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The gendered impacts of delayed parenthood on educational and labor market outcomes: A dynamic analysis of population-level effects over young adulthood

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Later parenthood is often beneficial for women, but less is known about its impact on men. As first births continue to occur later in life, it is important to understand whether this delay influences the educational and labor market outcomes of women and men differently, and how it changes the socioeconomic characteristics of children's parents at birth. However, education, employment, and fertility are linked, implying that complex models are required in order to analyze the time-varying impacts of delayed parenthood. We use dynamic longitudinal models and Finnish data to analyze how, and through which socioeconomic mechanisms, a material delay in parenthood is likely to influence educational and labor market outcomes over young adulthood. A three-year delay in young-adult parenthood for all women increases educational enrollment in their early 20s, employment in their late 20s, and partly due to higher education income in their 30s. The impact of the same delay for men is more modest, and almost negligible for their employment, suggesting that later parenthood exacerbates the educational advantage of women and attenuates the income advantage of men. However, it strengthens the socioeconomic standing of both men and women when they become parents, essentially due to the accumulation of effects.

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INTRODUCTION

Over the last half a century, one of the most profound changes in family formation throughout the Western world has been the increasing age of entering parenthood (Kohler, Billari, & Ortega, 2002; Sobotka, 2004). Since the 1970s, the average age of entering motherhood in OECD countries has increased by one year every decade (Mills et al., 2011). This delay is embedded within the broader context of a radical shift in the transition to adulthood that has been observed in almost all high income societies (M. Buchmann & Kriesi, 2011; Corijn & Klijzing, 2001; Furstenberg Jr, 2010). This radical shift includes delays in leaving the parental home, delays in leaving education, and delays in partnership formation and marriage, alongside a later entry into parenthood. In addition to changes in the timing of events, the sequence of transitions to adulthood has become more heterogeneous over time (Fussell & Furstenberg Jr, 2005; Shanahan, 2000). For instance, an increasing share of women in the US continue education after entering motherhood (Augustine, 2016). These trends in the transition to adulthood have a substantial gender dimension. Until the 1980s, men were more likely to enroll in higher education than women. Before the 1970s, the anticipation of a working career was exceptional for young women, and the minority of married women who did work were most likely to work as secondary earners (Goldin, 2006). Since the 1970s, the young adulthood of women increasingly resembles that of men, and in some aspects (in some contexts) the historic gender imbalance has even switched direction. In most high-income countries, women now have higher chances of being enrolled in education, and on average they graduate at a higher level than men (C. Buchmann, DiPrete, & McDaniel, 2008; Schofer & Meyer, 2005). Moreover, women are increasingly combining parenthood with employment, as done traditionally by men (Fussell & Furstenberg Jr, 2005; Goldin, 2006).

While the demographic literature has typically tried to understanding the socioeconomic *causes* of the timing of parenthood (Balbo, Billari, & Mills, 2013; Dribe & Stanfors, 2009; Mills et al., 2011; Sobotka, 2004), economic and sociological studies have paid more attention to the socioeconomic *consequences* of delayed parenthood (Bratti & Cavalli, 2014; Miller, 2011; Taniguchi, 1999). Nevertheless, most of this research has focused on women, not only theoretically but also empirically. Given changes in men's roles in families (Goldscheider, Bernhardt, & Lappegard, 2014; Goldscheider, Bernhardt, & Lappegård, 2015), and debates about the extent to which progress has (or has not) been made with respect to reducing male/female inequalities (Ellingsaeter & Leira, 2006; Esping-Andersen, 2009; Scott, Crompton, & Lyonette, 2010), it is crucial to take a more gender-neutral and gender-comparative perspective in order to understand how the timing of parenthood differentially influences men and women. Previous longitudinal studies that compare men and women provide valuable knowledge of how the socioeconomic impact of parenthood materializes at particular ages or particular stages of the life course (Gibb, Fergusson, Horwood, & Boden, 2014; Loughran & Zissimopoulos, 2009), but description of how the impact of parenthood timing evolves dynamically across young adulthood remains limited. Studies that provide strong causal interpretations are often based on particular sub-groups of the population (Bratti & Cavalli, 2014; Hoffman, Foster, & Furstenberg, 1993), rather than estimating aggregate effects at the population level. These are important gaps in the literature because the impact of parenthood timing may vary over the life course – in terms of magnitude and direction, in different ways for different groups – making results sensitive to the ages and subgroups that are analyzed. In addition, very few empirical studies have estimated the mediating role of socioeconomic factors in determining the impacts of delayed parenthood (Amuedo-Dorantes & Kimmel, 2005; Blackburn, Bloom, & Neumark, 1993), especially for men, which is unsurprising given the challenge that the dynamic nature of young adulthood imposes for the study of mediation (M. Buchmann & Kriesi, 2011; Furstenberg Jr, 2010).

The impact of delayed parenthood is not only limited to prospective parents, but can also be analyzed from the perspective of their children (whose birth is delayed). A delay in the transition to parenthood may change the parental background of children, contributing to better circumstances for children born to parents who postpone (Barclay & Myrskylä, 2016; Goisis, Schneider, & Myrskylä, 2017; McLanahan, 2004). Delay in parenthood has the obvious demographic effect of making the parents older, and if education and income change with age, this is reflected in the socioeconomic characteristics of the families at the time of entering parenthood. However, if a delay in parenthood increases educational outcomes or income dynamically at the population level, this would contribute via an additional mechanism than just ageing to improve the socioeconomic characteristics of new parents. We therefore aim to shed light on how a delay in parenthood affects educational and labor market outcomes of parents at the time of entering parenthood – i.e. the circumstances in which a child is born – which are critical from the point of view of later-life outcomes of both parents (Dariotis, Pleck, Astone, & Sonenstein, 2011; Myrskylä & Margolis, 2014) and their children (Augustine & Negraia, 2018).

The aim of this study is to move beyond previous studies by undertaking a dynamic analysis of the gendered impacts of delayed parenthood. We set out to answer three research questions, as follows: (1) What is the population-level impact of delayed parenthood on educational and labor market trajectories during young adulthood for men and women?; (2) To what extent is this impact mediated by socioeconomic characteristics?; and (3) How does delayed parenthood change the socioeconomic characteristics of the parents at the time when they enter parenthood? In order to answer these questions, we use dynamic longitudinal models and longitudinal Finnish register data that is representative of cohorts born in the mid-1970s. We build upon recent advances in causal methodology and employ dynamic causal models (the parametric g-formula), which allows us to model life-course processes as they unfold, simultaneously accounting for reverse causality, time-varying confounding and mediation (Bijlsma & Wilson, 2017; Clare, Dobbins, & Mattick, 2018; Keil, Edwards, Richardson, Naimi, & Cole, 2014). We also estimate the sensitivity of our results to unmeasured confounding. Taken together, this allows us to overcome many of the limitations of previous research without compromising our estimates of the population-level impact, and how this differs for women and men.

CONCEPTUAL BACKGROUND

GENDER AND PARENTHOOD IN YOUNG ADULTHOOD

The transition to parenthood continues to be a highly gendered experience: the birth of the first child typically leads to re-organization of the functioning of the household, with greater changes witnessed in women's than men's behavior (Barnes, 2015; Baxter, Hewitt, & Haynes, 2008; Maume, 2006; Sanchez & Thomson, 1997). Parenthood entails a persistent gendered effect on labor market participation of women, i.e. it often contributes to substantial decreases in earnings and employment (Cools & Strøm, 2016; Gibb et al., 2014; Knoester & Eggebeen, 2006; Loughran & Zissimopoulos, 2009; Lundborg, Plug, & Rasmussen, 2017; Millimet, 2000; Sigle-Rushton & Waldfogel, 2007). In men, respective changes are typically much smaller, and sometimes even in the opposite direction (ibid.). Further, in young adulthood, parenthood can intervene with crucial transitions of both women and men towards adulthood, including finishing education and entering labor market (Fussell & Furstenberg Jr, 2005). The reasons for a gendered pattern of behavioral change over the transition to parenthood has been widely theorized, including the economic views on household specialization and bargaining and the sociological views emphasizing gender reproduction and identities (Barnes, 2015). Mechanisms explaining a gendered pattern of change needs to be understood within the current constraints that the social context poses on individuals' life courses (Huinink & Kohli, 2014; Mayer & Schoepflin, 1989).

In a micro-economic view on the family (Becker, 1993b), household members are assumed to maximize their joint welfare by specializing in different tasks. Because of their assumed comparative advantage in childcare and other housework, women are assumed to specialize in these tasks over the transition to parenthood, while men specialize in paid work due to their assumed respective comparative advantage there. Furthermore, a bargaining perspective emphasizes that partners' access to different relative resources, such as income, determine power differentials within households (Brines, 1993; Milkie, 2011). Allocation of time in the family is the result of a negotiation process, where the bargaining power of a partner depends on the individual economic resources, e.g. female partners with higher incomes than their male partners are in stronger position to negotiate less time investment in unpaid work.

In a sociological view, gendered attitudes and beliefs regarding right ways of parenting are considered to contribute to differential responses of women and men to parenthood (Baxter et al., 2008). Gendered patterns of parenting can be viewed as part of an interactive process where men and women actively reproduce gender distinction (West & Zimmerman, 1987). Similarly, the view of social identities emphasizes the importance of behaving according to normative social roles – irrespective of any economic gains related to task allocation within the family – for the gendered behavioral changes over the transition to parenthood (Kaufman & Uhlenberg, 2000; Sanchez & Thomson, 1997). While traditionally women are expected to identify more strongly with roles within the family than men, for men, the "good-provider role" has been deeply rooted and encourages fathers to meet role expectations by providing sufficient economic security for the family through sufficient investment in paid work.

Gender specialization in the family in the strict sense has not been the reality of high-income countries in recent decades and fathers have become more involved in the unpaid work in families (Bianchi & Milkie, 2010; Goldscheider et al., 2015; Hook, 2006). The model of gender specialization has also been subject to critique particularly for being risky for families, as opposed to pooling of resources without rigid specialization of the partners (Oppenheimer, 1997). However, despite the change towards more symmetrical roles of women and men, discrepancy remains in the ways that mothers and fathers engage in different activities within and outside the family (Hook, 2006; Joshi, 1998; Prince Cooke & Baxter, 2010). Gender roles remain asymmetrical even in countries considered amongst the most gender equal, such as the Nordic countries (ibid.). This is illustrated e.g. in the employment rates which remain higher among men than women (OECD, 2019a) and in the low share of parental leave taken by fathers (Ellingsaeter & Leira, 2006).

In young adulthood, the concepts of economic specialization and bargaining could be applied also to situations where partners allocate time between parenting, paid work, and attainment of further education. Moreover, studying is often seen incompatible with parenting for women in particular, due to the large demands for time investment associated with both of these roles (Presser, 1971; Waite & Moore, 1978). The continued discrepancy in the task allocation between women and men within and outside the family contributes to expectation that the conflict between studying or working on one hand and childcare and other unpaid work on the other continues to be stronger among women than men. Among men, the conflict between further educational attainment and labor market participation in turn may be stronger than in women, given their typically stronger commitment to providing financially.

DELAY OF PARENTHOOD AND EDUCATIONAL OUTCOMES

Both the economic and sociological frameworks would predict that the delay of parenthood in young adulthood allows more time investment in studying and avoiding the difficulties of combining student and parent roles, and consequently to pursuing higher degrees (Hofferth & Moore, 1979; Ronald R. Rindfuss, Bumpass, & St. John, 1980; Ronald R Rindfuss, St. John, & Bumpass, 1984). The early literature on young-age motherhood and schooling outcomes stressed that the pervasiveness of the mother role would make it difficult for young women to invest time and intellectual resources to further educational attainment. Further, this demanding role was suggested to affect further aspirations of women, making them more likely to compromise their potential aspirations for further education as a consequence of motherhood. To the extent that parenthood remains less compatible with other activities among women than men, any positive effects of a delay in parenthood on attainment of further education are likely to be stronger among women than men.

Both women and men are likely to be influenced by social expectations regarding the right order of transitions in the life course, according to which the transition to parenthood ought to follow finishing education and establishing oneself in the labor market (Blossfeld & Huinink, 1991; Hoem, 1986). Today, the norms guiding the right timing and sequence of entering parenthood and finishing education may have lessened but they still guide our behavior (Fussell & Furstenberg Jr, 2005; Shanahan, 2000). Non-normative, i.e. too early, timing of entering parenthood is suggested to cause stress particularly among women due to conflicting time demands (Bacon, 1974), but normatively too early parenthood may cause stress also for men

(Einiö, Nisén, & Martikainen, 2015; Sigle-Rushton, 2005). Delay of parenthood may reduce this stress, and leave more time to complete other transitions to adulthood, including attainment of education.

Besides the potentially conflicting demands of attaining education and caring for a child, an early birth may increase the pressure to provide financially, which may in part contribute to difficulties to gain further education (Ní Bhrolcháin & Beaujouan, 2012; Thalberg, 2013). As long as breadwinning constitutes a more important part of men's than women's role as parents, participation in the labor market may be a mechanism through which parenthood affects schooling outcomes in young adulthood among men particularly. A delay in parenthood, thus, is likely to lessen this pressure and provide more opportunities to continue in education. In such a case, parenthood delay could have an indirect positive effect on attaining further education through reduced participation in the labor market among men in particular.

Literature on very young parents shows that they typically end up with lower than average educational outcomes, but a causal effect remains debated, because those avoiding early births tend to be different from those who become parents early in life in other respects, including socioeconomic circumstances of the family of origin (Hofferth, Reid, & Mott, 2001; Hoffman et al., 1993; McElroy, 1996; Sigle-Rushton, 2005). More generally, there is an uncontested strong negative relationship, particularly among women, between educational enrolment and entry into parenthood, even in the Nordic countries where gender roles are relatively symmetrical (Dribe & Stanfors, 2009; Jalovaara & Miettinen, 2013; Kravdal, 2007). While educational attainment is typically assumed to assert a stronger influence on birth timing than vice versa (Ronald R Rindfuss et al., 1984), a recent study showed that the effect of parenthood timing on education may in fact be stronger than the effect of education on fertility in women (Cohen, Kravdal, & Keilman, 2011), while respective investigations on men are lacking.

DELAY OF PARENTHOOD AND LABOUR MARKET OUTCOMES

The delay of parenthood may influence labor market outcomes of women and men in young adulthood either indirectly through changes in the educational career, i.e. potentially prolonged time spend enrolled and potential gains to educational attainment, or directly, net of changes in the educational careers. Whereas compensations in employment and earnings as a consequence of potential prolonged enrolment are more likely in the short term, in the long term any increases in educational attainment are likely to lead to increases in employment and earnings (Becker, 1993a). Indeed, prior research has suggested that increases in human capital may be an important explanation for more favorable labor market outcomes of women who enter parenthood later in life (Amuedo-Dorantes & Kimmel, 2005; Blackburn et al., 1993), whereas little prior research has investigated this issue in men. In addition to the potential indirect effect mediated by the educational career, the delay of parenthood can affect labor market outcomes in young adulthood also directly, net of any changes in the educational careers, at least among women (Gustafsson & Kalwij, 2006; Hotz, Klerman, & Willis, 1997).

The direct effect of a later timing of parenthood can operate by increasing the pre-birth human capital accumulated in the labor market, which then may affect the after-birth labor market behavior by increasing the cost of withdrawing from the labor market or reducing working hours (Happel, Hill, & Low, 1984). This explanation bears resemblance to the earlier introduced sociological argument regarding the right timing of life course transitions, according to which the establishment of oneself in the labor market preferably precedes the transition to parenthood (Fussell & Furstenberg Jr, 2005; Shanahan, 2000). Furthermore, a positive effect of parenthood delay on labor market outcomes can occur because any negative effects of parenthood on these outcomes have less time to manifest when the age at first birth is higher. As discussed primarily in the case of mothers, such effects can rise from slower accumulation of work experience or lower productivity, preferences to trade off higher wages for family-friendly jobs, or discrimination by employers see (Budig & England, 2001; Gustafsson, 2001) for reviews. A higher age at first birth may also affect labor market outcomes by reducing the completed family size since the time at risk of having additional children, which may have additional effects, is shorter (Hofferth, 1984). Previous studies show that the delay of parenthood is likely to have positive effects on career outcomes of women (Amuedo-Dorantes & Kimmel, 2005; Bratti & Cavalli, 2014; Miller, 2011; Taniguchi, 1999; Troske & Voicu, 2013).

Among men, studies taking a micro-economic perspective often assume that the timing of parenthood does not affect the labor market outcomes of fathers – rather, men are assumed to stay continuously employed (Gustafsson, 2001; Happel et al., 1984). However, as men have increased their participation in childcare and unpaid work in many countries and some even reduce their working hours because of children (Dommermuth & Kitterød, 2009; Hook, 2006), this assumption can be questioned. It is plausible that the timing of births might increasingly play a role also for men's employment and income over the career (Kreyenfeld, 2015). If their labor supply is compromised because of children, similarly to women, a later timing might have become more beneficial for their long-term labor market outcomes today. On the other hand, if a traditional division of labor in the household prevails, a later timing might even insert a negative effect on men's labor market outcomes. This may operate either due to a short-term lack of need to provide income for the family, or because of less pressure to increase labor supply at more advanced ages when parenthood then occurs, given typically higher levels of family income at such ages (Astone, Dariotis, Sonenstein, Pleck, & Hynes, 2010). This kind of reasoning may be most relevant for a delay of parenthood that occurs from very early ages (Weinshenker, 2015). Overall, the empirical evidence regarding the effects of parenthood timing on employment and earnings patterns among men is inconsistent (Astone et al., 2010; Chandler, Kamo, & Werbel, 1994; Killewald, 2013; Weinshenker, 2015).

AIMS OF THE STUDY

This study explores how the delay of parenthood contributes to changes in educational and labor market outcomes of women and men in young adulthood. Using high quality longitudinal data drawn from the Finnish population registers and dynamic simulation models appropriate for the complex life course setting, we analyze how delay of parenthood would influence educational attainment and enrolment on one hand and employment and income on the other across young adult ages. In addition to assessing the total effect on these outcomes, we investigate to what extent any changes in labor market outcomes are caused indirectly by changes in educational careers, and vice versa, whether changes in labor market outcomes lead to indirect changes in education. Importantly, throughout the study we assess gender differences in these effects at the general population level. Among parents, we additionally study the effect of the delay of parenthood on educational and labor market outcomes at the time point at which women and men enter parenthood.

Based on the literature introduced earlier, our general hypothesis is that the delay of parenthood contributes to stronger total increases in women’s than men’s labor market and employment outcomes. Among men, we hypothesize to witness weaker, if any, total effects on the labor market outcomes in particular. For labor market outcomes, we hypothesize women and men to be more similar in terms of the indirect (mediated by educational outcomes) than direct effects.

This is because investment in education is likely to increase employment and income irrespective of gender, whereas women are still much more likely to change their behavior in the labor market after entering parenthood than men. For educational outcomes, we hypothesize the indirect effect (mediated by labor market outcomes) to play a larger role among men and the direct effect to play a larger role among women. This follows from assuming that men are more likely to trade-off their studies to providing income for a family, whereas women are more likely to trade-off their studying to unpaid work, e.g. caring for a child. Among parents at the time of entering parenthood, we hypothesize that the delay contributes to beneficial changes in the studied aspects in both women and men, with potentially stronger effects in women.

The identification of all of these effects is challenged by the presence of reverse causality, confounding and the difficulty to quantify the role of mediation in a highly time-varying setting of young adulthood. Reverse causality in the context of this study refers to the effects of educational enrolment and attainment as well as those of employment and income on fertility behavior, all of which are considered relevant (Dribe & Stanfors, 2009; Koslowski, 2010; Kravdal, 1994; Lappegård & Rønsen, 2005). In the case of this study, confounding can be either time-constant or time-varying (Kravdal, 2007), referring to characteristics that affect both the timing of birth and the socioeconomic outcomes. Furthermore, previous studies that draw stronger causal conclusions of the effect of the delay are often compromised in terms of external validity, being based on non-population based samples. Given the magnitude of the change in the timing of parenthood, it is, however, important to study the consequences of the delay of parenthood not only among the parents that are being affected, but also in the general population.

To overcome these methodological challenges, this study builds on dynamic causal models with no prior application in the investigation of the topic. This dynamic longitudinal modeling approach allows accounting for reverse causality, and time-varying confounding and time-varying mediation, when assessing direct and indirect affects across young adulthood. At the same time, it allows identifying effects in the general population, as compared to only a potentially selected population subgroup.

THE CONTEXT OF THE STUDY

Finland can be characterized as a Nordic welfare state, with universal and generous benefits offered for parents to balance work and family and to promote gender equality (Ellingsaeter & Leira, 2006; Esping-Andersen, 2009). The dual-earner family model is strong, illustrated e.g. by separate taxation of the husband and wife since 1976 (Aarnio & Eriksson, 1987). Already in 1980, only 10% of married women aged 24–54 were housewives (Julkunen, 1999). In line with this, the female employment rates have been comparatively high, in 2017 at 69 as compared to the OECD average of 60 (OECD, 2019a). Further, part-time work is uncommon even among mothers (OECD, 2019b; Rønsen & Sundstrom, 2002). Men's employment rate in turn, at 71 in 2017, is below the OECD average (75 in 2017) (OECD, 2019a). The gender difference in employment rate in Finland is thus small in international comparison. The educational gender gap however is comparatively large: while the educational level of Finnish women is close to the OECD average, the level of men is below the average (OECD, 2019c). In 2017, 50 and 33 per cent of women and men aged 25–34 respectively were educated to the tertiary level in Finland.

Although Finland, like other Nordic countries, has been a forerunner in terms of men's investment in unpaid work at home, women continue to contribute more than men (Esping-Andersen, 2009; Goldscheider et al., 2014). Finnish fathers have been eligible to take parental leave since late 1970s (Ellingsaeter and Leira 2006; Haataja 2004), but men in families with small children continue to spend shorter periods at home and contribute less to unpaid work than women (Lammi-Taskula, 2007). In 1990 fathers took only 2–3 per cent of all subsidized leave days, by 2003 the share had risen to over 5 percent (Ellingsaeter & Leira, 2006) and by 2015 to 10 per cent (Salmi & Närvi, 2017). Women, in turn, tend to make use of public family allowances to stay relatively long periods at home after childbirth: in 2012, ten percent of Finnish mothers of children aged one or less worked and just above 50 percent of mothers of children aged between one and two worked (Nieminen, 2013).

The Finnish society is often characterized by relatively low social inequality in terms of income (Jäntti, Saari, & Vartiainen, 2006), and the Finnish educational system is considered flexible and socially inclusive (Orr et al. 2011). These societal characteristics may reduce intergenerational influences on fertility timing in young adulthood (Pöyliö & Van Winkle, 2019). Despite overall high level of equality in the society, and women's higher level of education, gender inequality persists in that men continue to earn more than women (Sauli, 2013). While the income difference is smallest in childless couples, where women make up 45 percent of the household income, it is largest among couples with children, where women make up only 40 percent. The difference is largest when the youngest child is aged one to two (Sauli, 2013).

The overall employment rate at 70 percent has been above the OECD average in recent decades (OECD, 2019a), but youth unemployment rate is relatively high (in 2017 20 vs. 12 per cent OECD average) (OECD, 2019d). The period from the mid-1990s until 2009 in the country was characterized by economic growth and most of the first childbearing in the cohort under study born in the mid-1970s took place during an economically sound period (Comolli, 2018). The mean age at entering parenthood in Finland has increased since mid-1970s, reaching 27.6. years among women and 30.0 years among men in 2000, and has risen more recently to over 29 among women and over 31 among men (Official Statistics of Finland, 2017). On average the increase in the age at first birth during the period between 1990 and 2016 was 1.0 years per decade among women (Eurostat, 2018) and the trend has been remarkably similar among men (Official Statistics of Finland, 2017). Since the early 1990s, the first birth rate of women aged 20-24 has continued to decrease, although it was rather stable in the first decade of the century. Also first birth rate at age 25-29 decreased in 1990-1998, and since 2010, showed a pro-cyclical response to economic trends (Comolli, 2018). The total fertility rate in Finland in 1990-2014 remained above 1.7, before decreasing strongly in the recent years (Official Statistics of Finland, 2017).

DATA AND METHODS

DATA

STUDY SAMPLE FROM FINNISH REGISTERS

We analyze children born in 1974–1975 and the impact of their fertility postponement on their own socioeconomic attainment. The study is based on a 10 percent random sample of households and institutionalized persons in the 1975 census in Finland (N= 471,738), which Statistics Finland has linked to available register-based annual socio-demographic information available in 1987-2007 (user permission TK53-780-11). In total, 12,830 children in this sample were born in 1974-1975. Out of those, 86.1% were registered as living in a two-parent and 4.5% in a mother-only family in 1975. Only 0.6% of children were living with their father but not their mother, and 8.75% were registered as living with neither parent. The latter share is mainly due to non-response of parents in the 1975 census for which reason family members of children could not be identified.[13] In this study, we analyze children who were born in Finland in 1974-1975 (less than one percent were foreign-born), lived in two-parent or mother-only households in 1975, and for whom mother's birth histories and other time-constant background characteristics (based on mother's fertility records, census in 1975 and register-based information at age 15) could be derived (n=11,341). The mother of the child is identified based on co-residence with the child in

1975 and fertility records of the mother. In the study sample, 98.7 per cent lived with their biological mother in 1975. The father of the index person is identified based on co-residence with the mother and the child in 1975. The sample consists of 5,472 women and 5,863 men present in the beginning of the follow-up. The follow-up runs from age 16 (calendar year 1990/1991) to age 32 (calendar year 2006/2007), with right-censoring of 477 individuals due to death or emigration. The study includes 189,042 person-years. All variables are listed in Table 1.

[TABLE 1 ABOUT HERE]

TIME-VARYING OUTCOMES, EXPLANATORS, MEDIATORS ANC CONFOUNDERS

The main processes studied are childbearing, education, labor market position, partnership, and independent living, following the DAG (Directed Acyclic Graph) in Figure 1. Partnership and living arrangements are included due to their central role in the young-adult life course and close connections to childbearing and socioeconomic attainment (M. Buchmann & Kriesi, 2011; Corijn & Klijzing, 2001; Furstenberg Jr, 2010). These processes are studied through a number of variables that we allow to function simultaneously as outcomes, exposures, mediators and confounders. All regression models, e.g. a model for birth occurrence, includes all other characteristics shown in the DAG as explanators, some of which are measured with multiple variables.

[FIGURE 1 ABOUT HERE]

Childbearing is measured through the binary variable 'first birth', which is 1 in the year that an individual has their first child, and 0 otherwise, the variable 'parenthood' which is 0 before an individual has their first child and 1 afterwards, and the variable 'time since first birth (TSFB)' which counts the number of years since the first birth.

Education is measured through the categorical variable educational level (primary, secondary, lower tertiary, and higher tertiary corresponding to ISCED 2011 (International Standard Classification of Education) categories 0-2, 3-4, 5-6 and 7-8, respectively), enrolment (yes or no), cumulative number of years enrolled, and number of times entered into education from not being in education. Information on enrolment is based on several register-based sources, the main source being the registers of currently enrolled students of educational institutions at the secondary and tertiary level. In order to classify as a student one does not necessarily need to accomplish credits during the semester. A person can be enrolled in an educational institution and be employed at the same time. Our primary educational outcomes of interest in the study are annual enrolment and whether a person had a tertiary-level degree. In the results section we show results for the lower and higher tertiary groups combined as 'tertiary', but model educational careers keeping these two categories as separate.

Labor market status is measured with several indicators of employment and income. Employment is measured firstly with a binary variable (1 if an individual is full or part-time employed for at least nine months in a year, 0 otherwise). In the original classification, a person is counted as employed and may accordingly accumulate months in employment within a year if (s)he has a valid working contract and has some income during the year, even if s(he) in fact was at home taking care of a child during the employed months. In order to measure actual time in employment we take the following steps. In case a person is on parental leave for more than three months in the year, (s)he is categorized as employed for less than nine months.[2] Similarly, if a person received an amount of home care allowance covering approximately more than three months in a year, (s)he is categorized as not employed for at least nine months that year.[3] Additionally, a measure for unemployment (1 if an individual is unemployed for at least 1 month in a year, 0 otherwise) and cumulative number of years employed (at least nine months per each year) are included.

Income is measured through the continuous variables yearly personal income, yearly household income, and cumulative personal income, all three measured in thousands of euro's. Income measures all personal taxable income within a year (with top-coding of the three per cent earning the most). Household income measures all taxable income of persons permanently living in the same household as the index person (not necessarily family members). Income thus covers not only work income but also income transfers such as unemployment benefits. Inflation is taken into account in the calculation of income variables, by converting yearly income in euros into income in euros in 2012 (Statistics Finland, 2013). Among the variables indicating labor market status, the outcomes of primary interest if this study are annual employment and personal income.

Partnership is a categorical variable (single, cohabiting, or married). Identification of cohabitation is based on co-residence of opposite sex persons of similar age and other criteria defined by Statistics Finland. Co-residential unions lasting for less than three months are not captured in the register data. Independent living stands for a time-varying categorical variable which indicates how an individual currently lives (with parents, as a tenant, as house owner, or as other). Category 'other' covers institutionalized persons and those with unknown housing type. Age is included as a time-varying categorical variable (age 16-19, 20-23, 24-27, 28-30, 31-32).

TIME CONSTANT VARIABLES

A number of baseline variables are included in the regression models to account for potential confounding of the studied effects by family background characteristics, such as parental childbearing behavior or social status, which may affect e.g. preferences for the right timing of childbearing (see Martín-García & Baizán, 2006; Nisén, Myrskylä, Silventoinen, & Martikainen, 2014). The measured variables include the age of the mother of the index person at the birth of her first child, the number of siblings, and the birth order of the index person, all three measured as continuous variables and based on the index person's mother's fertility history. A binary variable indicating whether the parents of the respondent were married at the time of the birth of the respondent is included; the category "no" consisting of cohabiting parents and lone mothers in 1975.

Categorical variables indicate the level of urbanization of the municipality in which the respondent lived at age 15 (rural, semi-urban, and urban) and the dwelling-based family type of the respondent at age 15 (single parent, cohabiting parent, married parent, without a parent or unknown), and whether the parents owned the home in which the respondent lived at age 15. For those who had already moved out of parental home at age 15 the measure is taken at age 14 or 13 (n=19); if the index person did not belong to the household population at ages 13 to 15 s(he) is classified as "other or unknown".

Parental level of education measures the highest level of education ever recorded by age 15 for either parent and consists of four categories as for the index person's own level of education as described above. Parental unemployment is a binary variable measuring long-term unemployment of either parent over a five-year period (two years before and after the year in which the index person turned 15). A parent is categorized as long-term unemployed if (s)he experienced unemployment for more than 12 months altogether over two subsequent years.

A categorical measure of household income at age 15 is based on the taxable income of the index person's household also based on information over five subsequent years. All taxable income is first converted to income in 2012 (Statistics Finland 2013), divided by the number of consumption units in the household in the current year, and after taking the mean over available years is divided into quintiles.[4]

METHOD

TOTAL EFFECT ESTIMATION

For women and men separately, we estimate the effect of postponing the first childbirth by three years on the time-varying covariates, with a special interest in the outcomes of primary interest (enrollment, tertiary attainment, employment and income). In order to allow for the interdependency between all variables, including adjusting for intermediate and time-varying confounding, we estimate the effect of a three-year delay using the parametric g-formula (Bijlsma, Tarkiainen, Myrskylä, & Martikainen, 2017; Bijlsma & Wilson, 2017; De Stavola, Daniel, Ploubidis, & Micali, 2014; Keil et al., 2014; Robins, 1986). The g-formula is performed through a series of steps that we perform entirely separately for women and men:

1. Randomly draw individuals from the data with replacement (n_{female} = 5,472, n_{male} = 5,863).
2. To the randomly drawn individuals (step 1), fit parametric models for covariates at time *t* as a function of covariate history at time *t*, corresponding to arrows from *t-1* to *t* in the DAG in Figure 1.
3. Take observations from the first year of follow-up (from the step 1 sample) and using the models (step 2), predict observations for the second year of follow-up. Then use those (predicted) observations to predict observations in the next year, etc. until the end of follow-up.

4. Save the predicted outcomes (from step 3) for the time-varying covariates for all simulated years (these represent the 'natural course scenario').
5. Perform step 3 a second time, but now not allowing childbirth when it occurs and instead postponing it manually by three years for everyone. Re-predict observations from the moment that childbirth would have occurred until the end of follow-up.
6. Save the predicted outcomes (step 5) for the time-varying covariates for all simulated years (these represent the 'delayed scenario').
7. Calculate the difference in outcomes between the natural course and delayed scenarios, and save these differences.
8. Perform the steps 1-7 500 times. The distribution of effect estimates (step 7) is used to derive the mean effect and the 2.5 and 97.5% quantiles are used to determine 95% bootstrap confidence intervals for the effect.

Step 1 and step 8 are performed to allow us to produce bootstrap confidence intervals, and to take into account the covariance between estimates from the natural course and the delayed scenario (Efron & Tibshirani, 1993). Note that furthermore we perform steps 3 and 5 multiple times within a bootstrap iteration and take averages over them to reduce the Monte Carlo error.

The models estimated in step 2 are specified as follows (with two exceptions, see below):

$$g\{E({V^h}_{i,t+1})\} = \eta^h + \boldsymbol{A}_{i,t}^{\top}\boldsymbol{\alpha^h} + \boldsymbol{B_i}^{\top}\boldsymbol{\beta^h} + \boldsymbol{V}_{i,t}^{\top}\boldsymbol{\mu^h} + \boldsymbol{D}_{i,t}^{\top}\boldsymbol{\delta^h} + \boldsymbol{L}_{i,t}^{\top}\boldsymbol{\lambda^h} \qquad (1)$$

where $\boldsymbol{V}$ is a vector containing time-varying variables (birth, education, enrolment, partnership, employment, unemployment, personal income, household income, housing), with *h* to denote a specific time-varying variable (the models are estimated for every V^h), *i* as an index for individuals in the sample, *t* for time in calendar years, and *g{.}* the corresponding link function (identity link for continuous V^h, logit link for binomial V^h, and multinomial for a categorical

V^h). $\boldsymbol{A}$ contains the dummy variables for age measured at time t, $\boldsymbol{B}$ the time-constant variable measured prior to age 16, $\boldsymbol{D}$ is a vector containing variables (other than the interaction terms) that are a deterministic function of the variables in $\boldsymbol{V}$ (parenthood, time since first birth, cumulative number of years enrolled, number of times entered education, cumulative number of years employed, and cumulative personal income). Finally, $\boldsymbol{L}$ contains a series of interaction terms: age with education level, enrolment, and cumulative enrolment, and age with parenthood. Equation 1 is estimated for all the time-varying variables in $\boldsymbol{V}$, with two exceptions; when modelling household income, personal income in the same year is also included as a covariate, as household income in a year is directly dependent on personal income in that same year as well[5]; and when modelling educational attainment, enrolment in the same year is also included as a covariate (including an interaction with age). In the results section we report population-averaged effects (PAEs). These are, as expected, smaller as compared to the average treatment effects among the treated (ATT), i.e. those who became parents by age 32. Appendix table 1 shows a selective comparison of the PAEs and ATT.

We also analyze the family circumstances that a child is born into before and after the intervention. This is done by subtracting the values of the time-varying variables in ***V*** and ***D*** in the natural course (step 4) at the time of birth from the respective values in ***V*** and ***D*** at the time of birth in the intervention scenario (3 calendar years later). Because of the one-year lag in the models, estimates in the current year are not affected by the birth itself in this year. The bootstrap distribution of these differences is used to derive confidence intervals and p-values (Efron & Tibshirani, 1993). This test is only performed for those individuals who have a child at or before age 29 in the natural course, as the simulation does not age individuals beyond the empirically observed age range (maximum age 32).

MEDIATION ANALYSIS

To gain more insight into the mechanism by which the delay of the first birth affects the primary outcomes of interest, we perform a labor market mediation analysis and an education mediation analysis (Bijlsma & Wilson, 2017; Lin, Young, Logan, Tchetgen, & VanderWeele, 2017; Wang & Arah, 2015). The labor market mediation analysis is identical to the total effect estimation, except in the delayed scenario the levels of the labor variables (employment, cumulative employment, unemployment, income, and cumulative income) are kept at the levels observed in the natural course scenario. By doing so, the delay intervention cannot affect these variables and hence all the effects that are estimated occur outside of the pathways involving labor market variables. The total effect minus this effect is the effect via the labor market variables ('mediated by the labor market variables') (Bijlsma & Wilson, 2017; Robins, 1992; VanderWeele, 2011; Wang & Arah, 2015). In the education mediation analysis we instead keep the education variables (enrolment, cumulative enrolment, number of entries into education, and educational level) at the natural course levels.

CONFOUNDING SENSITIVITY ANALYSIS

While we have a rich set of baseline and time-varying variables, it is possible that some important unmeasured variables remain that could bias our results. In particular, we perform a sensitivity analysis for confounding by 'early parenthood-low career orientation', i.e. a baseline confounder that makes individuals less likely to be enrolled in education and more likely to have children during the follow-up (Bijlsma & Wilson, 2017; VanderWeele, 2015). Following Bijlsma & Wilson (2017), we create a very strong artificial confounder (continuous variable) that is strong enough to make the multivariable associations between enrolment and first birth approach the null effect, becoming non-significant at the 5% alpha level. For women, this confounder increases the odds of first birth (comparing the 75^{th} and 25^{th} percentiles of the confounder) by 23 and the odds of not being enrolled by 5. For men, a similar confounder increases the odds of first birth by 152 and the odds of not being enrolled by 3. We then perform the total effect estimation while controlling for this confounder, to determine the population-averaged effect of the delay intervention if such a confounder was controlled for.

RESULTS

NATURAL COURSE AND TOTAL EFFECTS

Figure 2 shows the empirical data and simulated share of parents in the natural course scenario, which is the simulation of the empirical data without intervention, and in the counterfactual scenario, where we have intervened by postponing the entry into parenthood by three years. The natural course scenario closely tracks the empirical data. This is desirable, as deviations from the empirical data would indicate flaws in the model. As expected, men had a later entry into parenthood than women: in the natural course 65 per cent of women and 51 per cent of men had entered parenthood by age 32. In the counterfactual scenario, where parenthood timing has been delayed by three years, 51 per cent of women and 35 per cent of men, respectively, had become parents by age 32.

[FIGURE 2 ABOUT HERE]

Figures 3 shows the empirical data and the natural course of our educational and labor market outcomes of interest. Our natural course estimates correspond closely with the empirical data. In the case of tertiary educational attainment, there is a small underestimation of the underlying empirical data in both sexes. Because the bias is minor especially at younger ages, where inaccurate estimation of the natural course could cumulatively cause more error in effect estimates at higher ages, it is unlikely to substantially affect our effect estimation.

[FIGURE 3 ABOUT HERE]

Figure 3 highlights gender differences in the empirical data and correspondingly in the natural course. On one hand, women were more likely to be enrolled in their late teens and early twenties than men. The main reason for the particularly large difference in the natural course between women and men at ages 18 and 23 is compulsory military service among men which typically lasts from six to twelve months and delays men's entry into higher education (Defence Forces, 2019). In line, women began attaining tertiary degrees earlier and remained more likely to have attained such a degree. On the other hand, men were more likely to be employed and to earn higher incomes since the beginning of the twenties than women. While the gender difference in employment widened until age 27 and stayed constant afterwards, the difference in income notably widened throughout young adulthood.

[FIGURE 4 ABOUT HERE]

[FIGURE 5 ABOUT HERE]

Figure 4 shows the population-averaged total effect of the intervention on educational outcomes, enrollment and attainment. It illustrates that the delay of parenthood increased enrollment. Among women, a positive effect on enrolment was present from the late teens until late twenties, amounting to a 1.6 percentage point increase at most at age 23. There was an increase also among men, but it remained weaker in size at young ages as compared to women and peaked at a later age: the respective effect amounted to a 0.9 percentage point increase at most at age 27. The share of those attaining a tertiary degree by age 32 increased cumulatively by age as a consequence of the intervention, among women from the early twenties onwards, and among men from the mid-twenties onwards. The cumulative effect reached a 2.4 percentage points among women and by 1.1 percentage points among men by age 32.

As shown in Figure 5 the likelihood of being employed at least nine months a year increased strongly among women as a consequence of the three-year-delay intervention. The effect increased from the early twenties, peaked at age 27, amounting at most to a 3.8 percentage point increase, and quickly decreased thereafter and was no longer significant at age 32. Among men, the increase in employment was small. The annual income level of women increased also sizably in the counterfactual scenario, with a peak later than in the case of employment. Increases were seen throughout the twenties and early thirties, by about 800 euros at most at age 30. In men there was a relatively small but increasing positive effect present from age 26 onwards, amounting to 265 euros at most at age 32.

MEDIATION ANALYSIS

Figure 6 illustrates that the total effects of the intervention on educational outcomes were direct, i.e. not mediated by changes in labor market careers. The indirect effects remained at or close to zero throughout the follow-up. Correspondingly, the direct effects were stronger in women than men. This suggests that the delayed responsibility of caring for a child enables continued studying, particularly among women. It also suggests that changes in employment or income, caused by delayed parenthood, are not responsible for changes in education of women nor of men.

As shown in Figure 7, there was a strong gender imbalance in the direct effects of the first birth delay on labor market outcomes, i.e. the effects that were not mediated by changes in the educational careers. Among women, the direct effects of the first birth delay intervention largely followed the pattern of the corresponding total effects: they were strong and significant at most ages, but the employment effect was notably temporary as it decreased quickly after peaking at age 27. In women, the directs effect mainly accounted for the total employment effect, but the indirect effect contributed moderately yet increasingly at higher ages to the total income effect. In men, the small total increase in employment stemmed from a direct effect. As for income in men, there was some evidence of a small positive direct effect at higher ages, (significant only at ages 26 to 28), and there was a small but increasing indirect effect at higher ages (significant at age 32).

[FIGURE 6 ABOUT HERE]

[FIGURE 7 ABOUT HERE]

EFFECTS AT THE TIME OF ENTERING PARENTHOOD

The intervention caused both women and men to enter parenthood socioeconomically better equipped (Table 2). The effects on educational outcomes in the year of entering parenthood appeared stronger among women than men, while the opposite appeared to be the case with employment and income. Mothers and fathers were respectively 6.0 and 4.9 percentage points less likely to be enrolled before having the first child. In the counterfactual scenario both mothers and fathers were, by 9.9 and 7.7 percentage points respectively, more likely to have attained a tertiary degree. Both mothers and fathers, by 9.7 and 12.5 percentage points respectively, were more likely to be employed at least nine months per year. There was also a strong positive effect on income at the time of entering parenthood, amounting to 4,685 euros in mothers and 6,829 euros in fathers. These increases bear resemblance to the age-specific increases in educational and labor market trajectories in the natural course. Generally, we see that the delay contributes to increases in existing gender gaps, favoring men in terms of income and employment and women in terms of education.

[TABLE 2 ABOUT HERE]

The mediation analysis further shows that these effects were to a large part direct effects, not mediated by educational careers in the case of employment and income or by or labor market careers in the case of enrollment and educational attainment. Only in the case of enrollment of mothers, a quarter of the total effect was estimated to be mediated by changes in their labor market careers.

CONFOUNDING SENSITIVITY ANALYSIS

In women, the effect of the artificial confounder, aiming at capturing time-constant 'early parenthood-low career' orientation, (between the 25 and 75% quantile of the confounder distribution) on the first birth risk was very strong (odds ratio 23.7). The respective effect of the confounder on not being in enrolment (OR 5.14) was also strong. When the confounder was included in the regression model for the first birth, the effect of enrolment on birth reduced substantially from -0.51, ($p < 0.01$) to -0.03 ($p = 0.64$) on the OR scale. When the confounder was included in the model for enrolment, the effect of birth on enrolment reduced correspondingly from -0.58 ($p < 0.01$) to -0.04 ($p = 0.47$).

When the artificial confounder was included in models for the first birth and enrolment underlying the g-formula (see Step 2 of in our description of the g-formula), the effect of the delay intervention on tertiary educational attainment decreased only modestly, by 15 per cent, from a 2.3 to a 2.0 percentage-point increase in the share of women educated to the tertiary level (Table 3). We thus consider unobserved confounding that would both increase the first birth risk and decrease the enrolment risk in young adulthood to affect our estimates on educational attainment for women modestly.

[TABLE 3 ABOUT HERE]

In men, the effect of the artificial confounder (between the 25 and 75% quantile) on the risk of a first birth (OR 151.7) was also very strong. The effect of the confounder on not being in enrolment was notable (OR 2.86). When the confounder was included in the model on the first birth, the effect of enrolment decreased from -0.32, ($p < 0.01$) to 0.11 ($p = 0.15$) on the OR scale. When it was included in the model on enrolment, the effect of birth reduced from -0.52 ($p < 0.01$) to -0.04 ($p = 0.65$) correspondingly.

When the artificial confounder was introduced in the models for the first birth and enrolment in men underlying the g-formula, the effect of the delay intervention on attainment at the tertiary level decreased from a 1.1 to a 0.9 percentage-point increase, with a reduction of 17 per cent (Table 3). Thus, also in men, this strongest confounder that we were able to construct for the association between the risk of a birth and that of enrolment changed our estimates of the effect of birth delay on tertiary attainment only modestly.

We additionally note that when the corresponding effect of confounding was studied for *higher* tertiary education at age 32, the reduction in the effect estimate was larger, 40 per cent in women and 34 per cent in men. This suggests that time-constant selection by unobserved characteristics that affects both the likelihood of being enrolled and the likelihood of having a first birth at relatively young age may be more strongly present for the effect of first birth timing on attainment of higher levels of education. This is plausible because higher attainment requires a longer period of enrolment, and any effects between first births and enrolment have time to accumulate.

What comes to the role of unmeasured confounding for effects on labor market outcomes, the indirect effects via changes in educational career are likely to remain to a large extent despite the introduction of such confounding as described earlier. As in the case of education, it is obviously plausible that a more complex type of confounding is present in real settings, and additionally, the effect of the first birth not mediated by educational career can be subject to additional unobserved confounding. This issue is left for further studies to investigate.

DISCUSSION

This study aimed at quantifying the total, direct and indirect effects of parenthood delay on educational and labor market outcomes of women and men in young adulthood. This aim was assessed utilizing dynamic counterfactual modeling (Bijlsma & Wilson, 2017) and high quality longitudinal register data from Finland, a Nordic country relatively advanced in terms of gender equality (Ellingsaeter & Leira, 2006). Our results suggest that delaying parenthood has a strong impact on women, men and families to which children are born, but the effects are not uniform. Among all women, those who have children and those who do not, population level fertility delay increases educational enrollment and income; but for men, the impact on educational and labor market outcomes is modest. The intervention however had a strong positive impact on socioeconomic standing of both men and women at the time of parenthood, as this effect combines resource accumulation over age and the dynamic effect arising from postponement. The results illustrate that further delay of parenthood would exacerbate the educational advantage of women, attenuate the income advantage of men, and improve the socioeconomic characteristics of new parents.

Our main results on education show that a counterfactual delay of parenthood by three years would have led to an increase in educational attainment of both women and men born in Finland in the mid-1970s. Averaged to the general population, the effects amounted to 2.4 and 1.1 percentage point increases in the female and male population respectively. The results provide evidence for that delayed parenthood has benefited women socioeconomically more strongly than men and contributed to the reversal of gender differences in educational outcomes. The more beneficial effect of parenthood delay for women is in line with earlier literature emphasizing the gendered response to parenthood (Kaufman & Uhlenberg, 2000; Maume, 2006; Sanchez & Thomson, 1997). Our hypothesis of a stronger indirect effect of parenthood delay in men than women, as mediated by labor market careers, was not confirmed: neither women nor men witnessed increases in their education due to changes in labor market careers. This suggests that men do not attain higher degrees because their parenthood delay would cause them to delay or decrease their provision of family income. Rather, a substitution of parental obligations such as caring with studying appears as a more likely mechanism for both women and men.

In the light of the pace of changes in the educational attainment and timing of entering parenthood, witnessed mainly since the 1970s (C. Buchmann et al., 2008; Mills et al., 2011), we view the effects of the three-year parenthood delay intervention on educational attainment as moderate. In the period 1998–2017, the share of the population aged 25–34 with a tertiary degree across the OECD countries increased by 1.1 percentage points annually (OECD, 2019c), with respective increases of 1.4 and 0.8 percentage points in women and men. The maternal age at having the first child, on the other, increased in the period 1970–2008 respectively by one year per decade (Mills et al., 2011) and similar trends have been witnessed in paternal age (Khandwala, Zhang, Lu, & Eisenberg, 2017; Schmidt et al., 2012). Increasing educational attainment has been argued to contribute to the increasing age at entering parenthood, as women and men typically have low fertility rates during educational enrolment and in some contexts those with higher degrees also postpone parenthood after graduation as compared to those with lower degrees (Blossfeld, 1995; Kravdal, 2007; Kravdal & Rindfuss, 2008; Lappegård & Rønsen, 2005). However, by showing that educational levels increase as a consequence of the parenthood delay intervention, this study provides further evidence for that the increasing ages at entering parenthood are not only a consequence of increases in education, but they also contribute to increases in education, particularly among women. Currently young women are more highly educated than young men in almost all high-income countries (OECD, 2019c) and this will have significant repercussions in many areas of the society, not only including changes in women's position in the labor market, but also in areas such as marriage markets and family formation (C. Buchmann et al., 2008; Van Bavel, 2012).

Both of these trends, increasing educational attainment and increasing age at first birth, obviously, also show variation between countries, with Finland having witnessed increases in both tertiary educational attainment as well as timing of the first child earlier than many other high-income countries. Currently, the proportion of tertiary educated among Finnish women (50 %) is close to the OECD average (51%), while Finnish men (33%) rank below the average (38%), contributing to a relatively strong gender difference in tertiary attainment in the country (OECD, 2019c). Strong institutional and cultural support for gender equality in a Nordic country such as Finland is likely to have contributed to relatively early changes and the current strong position of women in terms of education (Esping-Andersen, 2009). In Finland access to modern contraceptives became increasingly available from the 1960s (Kosunen, Sihvo, Nikula, & Hemminki, 2004) and four in five mothers of children aged under 16 worked full-time already in late 1970s. The findings of this study support the view that countries currently witnessing decreases in first birth rates of women in their early adulthood are likely to witness increases in the educational level of their female population – and the same applies to men even if less strongly (Lutz, Butz, & Samir, 2017).

With regard to labor market outcomes, the delay of parenthood would have contributed to hypothesized strong increases in employment and income among Finnish women across young adult ages. In line with expectations, among men, there was only a weak increase in income from age 26 onwards, and hardly any increase (weak positive effect at ages 25-27) was found on employment. Mediation analysis further indicated that changes in the educational careers as a consequence of the first birth delay intervention contributed to increases in income among both women and men. Such an indirect effect amounted at most to 34 and 46 percent of the total effect, among women and men respectively. The direct effect, not mediated through changes in education, was present also in both genders, but its magnitude was much larger among women. Thus, our hypothesis of more gender similarity in indirect effects mediated by education than direct effect was partly confirmed, although the indirect effects appeared also larger for women. This illustrates that parenthood delay is likely to improve labor market outcomes of both women (Amuedo-Dorantes & Kimmel, 2005; Blackburn et al., 1993) and men through changes in educational careers, most likely operating though increases in human capital.

The pervasiveness of the strong direct effects of parenthood delay on employment and earnings trajectories of only women in young adulthood is not unexpected e.g. (Browning, 1992; Gustafsson, 2001) and yet notable in a Nordic country considered to be at the forefront of change towards gender symmetry. There may be several reasons for this. Firstly, it may indicate that even in such a country, the demands between childcare and other unpaid work at home are at conflict with the labor force participation of women. Secondly, a generous parental leave system in part encourages mothers to reduce their labor supply after childbirth in Finland (Ellingsaeter &

Leira, 2006; Haataja, 2004; Rønsen & Sundstrom, 2002). Fathers are eligible to share the income-tested parental leave lasting up to six months, and after the parental leave, either parent can stay home with a child with a modest flat-rate compensation until the child turns three (Miettunen, 2008). Although only a four-month maternity leave is reserved for mothers only, mothers continue to take the vast majority of all leave available. Thirdly, Finland is more traditional than the other Nordic countries regarding the employment of mothers: early motherhood is therefore a stronger predictor of labor market exclusion of young women in Finland than in Sweden and Norway (Lorentzen, Bäckman, Ilmakunnas, & Kauppinen, 2019) and the part-time labor market in Finland is weak (Rønsen & Sundstrom, 2002). Notwithstanding, we also found a small direct effect of parenthood delay on men's incomes. This is likely to indicate, in line with recent findings from other Nordic countries (Cools & Strøm, 2016; Lundborg et al., 2017), that men are neither entirely resilient to decreases in their earnings due to parenthood, or that at least any increases due to fatherhood may be temporary (Gupta, Smith, & Stratton, 2007).

An aim of the study was also to assess whether a delay of parenthood by three years contributes to changes in women's and men's socioeconomic outcomes at the time of entering parenthood. Our analyses show that the delay into parenthood would have strongly improved the circumstances of Finnish women and men born in mid-1970s at the time they were entered parenthood. Our expectations on stronger effects in women were only partially confirmed: in terms of educational attainment, the improvement appeared somewhat larger in women, whereas the probabilities of being employed and earning higher incomes increased more strongly among men. These gender differences are likely to arise strongly from gender-specific age trajectories in education and labor market as witnessed in the natural course. Notably, such gender-specific effects are likely to strengthen existing gender inequality within typical households in which men earn more and women are more highly educated. Further, such strong increases in men's incomes may contribute to the persistence of gender inequalities in the division of unpaid work. This is because relatively high income give men a strong bargaining position towards unpaid work at a critical moment when the amount of this work strongly increases in the family (Brines, 1993; Milkie, 2011). From the children's perspective, the delay in their birth contributes to better social circumstances at the time when they are born which are likely to be important for their later development and well-being. Prior literature has shown significant effects of parental socioeconomic characteristics at birth and in childhood on later life health and social advancement in Finland (Moustgaard, Avendano, & Martikainen, 2018; Remes, Moustgaard, Kestilä, & Martikainen, 2019; Sirniö, Martikainen, & Kauppinen, 2013). This observation is also consistent with the idea that by postponing childbearing parents can choose to have fewer children later and invest more heavily on the wellbeing of children that they eventually have.

In interpreting our findings several methodological issues need to be considered. A positive aspect of the study is its' reliance on large longitudinal data without self-report bias or loss to follow-up and reliance on advanced analytical techniques. We also consider the possibility to calculate effects of an intervention flexibly at different time points in the life course a methodological advancement. However, the estimated effects in this study may be biased if relevant time-constant and time-varying confounders are not controlled for. In the analysis a large number of time-varying confounders (all characteristics shown in the DAG in Figure 1 are modeled also as time-varying confounders) and a number of time-constant family background characteristics were controlled for. In order to test whether unobserved time-constant confounding may be biasing our results we carried out a sensitivity analysis where a hypothetical confounder aimed at measuring ‘early parenthood-low career orientation’, being associated strongly with educational enrolment and first birth risk, was included in the regression models. According to this analysis, the effect of the delay of parenthood on tertiary educational attainment was reduced modestly (<20 per cent), regardless of gender. Obviously, it remains possible that confounding in real life is more complex and time-varying in a way that is not captured here, and could theoretically affect our estimates more. Additional analysis showed that in the case of only higher tertiary education, the reduction of the effect amounted to 40 per cent in women and 34 per cent in men, and this calls for further investigation.

This study illustrates how recent advances in causal methodology as applied to longitudinal high-quality data can shed further light on how the delay of parenthood is related to the unfolding of educational and labor market careers of women and men. However, as men tend to become parents later than women (Kiernan & Diamond, 1983; Nisén, Martikainen, Silventoinen, & Myrskylä, 2014), a larger share of women than men become parents by age 32, gender differences in population-averaged effects can also stem from a larger share of women intervened. However, this is not driving the gender differences at the population level as similar gender differences were found also in the intervened population (see Appendix table 1). Overall, the causal interpretations of our results are as robust as our causal DAGs and the data that underlie our modeling. Although, we believe some of these biases are minimized by our register-based data set with reliable annual measurement, no loss to follow, and dynamic analyses, some possible explanatory variables, such as preferences, remain outside the scope of the data. We call for more birth cohort or country replications of these analyses.

Overall, this study demonstrates that the delay of parenthood remains – even in a Nordic country considered advanced in terms of gender equality – a strong determinant of women’s educational and labor market outcomes. However, the timing of parenthood in early adulthood matters also for men's educational outcomes – and in part therefore, impacts their income trajectories in the early thirties. Overall, the study results provide further evidence for that the delay of parenthood has contributed to the long-term trend of strengthening of women's educational and labor market position as compared to men as observed in several high-income countries. From the child's perspective, on the other hand, delays of parenthood lead to socioeconomically more beneficial childhood social circumstances. The results illustrate that the delay of parenthood can exacerbate the educational advantage of women and attenuate the income advantage of men. Particularly strong increases in men's incomes at the time of entering parenthood caused by delays in the timing of parenthood may however help to explain why progress in gender equality in unpaid work in families with children has been slow.

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[1] The non-response arises strongly from households of children born close to the end of year 1975. There was some evidence of selective non-response based on other characteristics in the 1975 census. Those excluded based on their family status (i.e. those whose family members could not be identified or those who lived in a father-only household in 1975) had for instance a lower mean age at birth and a lower level of education than those included. However, due to the small share of the excluded, the exclusion had only marginal impact on the analytical sample.

[2] The calculation of a parental leave month is based on parental leave days (average per month: 25.3 days). Parental leave allowance is paid for six days per week excluding public holidays (Miettunen, 2008). The usual maximum length of leave for a mother (incl. maternity leave) is ten months. A father can use approximately six months out of this leave, plus additional 18 days. In 2003–2007 fathers were entitled to an additional month. For ages 16 to 20/21 our employment measure does not cover parental leave. We assume this to cause negligible bias due to low teenage fertility and employment.

[3] After parental leave (child typically nine months old), either parent can stay home until the child turns three on a monthly flat-rate benefit (Miettunen, 2008). The amount of the home care allowance depends on the number of children and their age, place of living, family income, and year. Taking into account annual changes in the main part of the allowance, a proximate measure for a three-month-stay was used. For instance, a mother of a child aged <2, living in Helsinki with an average-earning spouse, would have received 513 euros per month in 2007 and correspondingly 3x513 euros defined a three-month-stay.

[4] Income is calculated only from years in which the person lived with a parent. Those with a missing value and whose family type is “without a parent or unknown” (n=53), were place in the lowest quintile.

[5] Controlling for own income effectively means that we model household income net of own income. The results would not change if we would directly model household income other than one’s own income.

Table 1 List of time-constant and time-varying variables of the study

Time-varying	**Range**
First birth	yes, no
Parenthood[1]	yes, no
Time since first birth[1]	0–18
Partnership	single, cohabiting, married
Educational attainment	primary, secondary, lower tertiary, higher tertiary
Enrolment	yes, no
Cumulative number of years enrolled[1]	0–17
Number of times entered into education[1]	0–16
Employment	yes, no
Cumulative number of years employed[1]	0–17
Unemployment	yes, no
Personal income (1,000 euros)[2]	0–77.1
Cumulative personal income (1,000 euros)[1]	0–928.5
Household income	0–150.8
Age	16–19, 20–23, 24–27, 28–30, 31–32

Time-constant	**Range**
Age of the mother at the birth of her first child	15.3–44.6
The number of siblings	0–14
The birth order of the index person	1–15
Parents married at the birth of the index person	yes, no
Level of urbanization of living area at age 15	rural, semi-urban, urban
Family type at age 15 (living with)	parents, single parent, cohabiting parent, married pare
Parental home ownership at age 15	yes, no, other or unknown
Parental level of education at age 15	primary, secondary, lower tertiary, higher tertiary
Parental unemployment at age 15	yes, no
Parental household income at at 15	quintiles

[1]Deterministically determined by other time-varying variables.
[2] The highest three per cent of incomes are top-coded.

Table 2 Educational and labor market outcomes: the effects of the of the three-year birth postponement intervention among female and male parents (i.e. among those who became parents by age 32) at the time when the first child is born.

Educational outcomes	Female			Male		
	Effect	95% CI		Effect	95% CI	
Total						
Enrollment	-0.060	-0.072	-0.046	-0.049	-0.064	-0.039
Tertiary attainment	0.099	0.091	0.106	0.077	0.068	0.084
Direct, not mediated by labor market career						
Enrollment	-0.045	-0.058	-0.034	-0.050	-0.059	-0.040
Tertiary attainment	0.104	0.097	0.111	0.076	0.068	0.083
Indirect, mediated by labor market career						
Enrollment	-0.014	-0.025	-0.004	0.000	-0.009	0.010
Tertiary attainment	-0.005	-0.011	0.001	0.001	-0.005	0.008

Labot market outcomes	Female			Male		
	Effect	95% CI		Effect	95% CI	
Total						
Employment	0.097	0.082	0.112	0.125	0.113	0.137
Income, 1 000 euros	4.719	4.443	4.998	6.799	6.469	7.115
Direct, not mediated by educational career						
Employment	0.103	0.091	0.115	0.129	0.116	0.143
Income, 1 000 euros	4.685	4.455	4.896	6.829	6.509	7.183
Indirect, mediated by educational career						
Employment	-0.006	-0.016	0.006	-0.004	-0.013	0.005
Income, 1 000 euros	0.012	-0.165	0.188	-0.036	-0.384	0.237

Table 3 Total population-averaged effect (PAE) of the three-year birth postponement intervention on the tertiary educational attainment in female and male population at age 32 in the main analysis and in the confounding sensitivity analysis.

	Female			Male		
	PAE	95% CI		PAE	95% CI	
Main analysis	0.024	0.019	0.029	0.011	0.014	0.007
Sensitivity analysis	0.020	0.015	0.024	0.009	0.007	0.012

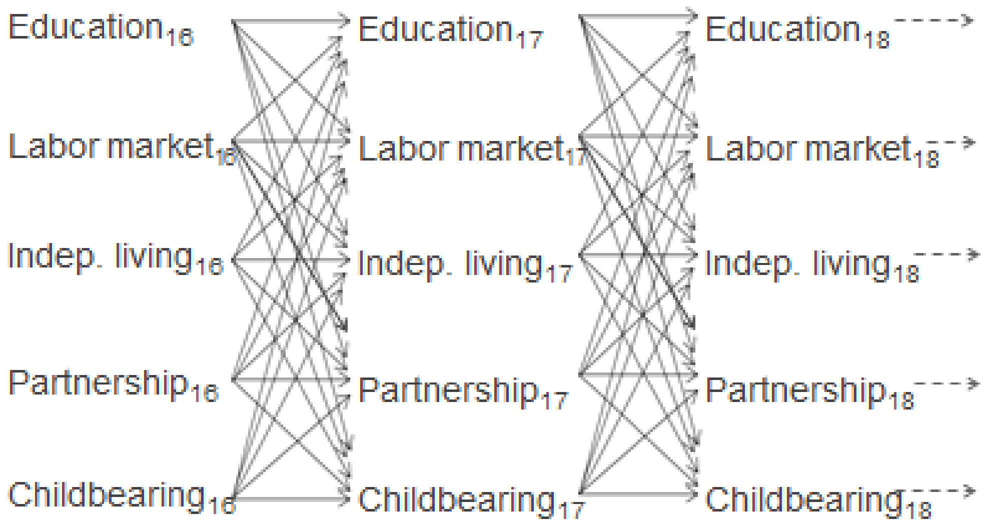

Figure 1 DAG of the study design representing the time-varying characteristics. The figure excludes the effects of time-invariant characteristics and interactions with age. Women and men are modeled separately. Indep. living = Independent living.

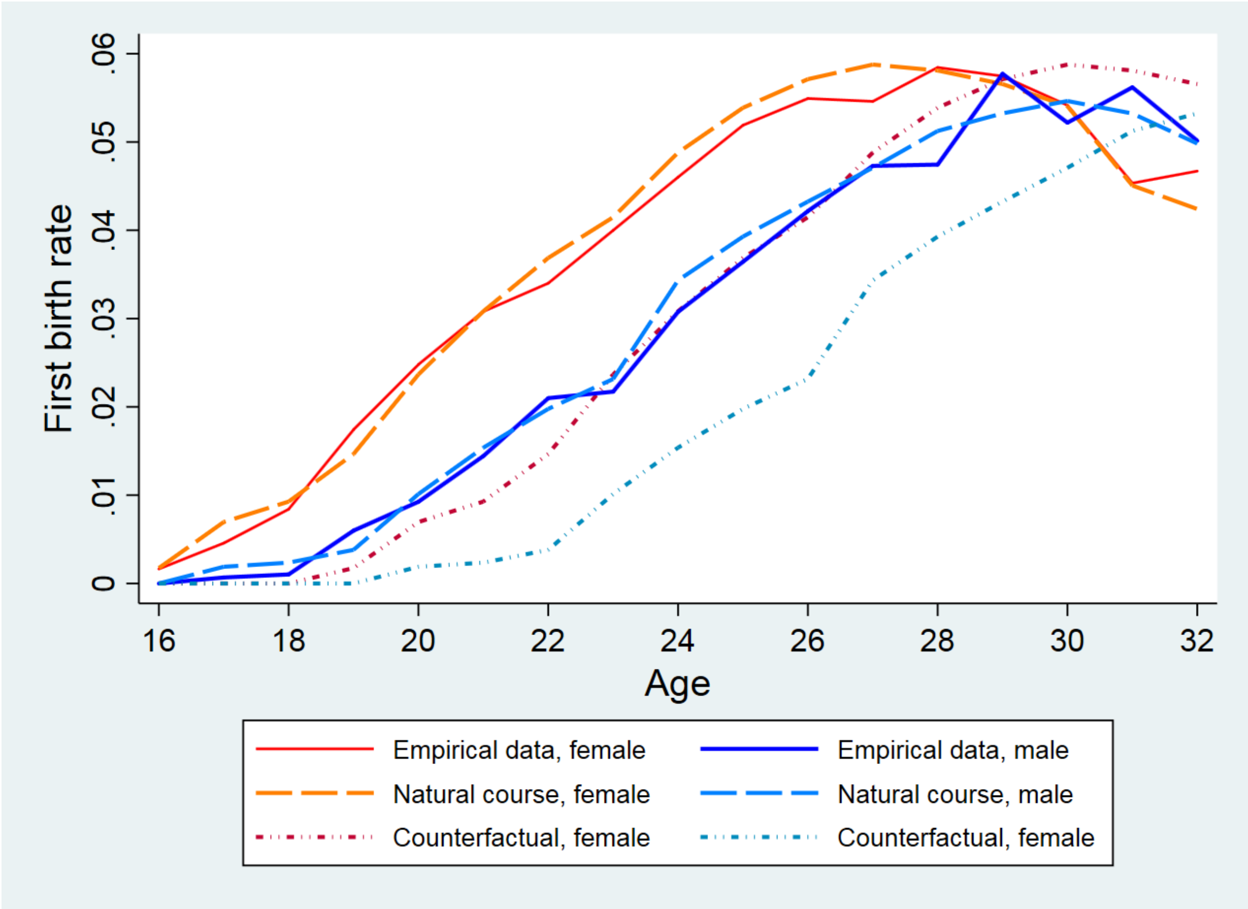

Figure 2 First birth rate: Empirical data, natural course, and counterfactual scenario (three-year-postponement intervention) in the female and male population.

Figure 3 Educational and labor market outcomes: Empirical data and natural course in the female and male population.

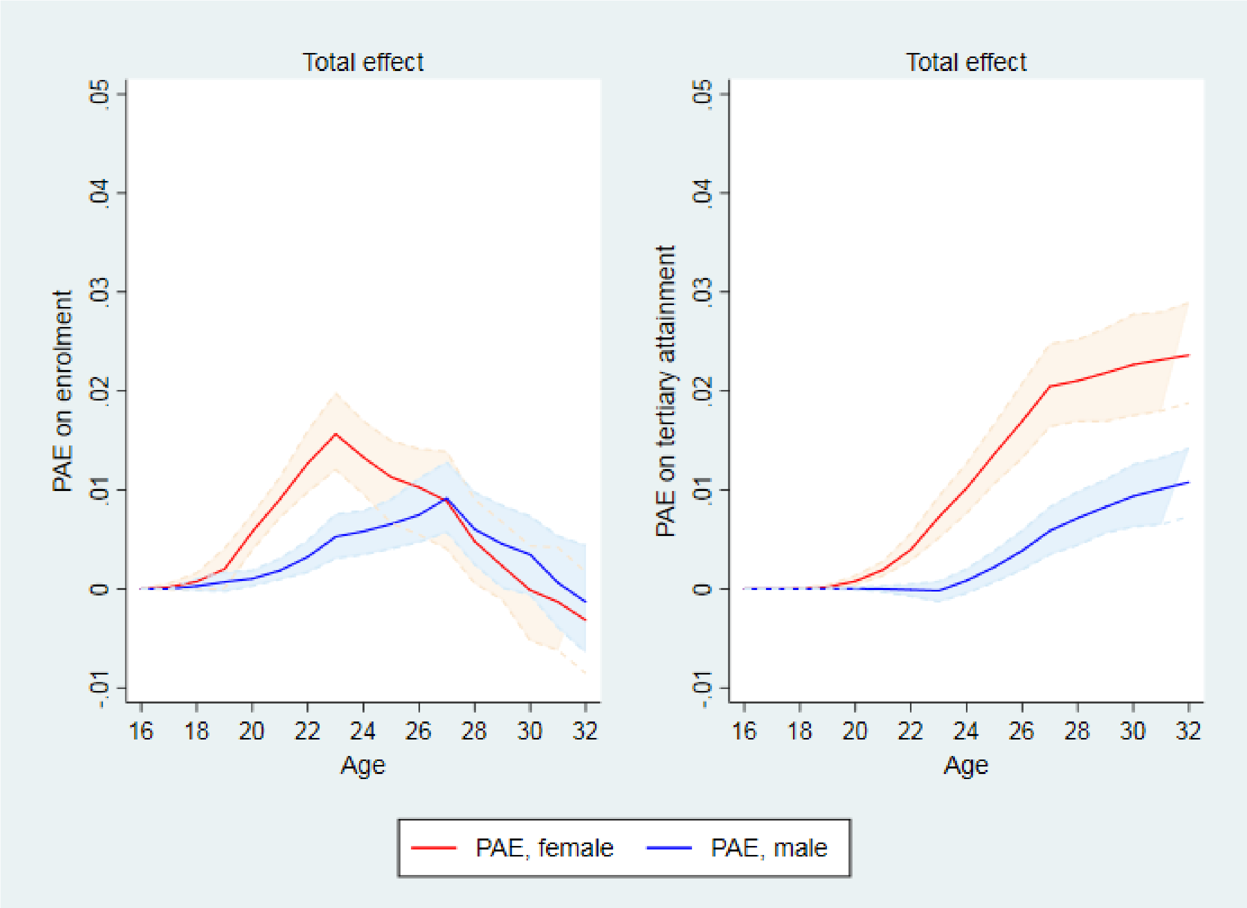

Figure 4 Educational outcomes: Total population-averaged effect (PAE) with 95 per cent confidence interval of the three-year birth postponement intervention in female and male population.

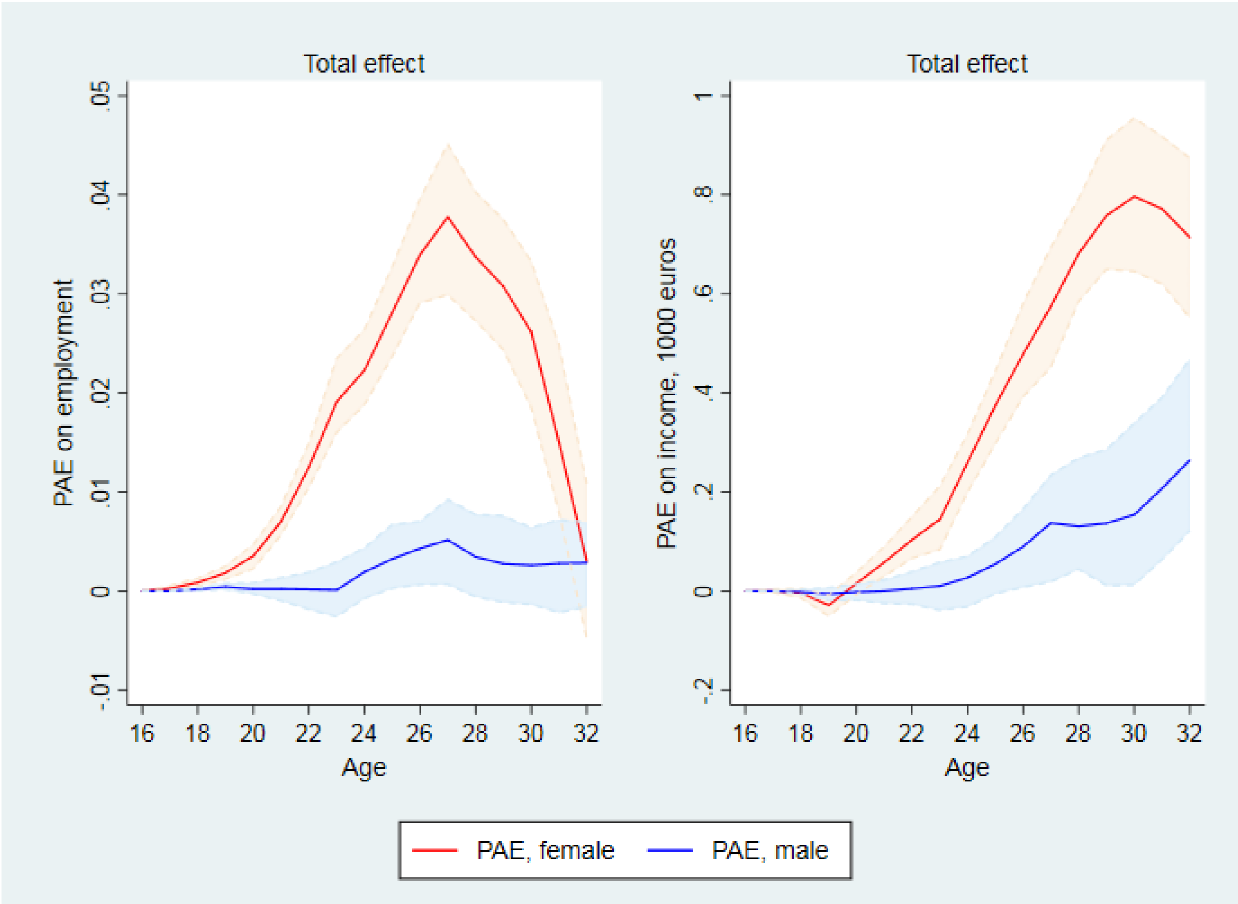

Figure 5 Labor market outcomes: Total population-averaged effect (PAE) with 95 per cent confidence interval of the three-year birth postponement intervention in female and male population.

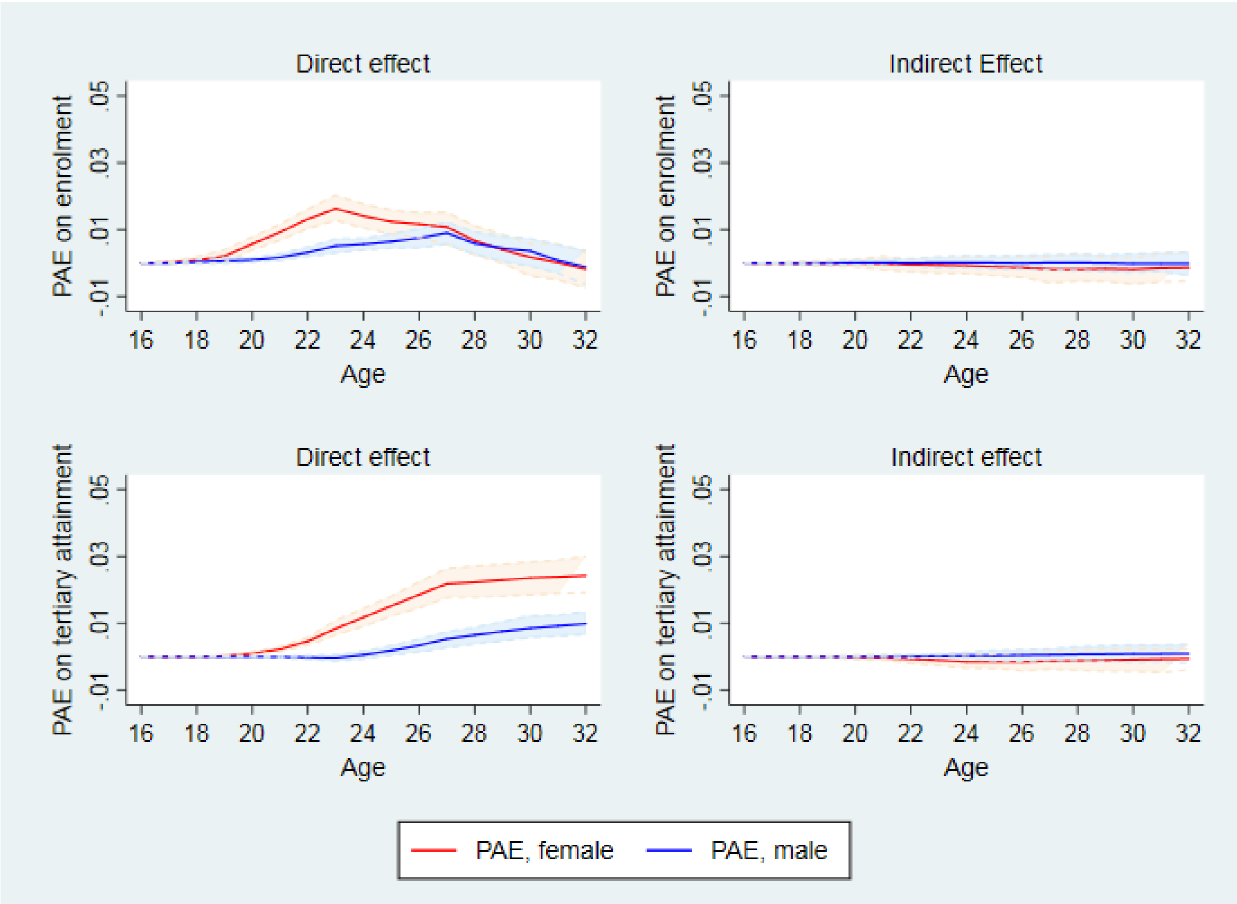

Figure 6 Educational outcomes: Direct (i.e. not mediated by labor market career) and indirect (i.e. mediated by labor market career) population-averaged effect (PAE) with 95 per cent confidence interval of the three-year birth postponement intervention in female and male population.

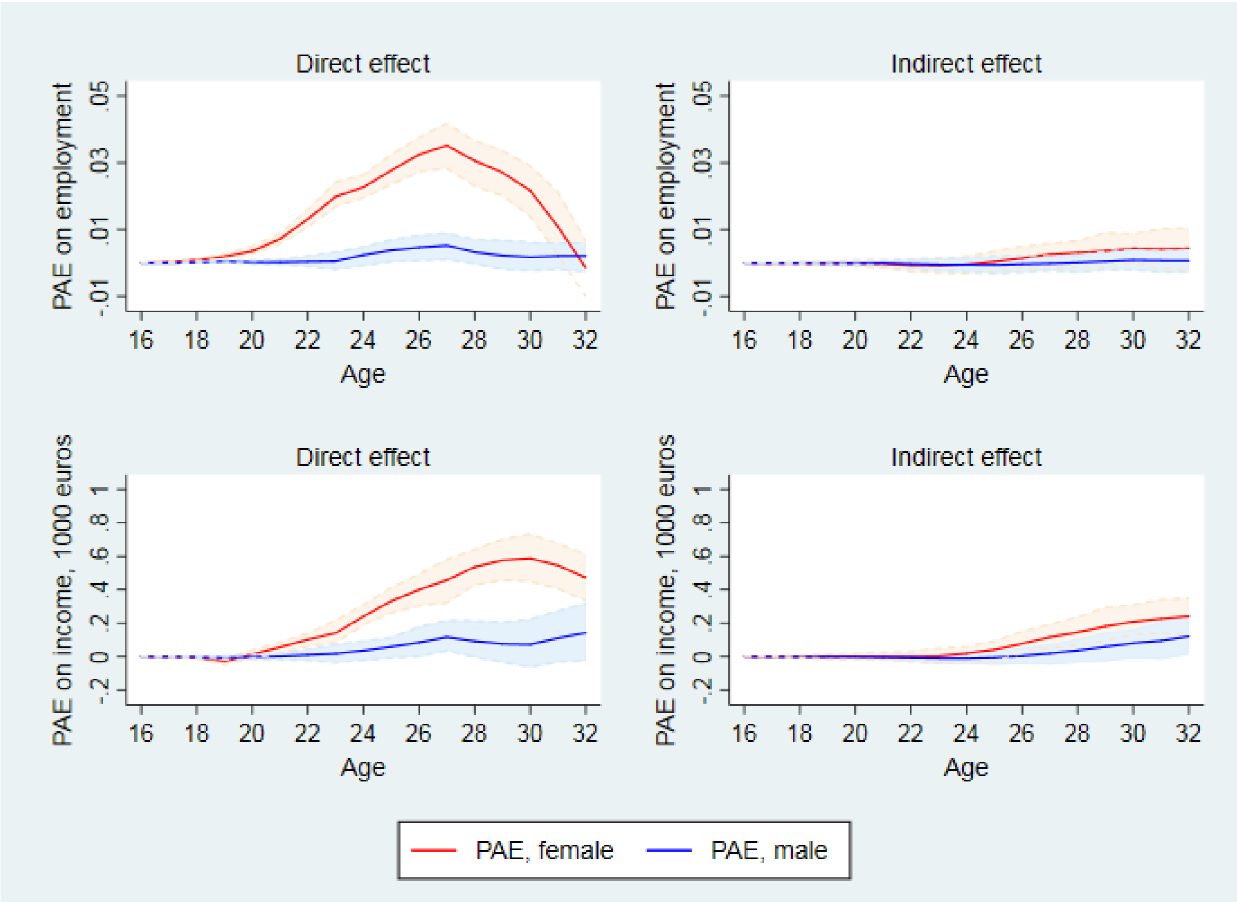

Figure 7 Labor market outcomes: Direct (i.e. not mediated by educational career) and indirect (i.e. mediated by educational career) population-averaged effect (PAE) with 95 per cent confidence interval of the three-year birth postponement intervention in female and male population.

Appendix A Total population-averaged effect (PAE) and total average treatment effect among the treated (ATT, i.e. among those who became parents by age 32), shown selectively at those ages where the effect reached its sex-specific maximum.

	Female			**Male**		
	PAE	95% CI		PAE	95% CI	
Employment at age 27	0.038	0.030	0.045	0.005	0.001	0.009
Income at age 30	0.797	0.645	0.955	0.265	0.122	0.469
Enrolment at age 23	0.016	0.012	0.020	0.009	0.006	0.013
Tertiary attainment at age 32	0.024	0.019	0.029	0.011	0.007	0.014
	ATT	95% CI		ATT	95% CI	
Employment at age 27	0.058	0.049	0.068	0.010	0.001	0.018
Income at age 30	1.255	1.023	1.472	0.559	0.126	0.968
Enrolment at age 23	0.024	0.019	0.030	0.018	0.012	0.025
Tertiary attainment at age 32	0.037	0.030	0.045	0.021	0.015	0.028