed motherhood on wages. Although the majority of the existing literature provides evidence for positive effects of a delayed first birth, there are a few studies indicating different results as well. Based on Swedish data, for example, Karimi (2014: 23) concludes "that motherhood postponement has negative effects on women's labor market outcomes". As an explanation, Karimi (2014) stresses the importance of the spacing of subsequent births. The late mothers of her sample are more likely to space further births in shorter time intervals, resulting in longer career interruptions (Karimi 2014: 56). In line with Karimi (2014), Schulze (2009: 159) also concludes negative effects of a late motherhood by analyzing the "socio-economic consequences of fertility" for couple households.

In addition to these findings, some of the existing studies emphasize the importance of the educational background for the relationship between birth timing and women's wages. It seems that highly educated women profit most from a delayed first birth (Amuedo-Dorantes/Kimmel 2005; Buckles 2008; Gustafsson 2001; Herr 2007; Miller 2011). Looking at highly educated women, Amuedo-Dorantes and Kimmel (2005: 38) even conclude a wage boost resulting from a delayed child birth. As an explanation for this finding, they discuss unobserved factors, especially factors that characterize "good" and "bad" jobs (Amuedo-Dorantes/Kimmel 2005: 39).

Apart from the importance of the educational background, a few existing studies furthermore indicate that the wage effects of a birth or of the birth-timing also vary according to the time elapsed since the first birth. However, the findings concerning these effects are heterogeneous. Thus, while some analyses indicate that the wage effects of the birth timing decrease as time since the birth passes (Chandler et al. 1994; Drolet 2002) other analyses indicate continuously increasing wage effects of motherhood (Buckles 2008; Ellwood et al. 2004).

All in all, the majority of existing studies report positive wage effects resulting from delayed childbirth, especially when comparing early and late mothers. Furthermore, the existing studies indicate that a late first birth is particularly profitable for highly educated women. Lastly, the negative wage effects seem to vary with the time elapsed since the first birthing. Nonetheless, despite these apparently distinct findings, the existing literature contains shortcomings.

First, the majority of the presented studies uses data from the National Longitudinal Survey and is therefore based on a "unique historical cohort" (Taniguchi 1999: 1018) of

women, which limits the extent to which these results can be applied to women of other birth cohorts. Second, life courses as well as careers are not solely determined by individual decisions, but are to a large extent structured by welfare state arrangements and shaped by socio-cultural conditions (Levy 2012: 356ff.; Mayer 2009: 414). Therefore the extent to which the presented results, which were primarily based on data from the United States, can be applied to women of other countries, like for example Germany, remains unclear. Accordingly, welfare state arrangements can vary strongly between different countries (Esping-Andersen 1990) and can lead to variations in the "gender pay gap" (Mandel/Shalev 2009) as well as in the "motherhood wage gap" (Gangl/Ziefle 2009). Third, the presented studies, at least partially, use different definitions of birth timing. Thus, despite the seemingly consistent findings, the question arises to which extent these different definitions might contribute to variations of the observed effects. In fact, even though there are some studies trying to analyze the effects of the first birth timing on numerous areas of life, there is no common definition of the "first birth timing". This applies not only to the definition of age ranges, used to identify late and early births (Zerle et al. 2012: 47), but also to the actual definition of first birth timing itself. In most existing studies birth timing is defined as the "age at first birth" (Blackburn et al. 1993; Miller 2011), however, there are some other definitions as well. For example, Herr (2012), as well as Karimi (2014), define the timing of the first birth relative to the labor market entry of the observed women, Troske and Voicu (2013) define it relative to marriage, Chandler et al. (1994), as well as Drolet (2002), lastly define the timing of the first birth as difference between the "actual" and the "predicted age at first birth".

Based on these shortcomings the present study adds to the literature in several aspects. First, given the fact that compared "with the wealth of American evidence that uses longitudinal data and fixed-effects estimators to identify the impact of childbirth [*on women's wages*], corresponding analyses for other countries still tend to be rare" (Gangl/Ziefle 2009: 346), we add to existing research by analyzing this important topic based on German data and therefore in a different structural and cultural setting. Second, we allow the effects of the first birth to vary by the timing of this life event, an aspect of the birth biography which has only rarely been analyzed until now (Karimi 2014: 56; Troske/Voicu 2013: 485; Zerle et al. 2012: 47). Finally, we not only rely on one single definition of birth timing, but use two different measuring instruments, namely, the age of the observed mothers at the birth of their first child as well as their career position at the birth of their first child. By using these two definitions of birth timing we are not only able to take the multidimensionality of fertility and labor market behavior into account (Brewster/Rindfuss 2000), but to directly compare the estimated effects of different definitions of the first birth timing for the same women.

3. Theoretical background and research hypotheses

Much of existing research is characterized by a narrow view on the relationship between fertility and women's employment, not explicitly taking the timing of childbearing into account (Brewster/Rindfuss 2000: 291; Troske/Voicu 2013: 485). Accordingly, the same

holds true for the existing theoretical considerations used to explain the observed effects. In a first step, this section provides a brief summary of these theoretical considerations. Based on this review, in a second step, the research hypotheses for the empirical analyses are developed.

One of the most popular approaches to explain the effects of a birth on women's wage is based on the human capital theory (Baum 2002; Boll 2011; Miller 2011). The underlying idea of this theoretical explanation is that the individual wage of a specific woman can be described as a function of her labor force experience and her education (Beblo/Wolf 2002; Mincer 1974; Mincer/Ofek 1982). Following this, the negative wage effects of a birth can be attributed to three mechanisms: opportunity costs, accumulation effects and depreciation effects, which are primarily generated by the child-related work interruptions connected to births. First, these career interruptions lead to an interrupted accumulation of new human capital ("accumulation effect").Thus, while women with a continuous employment biography are able to steadily accumulate wage-relevant human capital, mothers who experience a child-related work interruption are lagging behind in their human capital accumulation, an effect that should increase with the length of the labor force exit. Moreover, because mothers experiencing a child-related work interruption are not able to use their human capital during such a career break, negative wage effects of a birth might also be caused by the depreciation of existing human capital ("depreciation effect") (Baum 2002; Mincer/Ofek 1982). Lastly, the direct wage losses caused by "opportunity costs" may contribute to the wage differences between mothers and childless women as well. Although the human capital theory provides convincing explanations for the observed effects, this approach alone is insufficient to fully understand the existing findings. Thus, a variety of studies show that the negative wage effects of a birth remain in force, even after controlling for numerous aspects of human capital (Anderson et al. 2003; Avellar/Smock 2003; Budig/England 2001). Following this, Waldfogel (1997: 216) concludes: „Taking time out of the labor market is certainly an important part of the explanation for mothers' lower earnings, but it is not the whole story."

Based on the assumption that individuals as well as households have only limited resources like time and money to maximize their utility functions, the new home economics can also contribute to a better understanding of the negative wage effects of motherhood (Becker 1982; Becker 1991; Budig/England 2001). This concept offers an explanation for the negative wage effects of a birth even if no work interruptions exist and hence, the human capital stock of mothers and childless women is identical (Becker 1985). These negative birth effects can be explained by the fact that beginning with the birth, more time and energy has to be invested in household tasks, while less effort can be spend on paid labor. However, following Becker's (1985) work effort hypothesis the availability of time as well as energy is limited to the individual (Anderson et al. 2003: 275; Bielby/Bielby 2002), so that these additional tasks may lead to productivity losses. For instance, mothers may not be able to fully use their leisure time for recuperation.

Some studies also stress the importance of statistical discrimination to explain the negative effects of a birth (Correll et al. 2007; Waldfogel 1998). Following this approach, mothers may be systematically exposed to discrimination, for example, they may be passed over for promotions, which can lead to negative effects on their wages in the long run. This explanation is closely connected to the signaling approach (Akerlof 1970),

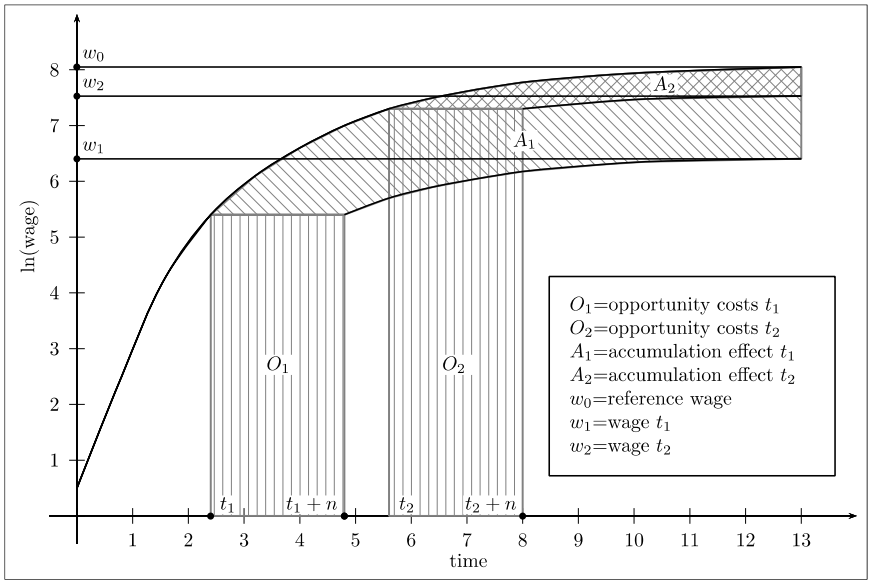
which explains that employers try to choose the most appropriate candidate (for example) when it comes to promotions. However, because information about the candidate's qualification is scarce, employers rely on certain easily available signals used as indicators for the qualification of a candidate. Motherhood might thereby be a signal for future role conflicts (Duxbury et al. 1994; Hammer et al. 2003) which could lead to productivity losses. Hence, employers probably prefer childless women, and that, on the other hand, leads to a systematic discrimination of mothers (Correll et al. 2007).

The negative wage effects of motherhood can also be explained through changes in the labor market behavior of mothers after childbirth, so that the observed wage effects may not be caused by external factors, but solely by self-selection (Budig/England 2001: 207f.). Following this explanation, mothers may adapt their labor market behavior around the birth of their child in a way which is more compatible with motherhood. For example, women might shift from full-time to part-time employment or refuse promotions to cope with both tasks, as a mother and as employee. However, part-time jobs are, for instance, often connected with lower payments (Wolf 2010). Some empirical studies seem to support such an explanation (Drobnič et al. 1999) by providing evidence for a changed market behavior after childbirth.

At last, the wage effects caused by childbirth may be no causal effects, but rather the result of unobserved heterogeneity (Budig/England 2001; Taniguchi 1999). In this case, motherhood would have no direct effect on women's wages. Instead, mothers and childless women would vary in certain unobserved characteristics, like for instance their work orientation, which are also related to their wages. If the assumption of unobserved heterogeneity is true, the observed effects of childbirth on the wages of women might be no causal effects, but rather the effect of these unobserved characteristics (Taniguchi 1999: 1010). Closely related to this argumentation, it is also possible that the observed effects are not the result of births affecting wages, but rather the result of wages affecting births (Herr 2012: 14). Accordingly, women may anticipate the moment in their careers in which their wage growth begins to decrease and hence decide to become a mother. Both of these explanations are especially important for the selection of an appropriate method of analysis.

However, although each of these concepts may provide consistent explanations for the observed effects, it is hard to find empirical evidence confirming these approaches (Correll et al. 2007: 1297). Furthermore, given the complexity of the underlying mechanisms, it seems inappropriate to explain the observed effects with one single approach. Rather, it seems adequate to interpret existing findings as results of different interdependent processes, although it may be possible that some of these processes are of particular importance for specific subgroups.

Figure 1: A graphical illustration of the wage effects of the timing of the first birth based on the human capital theory: opportunity costs and accumulation effects



Note: Own representation based on Miller (2011: 1074ff.) and Wetzels (1999: 97).

Hypotheses

The human capital theory, summarized in the previous section, can not only provide a better understanding for the wage effects of a birth, but also of the birth timing (Miller 2011; Wetzels 1999). Accordingly, this concept points to three effects that may vary with respect to the timing of birth: opportunity costs, accumulation effects and depreciation effects. Figure 1 summarizes the first two effects mentioned. It can be seen that the opportunity costs increase with time. Although, even if the opportunity costs may have an influence on lifetime income, there is no reason to assume that these effects also affect the hourly wage rate. Therefore, they are not described in more detail. Similar to the opportunity costs, the depreciation effects should also gain in importance as time passes. It can thus be assumed that women, who bear their child later in life, have already accumulated more human capital, which then can be depreciated during child-related career breaks (Boll 2011: 174; Mincer/Ofek 1982). In contrast to the opportunity costs and the depreciation effects, Figure 1 indicates that the accumulation effects lose their importance over time. In summary, based on the human capital theory, different wage effects depending on the birth timing can be assumed. Given the existing findings, it thereby seems appropriate to suppose positive wage effects of a delayed first birth. In addition to the human capital theory, the signaling approach also indicates wage effects varying by the first birth timing. According to this approach, it can be argued that an early birth should be a more negative signal to employers than a late birth, for example with regard to the labor market attachment. This would lead to a stronger discrimination of early mothers and thereby in the long run to lower wages. Finally, the negative wage effects of an early birth can also be

explained by using the new home economics. Based on this theory, early mothers may suffer more from productivity losses than late mothers, because, for example, they have accumulated less life experience and therefore face more family-work-conflicts. Following these theoretical considerations, the first research hypothesis, which will empirically be analyzed, states: *the timing of first birth directly affects women's wages (H_1). Based on the previous theoretical considerations and existing empirical findings, it can be assumed that especially an early motherhood has negative wage effects.*

Furthermore, the human capital theory also indicates that it is not the age at first birth, which is important for women's wages, but rather the position these women have achieved in the wage curve up to the birth of their first child. However, because the age at first birth comprises no information on this career position, in the empirical analyses the timing of the first birth is not only measured as the age at first birth, but also as the timing relative to the labor market entry. This relative definition of birth timing is not only closer connected to the literature on wage growth (Herr 2007: 2), but is also linked stronger to the life course theory, which not only stresses the importance of the timing of life events, but also of their spacing to other life events like, for example, the labor market entry (Elder 1994: 6). Therefore, the second hypothesis to be tested states*: the observed wage effects of the first birth timing will vary according to the used measuring instrument (H_2). Based on the theoretical considerations presented above, the relative definition of the first birth timing should thereby lead to stronger effects.*

Based on the considerations summarized in Figure 1, it can further be assumed that the effects of the first birth timing vary with the slope of the underlying wage curve, with an increasing slope leading to a growing importance of each of the human capital effects described in hypothesis 1 and thereby to a rising importance of the first birth timing as a whole. In contrast, the effects of the timing of the first birth should lose importance as the slope of the underlying wage-curve decreases and should fully disappear in cases of missing wage growth (Miller 2011: 1075). Given that jobs with a steep wage curve are probably also jobs that make high demands on the educational background of the employee (Connolly/Gottschalk 2006), this argumentation as well as existing findings (Herr 2007; Miller 2011) lead to the third research hypothesis: *the importance of the first birth timing increases with a growing slope of the underlying wage curve and thereby with a growing educational background of the observed women (H_3).* Another theoretical explanation for this hypothesis is given by the signaling approach: Following this concept, an early birth should be a negative signal especially for highly educated women, since they are more often working in much higher demanding jobs than their lower educated counterparts.

Based on the human capital depreciation and the interrupted human capital accumulation during a child-related career break, it can further be assumed that the wage effects of the first birth vary with the length of the child-related work interruption around this life event (Beblo/Wolf 2002: 91). However, the influence of the birth timing on this is hard to predict. On the one hand, it is possible that the length of the child-related work interruption gains importance if the birth occurs later in life, because by then there is more human capital accumulated that can be depreciated during a career break. On the other hand, as the bulk of human capital is accumulated in early career stages, the opposite may also be possible. This argumentation leads to the fourth hypothesis: *the wage effects of the first birth timing vary depending on the length of the child-related work interruption around first birth (H_4).*

Moreover, existing findings also indicate that the wage effects of the first birth timing vary with the time elapsed since birth. Following, for instance, the signaling approach, the negative wage effects of first birth should not occur immediately after reentering the labor market, but rather on the long run. In contrast to this argumentation, short-term wage effects based on the depreciation of existing human capital are, however, also possible. These considerations lead to the fifth hypothesis: *the wage effects of the first birth timing vary depending on the time elapsed since the first birth (H_5).*

At last, it will be analyzed, if the wage effects of the timing of first birth vary depending on the marital status at first birth – a hypothesis based on the new home economics. Following this approach, in absence of a specialization of spouses, women who were unmarried at the time of their first birth should experience lower wage effects of the first birth timing than married women, who mostly can rely on a working partner and are therefore able to specialize themselves in household tasks. The variation of the effects of the first birth timing on women's wages with the marital status may also provide evidence for the underlying mechanisms behind these effects and can especially contribute to better understand, whether the observed effects are – at least in parts – the results of a changed labor market behavior after the first birth or not (Budig/England 2001: 218). Empirical evidence for this hypothesis, based on research about the "motherhood wage gap", is ambivalent (Budig/England 2001; Taniguchi 1999). Following this line of reasoning the last hypothesis to be tested is: *women who were married at the time of their first birth experience larger wage effects of the first birth timing than women who were not married at first birth (H_6).*

4. Data, Sample and Methods

The empirical analyses are based on data of the German Socio-Economic Panel (SOEP). The SOEP is an annually conducted panel survey representative for Germany which began in 1984 and comprises personal interviews of all household members aged 17 years or older (Wagner et al. 2007, 2008). The major advantages of the SOEP are the detailed collection of the households' and individuals' economic situation as well as the detailed collection of the birth biography.

Given that generative behavior is sequential (Huinink/Kohli 2014: 1314) and it is therefore inappropriate to assume that the financial consequences, which arise from subsequent births are equal to those of the first birth, the following analyses focus on the wage effects of the first birth timing only.

The unbalanced panel sample, used for the analyses, is based on the SOEP waves 1984 to 2010 including the following restrictions on the sampled West German women: age ranging between 17 to 45 years[1]; entered the labor market until the age of 35[2]; pro-

1 The limitation of the sample to women aged between 17 and 45 years was introduced due to the reproductive phase of women that is usually specified by the age range between 15 to 49 years (Hinde 1998: 96; Rowland 2003: 235). Although the chosen age range can lead to the problem that early mothers have more time for further wage growth after the first birth, this should only marginally influence the estimated results, since the presented models not only control for the women's age, but

vided realistic data on their wages and their working hours, while being in the labor market. To be able to precisely measure the causal effects of the first birth timing, the sample was further restricted to women, who provided data at least at three points in time: in the year before the first birth, in the year of the first birth and in the year after the first birth. Finally, to measure the wage effects of a first birth, the sample comprises only women that at least once provided data on their wages before the first birth. After the operationalization, the final sample contains 1.676 women of which 383 women bore their first child during the observation period.

Dependent Variable

The dependent variable, used for the analyses, is the log hourly wage of the observed women[3]. This variable is based on the "current gross labor income in euros" that is provided by the SOEP, whereas item non-response was imputed by a two stage-procedure (Frick/Grabka 2005). Given the possibility that wage differences between early and late mothers may be influenced by differences concerning one-time payments, those payments were proportionally added to the wages (Beblo/Wolf 2000: 8). Furthermore, wages were deflated by the consumer price index provided by the German Bundesbank (Beblo/Wolf 2003: 565). Additionally, to obtain the hourly wage, the monthly income was first calculated on a weekly basis and then, using the actual working hours, converted into the hourly wage. Individuals providing implausible data, outliers[4] and self-employed people were excluded. At last, the logarithmized hourly wage was calculated using the natural logarithm. Since using this transformation would lead to an exclusion of all non-working episodes, a wage of 0.01 € was assumed for these cases.

Independent variables

For a detailed analysis of the wage effects of the timing of the first birth, two different instruments are used: the "('biological') age at first birth" (Taniguchi 1999) and "the 'relative' age at first birth" (Herr 2012). While the former is identical to the mostly used "mothers' age at first birth", the "relative age" is calculated as difference between the age at first birth and the age at labor market entry (Herr 2012: 5). Both instruments are implemented in two different ways: as a binary and as a categorial variable. While the former uses the mean value of each of the definitions of the first birth timing as a threshold, the latter is based on the first and fourth percentile to identify "late" and "early" motherhood and on the second and third percentile to define "normal" motherhood. In accordance with the statistical method used, the measures of the timing of the first birth are in-

also for the time elapsed since the first birth. Furthermore, as is shown by the sensitivity analyses, the main results remain stable even after this sample limitation is removed.

2 The labor market entry is defined as the point in time at which an observed woman has spent at least 6 months in full-time employment, part-time employment or unemployment.

3 The generation of the dependent variable is based on Boll's approach (2011: 41f.).

4 To minimize the influence of implausible values and outliers, women with an income in the bottom 1% of the income range as well as women with an income in the top 1% of this range were excluded from the sample. However, as is shown by the sensitivity analyses, the main results remain stable, even after this sample limitation is removed.

cluded in the models as interactions with the time varying variable "birth of the first child".

In addition to the birth timing, the analyses also include measures for the further birth biography, the employment biography, the current employment situation as well as for the sociodemographic background of the observed women.

Table 1: Mean values of the used variables by the age at first birth and the relative age at first birth

Variable	Age at birth			Relative age at birth			Childless
	19-26	27-32	>32	0-5	6-11	>11	women
Log. hourly wage (in €/h)	2,24	2,54	2,70	2,36	2,53	2,58	2,44
Birth biography							
Number of children	1,27	0,96	0,68	1,15	0,98	0,78	0,00
Time since first birth	5,55	3,50	2,15	4,54	3,86	2,64	0,00
Length of the work interruption around first birth	2,28	1,73	1,38	2,01	1,81	1,52	0,00
Employment biography (in months)							
Full-time experience	49,02	80,06	116,00	36,66	79,47	134,11	85,20
Part-time experience	34,55	20,93	14,80	28,45	23,12	17,60	6,81
Unemployment experience	3,40	1,78	4,32	3,17	1,87	4,35	3,08
Household experience	16,90	9,33	7,88	12,80	11,34	8,68	1,55
School/ (Vocational) Training experience	52,70	73,68	90,82	76,95	73,99	59,58	75,96
Motherhood experience	17,82	14,66	11,69	16,63	14,98	12,44	0,00
Time in gap	0,46	1,45	0,24	1,03	1,10	0,30	0,55
Current employment situation							
Full-time	0,22	0,36	0,47	0,23	0,36	0,46	0,63
Part-time	0,38	0,29	0,22	0,37	0,29	0,24	0,10
Not-working	0,34	0,32	0,30	0,35	0,32	0,29	0,18
School/ Training	0,06	0,03	0,01	0,06	0,03	0,02	0,09
Length of the time at the workplace	2,92	4,19	4,72	2,82	4,02	5,25	5,02
Sociodemographic background							
Age	28,93	31,21	34,75	29,12	31,44	34,08	28,77
Married	0,71	0,63	0,61	0,69	0,65	0,61	0,21
Divorced/ widowed	0,01	0,02	0,05	0,00	0,02	0,06	0,04
Single	0,28	0,34	0,34	0,31	0,33	0,33	0,75
N=Number of persons	100	188	95	114	182	87	1.293

Note: Results not weighted.
Source: SOEP waves 1984-2010, own calculations.

Birth biography: This includes the time elapsed since the first birth, the length of the child-related work interruption around the first birth as well as a variable measuring further births to control for the birth biography. As the descriptive results in Table 1 show, for both definitions of the first birth timing, a delayed first birth is related to a decreasing number of children as well as to a shorter time period since the first birth.

Employment biography: Besides the birth biography the analyses also include information on the employment biography of the observed women. Table 1 provides evidence that this is not only necessary from a theoretical point of view (Mincer 1974), but also from an

empirical one. To control the different employment biographies, detailed measures of the labor force experience are included in the empirical analyses: the full-time, part-time, school/training, unemployment, household and motherhood experiences, the time spent in an unspecified status ("time in gap") and, to control for non-linear effects, the squared versions of these variables. As far as possible, these variables were built on a monthly basis[5]. Only in cases where no monthly information was available, yearly information was used. As is shown in Table 1, early and late mothers also differ with regard to these variables. Thus, early and late mothers are not only in different stages of their careers, but also seem to follow different career paths. Accordingly, independent from the measuring instrument used, late mothers accumulated more full-time, less part-time, as well as less household experiences than early mothers.

Current employment situation: To control the current employment situation of the observed women, measures of their current labor force status as well as the length of the time at the workplace are included in the statistical models. As presented in Table 1, late mothers work more often full-time and at the same time less often part-time than early mothers. Furthermore, late mothers are less often unemployed or in school/training. Finally, the length of the time at the workplace also varies systematically with regard to the first birth timing.

Sociodemographic background: Because the wages as well as the employment dynamics of the women observed are likely to be influenced by their sociodemographic background, controls of these factors are also added in the analyses. These comprise the current age of the women, the squared version of this variable as well as their current marital status.

Methodological approach

Facing the methodological issues of unobserved heterogeneity and endogeneity which are connected to the events of interest, the estimation of the effects of the first birth timing on women's wages based on survey data places high demands on the analytical methods selected.

Based on the existing literature, three different methodological approaches can be differentiated to analyze the wage effects of the first birth timing. While, for instance, Herr (2012) uses simple OLS regressions to analyze these effects, Taniguchi (1999) uses fixed-effects panel analyses to measure the causal effects of the first birth timing. At last, Miller (2011), like for instance Herr (2007), uses instrumental variables to analyze the wage effects of the first birth timing.

Due to the fact that a simple OLS approach fails because of the complexity of the mechanisms underlying the relationship of interest and the quality of instrumental variables is not testable in principle[6], in line with Taniguchi (1999), the following analyses are based on fixed-effects panel models. Estimating the wage effects of the first birth timing using fixed-effects models thereby enables measuring these effects without the influence of unobserved heterogeneity. Finally, to take the endogeneity of the underlying processes into account, different model specifications are used and several robustness checks are conducted.

5 To assure that no individual accumulates more than 12 months of labor force experience per year, overlaps between different employment episodes were removed during the data operationalization process. This procedure was based on Boll's approach (2011: 43ff.).

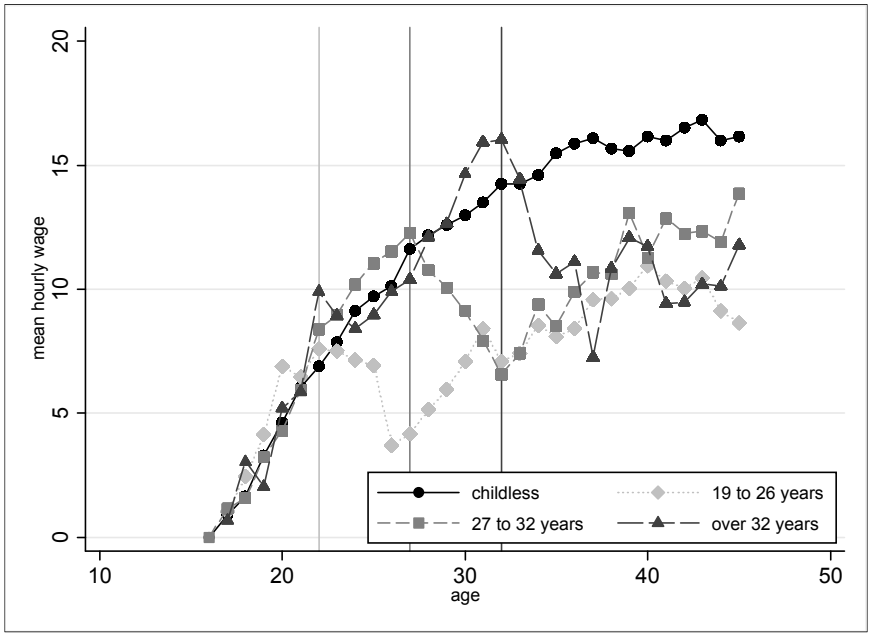
6 A detailed discussion on the use of instrumental variables for this topic is given by Ellwood et al. (2004: 14ff.).

5. Results

5.1 Descriptive analysis

As the mean values presented in Table 1 indicate, even on the basis of descriptive analyses, wage differences between late and early mothers can be observed, with late motherhood leading to wage benefits. Furthermore, Table 1 also indicates that late mothers even earn higher wages than their childless counterparts. Thus, in line with the majority of existing studies, Table 1 provides evidence for positive wage effects of a delayed first birth. However, given that early and late mothers are in different stages of their careers (see Table 1), these results have to be treated cautiously as the differences between the observed timing groups cannot be compared directly. To control for the different career stages of early and late mothers multivariate analyses are needed.

Figure 2: Development of the mean hourly wage by the biological age at first birth



Note: Results not weighted.
Source: SOEP waves 1984-2010, own calculations.

Based on the biological age at first birth, Figure 2 shows the age-specific wage curves of early and late mothers, presenting clear patterns: before the first birth, even when comparing mothers to childless women, the presented wage curves of the different timing groups are very similar indicating that none of these groups pre-selects itself into more mother-friendly but worse paid jobs. However, after the first birth the wage curves of each of the timing groups begin to fall sharply and start to differ from the wage curve of childless

women, probably caused by the child-related work interruptions connected to motherhood. Furthermore, it has to be pointed out that the wage curves of each of the timing groups seem to converge on the long run. Lastly, Figure 2 indicates that the time span needed to regain the wage earned previous to the first birth differs between the observed timing groups. While mothers of the earliest timing group need about 6 years to recover from their child-related work interruption, mothers of the medium age group need about 12 years. The wages of mothers of the oldest age group never seem to recover from first birth.

5.2 Fixed-effects results

The following results of the fixed-effects models are exclusively based on women, who bore their first child during the observation period[7]. Table 2 presents the wage effects of the first birth timing using the biological age. Table 3, on the other hand, shows the results based on the relative age at first birth.

As is shown in Table 2, the results based on the biological age at first birth provide a uniform appearance: independent of the operationalization of the underlying variable used to measure the timing of the first birth, especially late mothers seem to experience a "motherhood wage gap". Thus, only late mothers earn lower wages after their first birth. Depending on the operationalization of the used measuring instrument, these negative wage effects can either be observed for mothers at the age of over 29, 32 or, though only marginally significant, 27 years at the time of their first birth. Furthermore model 2 indicates that the negative wage effects related to the first birth increase as the birth is delayed to older ages. *Because these findings indicate different wage effects of the first birth depending on the age at this life event, the first research hypothesis can be confirmed (H_1).*

In contrast to these findings, the results based on the relative age at first birth provide no evidence for significant wage effects of the first birth timing (see Table 3). *Thus, as the results of the first birth timing vary depending on which definition is used, the second hypothesis is also verified (H_2)*. However, against the theoretical considerations of the second hypothesis, the findings emphasize the importance of the biological age at first birth rather than the importance of the relative age at first birth.

Looking at the models separately estimated for women with different educational backgrounds (see Tables 2 and 3), the results based on the biological age at first birth indicate that the negative wage effects of late motherhood can especially be observed for women with an intermediate level of education. However, in contrast to the theoretical considerations and to the existing findings, the estimated models do not show significant effects of the first birth timing on the wages of highly educated women[8]. The estimations

7 As previously described and in accordance with the used statistical approach, the variables of the timing of the first birth are included in the form of interactions with the time varying variable "birth of the first child". Following this approach, the estimated effects can be treated in accordance to the common interpretation of interaction coefficient.

8 Because this result could be explained through the low number of highly educated women, who bear their first child previous to the age of 30, the estimations were repeated using education-specific thresholds for early and late motherhood (results available upon request). The results, however, largely remained unchanged.

based on the relative timing, on the other hand, show significant wage effects for women with both a low and an intermediate level of education. Yet, the coefficient for women with an intermediate level of education only reaches marginal significance. Additionally, even if only marginally significant as well, these models also indicate positive wage effects of an early first birth for highly educated women. *Summarizing these results, the estimations indicate different wage effects depending on the educational background of the observed women. Hence, hypothesis 3 is at least partially confirmed (H_3).*

Table 2: Fixed-effects results based on the 'biological' age at first birth (β-coefficient, t-values in parentheses)

	Model 1	Model 2	Model 3 (low level of education)	Model 4 (intermediate level of education)	Model 5 (high level of education)	Model 6 (un-married)	Model 7 (married)
Birth of the first child	0.033 [0.9587]	0.0552 [1.2024]	-0.0342 [-0.5036]	0.0279 [0.7239]	0.1298 [1.3431]	0.0309 [0.5610]	0.0348 [0.7610]
Birth * Birth ≤ 29 years	–	–	–	–	–	–	–
Birth * Birth > 29 years	-0.1099*** [-2.9445]	–	-0.0874 [-1.3972]	-0.0900** [-2.1455]	-0.0341 [-0.3550]	-0.0192 [-0.3403]	-0.1558*** [-3.5626]
Birth * Birth 19-26 years	–	–	–	–	–	–	–
Birth * Birth 27-32 years	–	-0.0724* [-1.7582]	–	–	–	–	–
Birth * Birth > 32 years	–	-0.1851*** [-2.9773]	–	–	–	–	–
Number of observations	5.662	5.662	1.121	3.692	849	1.621	4.041
Number of groups	383	383	73	240	70	113	270

Note: Results weighted; the dependent variable is the log hourly wage, not presented are the coefficients of the period dummies, the birth biography, the employment biography, the current employment situation, and the sociodemographic background; significance level: * p<0.1, ** p<0.05, *** p<0.01 (based on Huber-White-Sandwich estimations);

Source: SOEP waves 1984-2010, own calculations.

In line with the theoretical considerations, the estimated models based on the biological age furthermore provide evidence for the assumption that the wage effects of the first birth timing vary systematically with the length of the work interruption around the first childbirth (see Table 4 in the appendix). Following this, the length of the work interruption around first birth seems to be especially important for late mothers, whereby each additional year significantly leads to lower wages. *Consequently, the fourth hypothesis is confirmed by the estimated models (H_4).*

Besides these findings, some of the existing studies have shown that the effects of the first birth on women's wages vary depending on the time elapsed since first birth (Chandler et al. 1994; Ellwood et al. 2004). Independent of the definition of the first birth timing, this finding is confirmed by the estimated models. Following this, in Table 4 (see appendix) it can be seen that each year which further elapses since first birth has positive effects on the wages of early mothers. However, for late mothers no such "wage recovery" can

be identified. *According to these results, the fifth hypothesis of the present study is also supported by the empirical findings (H_5).*

Lastly, to verify the hypothesis of different wage effects of the first birth timing depending on the marital status at first birth, the models were separately conducted for married and unmarried women (see Tables 2 and 3). Following this approach, the results based on the biological age at first birth indicate that the previously observed negative wage effects connected to late motherhood are limited to women who were married at the birth of their first child. Contrary to these results, the estimations based on the relative definition of the first birth timing do not show any significant effects. *In accordance with these findings the sixth hypothesis of the present study can also be confirmed, at least when using the age at first birth as definition of the first birth timing (H_6).*

Table 3: Fixed-effects results based on the 'relative' age at first birth (β-coefficient, t-values in parentheses)

	Model 1	Model 2	Model 3 (low level of education)	Model 4 (intermediate level of education)	Model 5 (high level of education)	Model 6 (un-married)	Model 7 (married)
Birth of the first child	0.006 [0.1690]	-0.0115 [0.2525]	0.0024 [0.0335]	0.0208 [0.5517]	0.1010* [1.9377]	0.0426 [0.7606]	-0.0246 [-0.5494]
Birth * Birth ≤ 8 years	–	–	–	–	–	–	–
Birth * Birth > 8 years	-0.0562 [-1.2376]	–	-0.1412** [-2.2924]	-0.0845* [-1.8534]	0.0003 [0.0046]	-0.0858 [-1.3250]	-0.0429 [-0.8187]
Birth * Birth 0-5 years	–	–	–	–	–	–	–
Birth * Birth 6-11 years	–	-0.001 [0.0228]	–	–	–	–	–
Birth * Birth > 11 years	–	0.0157 [0.2730]	–	–	–	–	–
Number of observations	5.662	5.662	1.121	3.692	849	1.621	4.041
Number of groups	383	383	73	240	70	113	270

Note: Results weighted; the dependent variable is the log hourly wage, not presented are the coefficients of the period dummies, the birth biography, the employment biography, the current employment situation, and the sociodemographic background; significance level: * p<0.1, ** p<0.05, *** p<0.01 (based on Huber-White-Sandwich estimations);

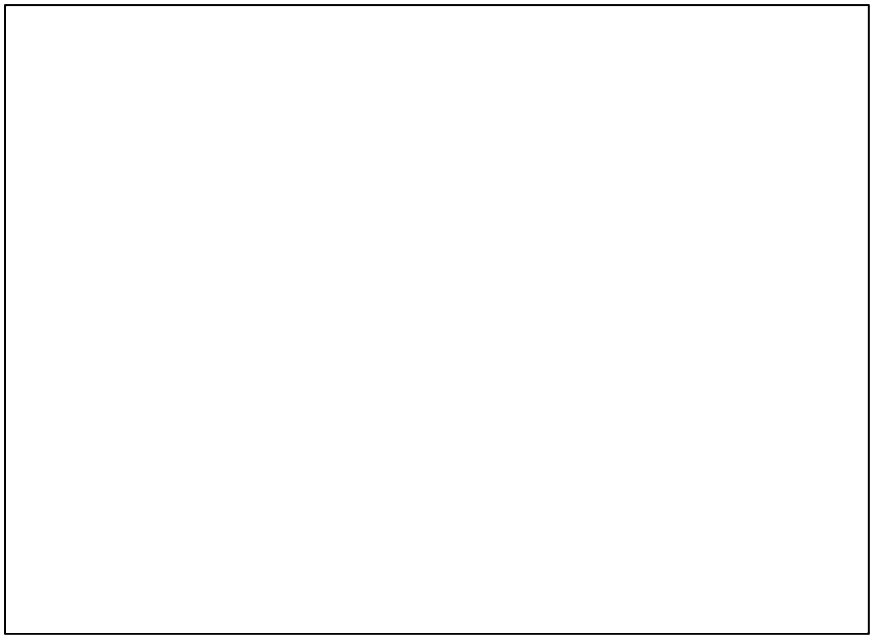
Source: SOEP waves 1984-2010, own calculations.

Summarizing the above, the results of the fixed-effects models indicate that the often stated finding of a "motherhood wage gap" can be especially observed for mothers who bear their first child relatively late in life. Furthermore, the results also provide evidence that the negative wage effects of such a late first birth can specifically be observed for women with low and intermediate levels of education as well as for mothers who were married when they gave birth to their first child. The estimated models also indicate that the wage effects connected to late first births vary with the length of the work interruption around childbirth. Additionally, the findings show that at least the wages of early mothers increase as the time since the first birth elapses. Lastly, the estimations demonstrate that the observed wage effects of the first birth timing vary according to the underlying definition of this variable.

Sensitivity analysis

To evaluate the robustness of the presented results, the estimations were repeated based on both, different model specifications and different sample compositions[9] (Myrskylä/ Margolis 2012).

Figure 3: Results of the sensitivity analyses based on the age at first birth (binary) – point-estimations and 95%-confidence intervals



Note: Results of the basis-models, lag(1)-models, lag(2)-models, lag(3)-models and AR(1)-model weighted; estimations of the basis-models, lag(1)-models, lag(2)-models, lag(3)-models and Arellano-Bond-models based on Huber-White-Sandwich estimations.

Source: SOEP waves 1984-2010, own calculations.

First of all, to account for the possibility of correlated error terms, which can lead to inefficient estimations, the models were repeated allowing for autocorrelation (AR(1)). As it is exemplarily shown in Figure 3, when using this model specification, the estimated results remain largely unchanged.

Since the relationship between the timing of the first birth and women's wages can also be influenced by the effect of the wages on the timing of the first birth, dynamic panel models were estimated in a next step. The results presented in Figure 3 exemplify that even after controlling for lagged versions of the dependent variable (up to 3 years), the effects of the timing of the first birth on women's wages largely remain unaffected.

In a last step, the presented models were repeated using the Arellano-Bond procedure that not only uses lagged versions of the dependent variable for the estimations, but also

9 Results of the sensitivity analyses available upon request.

includes lagged versions of the independent variables as instruments (Arellano/Bond 1991). Even though the estimated coefficients change when this model specification is used, the estimated results still show significant negative wage effects caused by a late first birth (see Figure 3).

Lastly, in addition to these tests, some of the sample limitations were gradually removed to evaluate how the presented results depend on the underlying sample composition. In a first step, the sample was no longer limited to women aged between 17 and 45 years; results remained relatively stable. To increase the number of observations, in a second step, the estimations were conducted again, this time including self-employed women and outliers. However, even after these changes of the sample composition the basic results remained relatively stable.

Summarizing the above, the sensitivity analyses provide evidence for a relatively high consistency of the presented findings. Especially the main effects of the first birth timing remained stable, both after the conducted robustness checks and after the changes of the sample composition.

6. Discussion

The goal of the present study was to investigate, whether the timing of the first birth has causal effects on the wages of West German women. Given the estimated results based on the data from the German Socio-Economic Panel this can be confirmed. However, in contrast to the majority of the existing findings, the results of the fixed-effects panel estimations indicate negative wage effects of delayed childbearing. Depending on the operationalization of the underlying measuring instrument, these negative effects can either be observed for women aged above 27, 29 or 32 years at the time of their first birth. Thus, present results are consistent with the findings of Karimi (2014) and Schulze (2009), who also conclude negative wage effects caused by late first births. The differences in the results between the present study and the majority of the existing analyses are probably due to differences in the empirical approaches used to measure the effects of the first birth timing. According to that, the presented results do not imply early mothers to earn higher wages than late mothers. In fact, the presented estimations rather indicate that late mothers earn lower wages after their first birth, an effect that cannot be observed for early mothers. Thus, as the empirical approach, used to assess the influence of the first birth timing on women's wages can have a large influence on the results obtained, the differences between the present study and the existing literature can not necessarily be explained by different effects of the first birth timing. However, altogether, the presented findings rather indicate a "late motherhood wage gap" than a general "motherhood wage gap".

A possible explanation for this "late motherhood wage gap" might be the assumption that late mothers are more willing to "sacrifice" their careers for their first child. Accordingly, given the fact that later mothers have lower chances for a pregnancy and a shorter time period remaining to become a mother, the desire for a child may be greater among late mothers, resulting in such a higher willingness to "sacrifice" the own career for a planned child. Early mothers, on the other hand, might think they could miss a potentially promising career. Based on the new home economics, a further explanation for this "late

motherhood wage gap" may be the fact that late mothers already achieved a solid financial situation and a well-established position in life, so that productivity losses are more "affordable" to them. Early mothers, on the other hand, may have to invest more of their time and energy in their careers in order to provide the best possible conditions for their child. Moreover, it is also possible that late first births have negative wage effects, because these births take place in a stage of life, where many crucial transitions are made, a stage Bertram et al. (2011: 96) call the "rush hour of life". However, a more methodological explanation of the "late motherhood wage gap" is possible as well. As Figure 2 has already shown, in comparison to late mothers, early mothers need a shorter time span to regain the wages they earned previous to the birth of their first child. Thus, in line with the underlying fixed-effects approach, the presented findings may also be interpreted as an effect caused by the different wage levels early and late mothers have achieved before the birth of their first child. Lastly, following Karimi's (2014) argumentation, the effects may also be caused by a different birth spacing of early and late mothers. However, since the direction of the main results remained stable, even after the analyses were repeated based on a subsample of women who exclusively gave birth to their first child during the observation period, birth spacing seems to be no sufficient explanation for the observed effects[10].

Furthermore, the estimated results have shown that the observed effects of the timing of the first birth on the wages of women depend on the underlying definition used to measure the timing of the first birth. Thereby especially the age at first birth lead to significant effects. On the contrary, when using the 'relative' age at first birth no significant effects emerged in the basic models. In accordance with these results, both of these instruments seem to measure slightly different kind of effects: while the relative birth timing presumably measures a woman's stage in her wage curve and therefore mechanisms which are controlled for by the independent variables, the biological age seems to additionally measure further wage-relevant aspects, like, for example, the effects produced by statistical discrimination.

In addition, the presented results have also shown that the negative wage effects caused by late motherhood are limited to women with a low and intermediate level of education (Fitzenberger et al. 2013: 58). In contrast to these findings, though only marginally significant in one model, highly educated women seem to experience a "wage boost" when becoming a mother in earlier life stages. Maybe for highly educated women an early motherhood leads to an employment interruption in a relative favorable career stage. However, even the absence of any significant effect of the first birth timing on the wages of highly educated women is an interesting result: this finding might reflect the different conditions for flexible work arrangements between less and highly educated women, that may help to balance work and family life and thereby reduce the negative effects on women's wage (Anderson et al. 2003: 273). However, more detailed analyses were not feasible due to the low number of observations.

According to the theoretical considerations summarized in the fourth hypothesis, the estimations have also shown that the effects of the timing of first birth vary systematically with the length of the career interruption experienced around this life event. Following this,

10 Results available upon request. Further analyses were not feasible due to the low number of observations.

the presented results indicate that the length of the child-related work interruption gains importance as the birth occurs later in life, maybe because by then there is more human capital accumulated that can be depreciated during such a career break (Beblo/Wolf 2002).

As it was assumed by the fifth hypothesis and in line with, for instance, the findings of Fitzenberger et al. (2013), the estimated models have also shown that the wages of early mothers increase as the time since the first birth passes. However, for late mothers no significant effects could be observed. These findings can probably also be attributed to the different wage levels early and late mothers have achieved previous to the birth of their first child. Nevertheless, it is also possible that late mothers already have reached a stage in their career in which their wage growth begins to stall.

Finally, and in line with the theoretical considerations of the sixth hypothesis, the results based on the biological age at first birth have shown that the negative wage effects caused by late motherhood are especially limited to women who were married at the time of their first birth. A possible explanation for this may be the assumption that women who bear their first child while being married are more likely to be able to rely on their spouse as breadwinners and thus experience negative effects on their wages, even when controlling for their current labor market situation as well as for their employment biography (Budig/England 2001: 218). The finding that these results are limited to late mothers can maybe be explained by the differences in importance of the own career for early and late mothers: early married mothers may have to concentrate more on their careers than their late counterparts, since it is more likely that their partners may not earn enough money "to make ends meet". The own career may therefore be of higher priority for early mothers, which results in the observed effects.

The finding that the negative effects of the timing of the first birth on women's wages can exclusively be observed for married women, can also help to gain a better understanding of the mechanisms underlying the observed wage effects (Budig/England 2001: 218). Following this, these effects cannot be explained by differences in the human capital of the observed women or by differences in the actual labor force status of these women, since these factors were controlled for in the estimated models. The observed effects can also not be explained with the help of the signal theory, as on the basis of this theoretical concept an early unmarried birth should be a more negative signal to employers than a late married birth. However, a possible explanation for the presented findings is the assumption of a different productivity of married and unmarried mothers. Following that, contrary to married mothers, unmarried mothers can independently of the timing of the birth not "afford" productivity losses caused by this life event, because they have higher needs for their careers. In contrast, late married mothers may have ideal conditions for productivity losses, like for example a spouse who earns good money or a relatively good financial situation.

7. Summary

The negative effect of motherhood on women's wages, the so-called "motherhood wage gap", is a well-established finding in existing literature. However, evidence based on German data as well as on the effects of birth timing is scarce. Therefore, this investigation focused on the effects of the first birth timing on the wages of West German women.

The estimated fixed-effects models have shown that the wage effects caused by a first birth vary systematically with the timing of this life event, even after controlling for detailed measures of the human capital as well as of the employment biography of the observed women. According to the well-established "motherhood wage gap", these empirical findings provide evidence for a "late motherhood wage gap".

Although these results were robust to several model specifications, there also are some limitations. First of all, further analyses of the underlying mechanisms were partially not possible due to the low number of observations. Especially the estimations separately conducted for women of different educational backgrounds suffered from this. Furthermore, though the presented models controlled for detailed measures of the individual career of the observed women, characteristics of the current employer as well as of the current partner were not included in detail. However, based on theoretical assumptions and the presented results, this seems reasonable for a better understanding of the underlying mechanisms. Besides these limitations, the findings of the present study also point to further research questions for future analyses.

First of all, the estimated results are limited to West Germany. Therefore, the extent to which these results can be applied to other samples of women, like for instance East German women, remains unclear. Furthermore, as already stressed by Taniguchi (1999: 1018), the effects of the timing of the first birth on men's wages also remain unknown. Although there are some studies analyzing the effect of a birth on men's wages (Pollmann-Schult/Diewald 2007), empirical evidence on the effects of the timing of the first birth on men's wages is rare (Kind/Kleibrink 2012). Second, given the differences between the findings of the present study and the findings of the existing literature, the question arises, whether these discrepancies are the result of different effects of the first birth timing or whether they can rather be attributed to the different data basis or to the different empirical approaches used. To answer this question and to gain a better understanding of the underlying mechanisms, international comparative analyses of the effects of the first birth timing are needed. Such analyses can especially help gain a better understanding of the influence of the institutional and cultural framework on the observed effects of the first birth timing. Third, the timing of the first birth is only one aspect of the birth biography. Thus, for example, the life course theory not only stresses the importance of the timing of life events, but also the importance of their spacing and sequencing (Elder 1994: 6, 2003: 9ff.). Because of these complex influence possibilities, future studies should not only focus on the effects of the timing of the first birth on wages, but should also consider further aspects of this important life event. Fourth, given the fact that despite the changes in family life most of the births in West Germany still take place within marriages or partnerships (Statistisches Bundesamt 2013b: 39), it seems especially interesting to not only focus on the effects of the first birth timing on the wages of women or men, but to additionally focus on the financial consequences of the first birth timing for the household as a whole (Schulze 2009). Based on the assumption of an efficient specialization of the household members (Becker 1985, 1991), it might be that the effects of the first birth timing on wages are reduced or even neutralized when looking at the household as a unit, at least for some partnership constellations.

Although there are still some open questions and some limitations the present study provided interesting insights into the relationship between the timing of the first birth and

women's wages. Thus, based on the underlying sample, the often concluded finding of a "motherhood wage gap" seems to be limited to mothers who bear their first child relatively late in life. Hence, our results rather indicate a "late motherhood wage gap". It must be stressed, however, that even though the conducted analyses consistently showed that a late first birth leads to negative effects on the wages of women, these results do not indicate that later mothers have lower wages than early mothers. Based on the statistical approach used for the analyses, these results rather indicate that late mothers have lower wages after the birth of their first child, an effect that cannot be observed for early mothers. Although this may limit the comparability to the results of other studies, the presented findings provide clear evidence for the assumption that early and late mothers experience different wage effects caused by their first birth. This is an important finding, because it shows that, to fully understand the economic consequences connected to motherhood, it is not sufficient to rely on motherhood as a binary category or as a simple transition, but to consider additional aspects of this important area of life. Although the estimated effects differ dependent on the underlying definition of the first birth timing, the timing of the first birth, measured as a woman's age at birth or her career position at first birth, thereby seems to be such an important aspect. However, further research on this important topic is needed especially in view of its political relevance, for as Petersen et al. (2010: 1286) state: "Nothing can be done about the natural law that women give birth, but its social and economic consequences are obviously amenable to modification (…) ".

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Appendix

Table 4: Fixed-effects results based on the relative and biological age at first birth (β-coefficient, t-values in parentheses)

	Biological age			Relative age	
	Model 1	**Model 2**		**Model 1**	**Model 2**
Time lag since first birth	0.0209** [2.4172]	–	Time lag since first birth	0.0202** [2.2497]	–
Length of the work interruption around the first birth	–	0.0097 [1.5371]	Length of the work interruption arround the first birth	–	-0.0053 [-0.6970]
Time lag * Birth ≤ 29 years	–	–	Time lag * Birth ≤ 8 years	–	–
Time lag * Birth > 29 years	0.0035 [0.6568]	–	Time lag * Birth > 8 years	0.0024 [0.4557]	–
Length of work interruption * Birth ≤ 29 years	–	–	Length of work interruption * Birth ≤ 8 years	–	–
Length of work interruption * Birth > 29 years	–	-0.0240*** [-3.1464]	Length of work interruption * Birth > 8 years	–	0.0002 [0.0250]
Number of observations	5.662	5.662		5.662	5.662
Number of groups	383	383		383	383

Note: Results weighted; dependent variable is the log hourly wage, coefficients of the period dummies, the birth biography, the employment biography, the current employment situation, and the sociodemographic background not presented; significance level: * p<0.1, ** p<0.05, *** p<0.01 (based on Huber-White-Sandwich estimations).

Source: SOEP waves 1984-2010, own calculations.