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Disertační práce

2013 **Martina Štípková**

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FAMILY CHANGE AND ITS IMPACT ON THE HEALTH OF NEWBORNS IN THE CZECH REPUBLIC

Disertační práce

Vypracovala: Školitel:

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PROHLÁŠENÍ

Prohlašuji, že jsem práci zpracovala samostatně a použila jen uvedené prameny a literaturu.

V Praze dne Martina Štípková

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CONTENTS

1 INTRODUCTION

Health, like other valuable assets, is not distributed randomly in the society. For various reasons, some people are healthier, wealthier and happier than others. Decades-long research on social stratification shows that a wide range of precious assets are reproduced across generations. Being born to the right family, improves (but does not determine) one's chances to be successful at school and attain high education, get a prestigious and well-paid job, meet a partner with preferred characteristics, get married and have a happy family. Health of children is influenced by family background, as well.

My dissertation inquiries into the association between family background and the health of newborns in the Czech Republic. It focuses on the period of extensive societal transformation after the collapse of state socialism. Childbearing patterns changed dramatically during this period and these changes altered the ways how family background shapes the health of children. The subject of the research, the health of newborns, lies at the cross-section of sociology, demography/population studies and epidemiology. This is reflected also in the literature I use to support my arguments. But the question that motivates the research (how does family background influence wellbeing of children) is at the core of sociological inquiry. The present research extends our understanding of this process.

Health has been a rather neglected subject in Czech sociology until relatively recently. A growing interest in health-related topics can be observed in Czech sociology since several years (see e.g. [Dudová 2010; Dzúrová et al. 2006; Hamplová 2012a; Hasmanová Marhánková 2008; Hrešanová 2008; Hrešanová 2008, 2011; Kreidl 2008; Slepičková 2009; Slepičková, Fučík 2009; Slepičková et al. 2012]). However, research on social stratification of health is still very limited. Beside the substantive results it provides, the present research could also stimulate further research agenda in this field. I hope that my work will help to attract attention of more social scientists to the study of health and its social causes and consequences.

The dissertation has two introductory theoretical chapters and two empirical parts. The Theoretical chapter (Chapter 2) discusses motivations for the research of the relationship between family processes and the health of newborns. It explains that social status and health influence each other during life course and across generations. It thus acknowledges the importance of family processes for the health of children. Research goals and questions are then outlined in Chapter 3. The research has two relatively independent parts.

The first empirical part (Chapters 4 to 8) analyses the transformation of family arrangements to which children are born from a perspective of social stratification. It focuses on the remarkable spread of non-marital childbearing that occurred in the first two decades after the collapse of the socialist regime and studies socioeconomic differences in family arrangements of mothers. This provides the necessary first step for understanding the processes that may have influenced the impact of family background on the health of newborns.

The second empirical part (Chapters 9 to 13) addresses the health of newborns and its relation to family background. It analyses trends in the health of newborns measured with birth weight. The main focus is placed on disparities in birth weight by maternal family arrangement. Their sources are sought for in shifting characteristics of married and unmarried mothers and changes in the meaning of unmarried motherhood.

The findings of both of these analytical parts are summarized and interpreted in the conclusion (Chapter 14). The final chapter (Chapter 15) is methodological. It summarizes information about all data sources and methods of analysis used throughout the dissertation.

I have already written and published some partial analyses of the data from birth register [Kreidl, Štípková, 2009; Štípková, Kreidl 2011; Štípková 2012]. Although I use some of the previous arguments here, the published analyses are not reproduced in this dissertation in their original intentions and I quote them as independent sources.

2 THEORETICAL MOTIVATION FOR THE RESEARCH OF FAMILY PROCESSES AND THE HEALTH OF NEWBORNS

2.1 Introduction

Researchers of social stratification have spent decades studying the various channels of intergenerational transmission of a wide range of precious assets. Family arrangement is one of them. It is related to the children's later outcomes and life prospects. Research shows that children born to unpartnered mothers face numerous disadvantages in comparison to children from two-parent families. They suffer, on average, from more behavioural problems [Carslon 2006] or slower cognitive development [Gennetian 2005]. Consequently, they tend to have a lower educational attainment and worse job prospects [Biblarz, Raftery 1999]. There are also differences between various kinds of two-parent families with marriage being more beneficial for children's life chances than unmarried cohabitation [Brown 2004; Manning, Lichter 1996].

The main argument of this chapter is that family background, among the outcomes listed above, influences also health of children, even at the very beginning of their lives. This contributes to the reproduction of social inequalities. The chapter starts with describing the relationship between social influences and health. It emphasizes two crucial influences: socioeconomic status and family arrangements. After the general patterns of social causes and consequences of health are discussed, I focus on the health of children and the intergenerational relationships between health and social status. I explain that the health of children is one of the channels of the intergenerational transmission of social status. Finally, the importance of acknowledging how family change influences this process is stressed.

2.2 Social causes and consequences of health

There is a large body of research that describes an association between various health measures and a wide range of individual social characteristics and conditions of life. The social factors that have been observed to influence health include socioeconomic status [Elo 2009], social relationships and networks [Smith, Christakis 2008], ethnicity [Parekh, Rose 2011; Vickie et al. 2003], migrant status [Kandula et al. 2004; Sole et al.

2013] or religious affiliation [Chatters 2000]. The following review focuses on the role of socioeconomic status and family arrangements on health, as they are crucial variables whose influence on health is studied in this dissertation.

2.2.1 What is health and how it can be measured

Although everybody understands what health is, researching health is not an easy task. The WHO definition states that "[h]ealth is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" [WHO 1946]. However, there is no straightforward way of measuring this well-being. Therefore researchers focus rather on studying the "disease or infirmity" and their consequences (i.e. mortality and length of life). The mortality and length of life approach to studying health has been dominant until 1960s, but the need for a more sensitive measure of health intensified with growing average duration of human life [Sermet, Cambois 2006].

These more sensitive indicators of health can be framed in several approaches to the concept of health. Blaxter [2010: 4-27], for instance, distinguishes two kinds of conceptualizations of health which lead to different measures of health. The biomedical model focuses on identification of diseases, i.e. abnormalities and deviations from normal (healthy) physiological and psychological functions. Alternatively, the social model of health emphasizes the experience of health and body functions. This approach is reflected in the WHO definition of health quoted above, which explicitly avoids equating health with an absence of disease.

Measures of health following the biomedical model identify the incidence and prevalence of medically diagnosed diseases. The measures stemming from this approach include diagnosed morbidity, and self-reported morbidity. Diagnosed morbidity refer to the diseases identified by health practitioners while self-reported morbidity relies on respondents' answers on whether or not they suffer from particular diseases (or were diagnosed to have them) [Sermet, Cambois 2006: 15-18]. The social model of health focuses on how symptoms of diseases influence daily life. It measures disability that is caused by impairment of physiological or psychological functioning. The measures include practical checks of or questions on e.g. sight or hearing impairment, limitations in daily life activities (e.g. being able to climb stairs) [Sermet,

Cambois 2006: 18-23]. The social approach to health is reflected also by a third method of measuring health, the subjective assessment of one's health. This is most commonly done by asking respondents to rate their health on a (usually five-point) scale [Jylhä 2009; Sermet, Cambois 2006: 23-25].

2.2.2 Association between health and socioeconomic status

The socioeconomic gradient in health has attracted vast attention of researchers [cf. Elo 2009]. Socioeconomic status (SES) measured by occupational class, educational attainment, income or employment status (whether one works) has been found to influence a wide range of health outcomes. Having a higher SES is negatively correlated with mortality [DHSS 1980; Meara et al. 2008; Torssander, Erikson 2010; Sobotík, Rychtaříková 1992] (including homicide and fatal injuries [Cubbin, Smith 2002], or suicide [Taylor et al. 2005]), disability [Walker Becker 2005], serious diseases like type-2 diabetes [Espelt et al. 2012; Ricci-Cabello 2010] or cancer[1] [Daixin et al. 2010], depression [Lorant et al. 2003; Ross, Mirowsky 1989], and subjectively reported ill health [Mackenbach et al. 2005]. People with higher socioeconomic status also have higher survival chances when diagnosed with cancer [Woods et al. 2006].

Various sources of the health disadvantage concentrate at the bottom places of the social hierarchy. Evans and Kantrowitz [2002], for instance, provide a review of environmental risks which are stratified by income. They include exposure to toxic substances (including air and water pollution), ambient noise, crowded or substandard housing, poor quality of educational facilities, dangerous work environment etc. [*ibid.*]. People with lower level of education are also more likely to engage in risky or unhealthy behaviour like smoking, heavy alcohol drinking or unsafe driving, and to be obese [Cutler Lleras-Muney 2010].

The socioeconomic gradient works also at the higher positions of the social ladder. For instance, longitudinal studies of British civil servants have shown that even health outcomes of people who are not poor, have a secure job and a good access to health care

[1] The socioeconomic gradient is inverted in some kind of cancers (e.g. breast cancer) [Daixin et al. 2010]. But once the cancer is diagnosed, survival chances are higher for patients with higher SES [Bradley et al. 2002; Rachet et al. 2010].

differ by their rank in social hierarchy [Marmot 2004]. The explanation of this 'status syndrome' (which is the title of the Marmot's book) lies in autonomy and control over one's life which is larger among people with higher rank in job hierarchy. Similarly, Mirowsky and Ross [2003] explain the favourable effect of education with what they term *learned effectiveness* which makes educated individuals able to control their lives. Education, in the authors' words "*develops the capacity to find out what needs to be don and how to do it, and develop habits and skills of self-direction. Together those prove effective when seeking health*" [Mirowsky, Ross 2003: 197].

2.2.3 Association between health and family arrangements

Another social factor that is associated with health is family arrangement or, generally speaking, the kind of social relationships a person is surrounded with. The relation between health and social relationships (including marriage) has received an increasing research attention since several decades [Smith, Christakis 2008]. Married men and women, compared to never married, divorced or widowed, have been found to have lower mortality [Gove 1973; Hu, Goldman 1990; Manzoli et al. 2007; Rychtaříková 1998], report higher self-rated health [Hughes, Waite 2009] and less limitations in bodily functions [Hughes, Waite 2009; Pienta et al. 2000]. They also have less diagnosed physical health problems [Dupre, Meadows 2007; Holt-Lunstad et al. 2008], and suffer less from depression and ill mental health [Gibb et al. 2011; Holt-Lunstad et al. 2008]. In addition, not only the mere existence of a marriage, but also its length [Dupre, Meadows 2007; Lillard, Whaite 1995] and quality [Holt-Lunstad et al. 2008] seem to make a difference.

There is much less evidence on whether also non-marital relationships are similarly protective against risk of death and ill health. Some studies show a positive effect of living with a partner, irrespective of formal marital status [Lund et al. 2002], while others suggest an additional beneficial effect of marriage compared to cohabitation [Joung et al. 1994; Koskinen et al. 2007]. As, argued by Hamplová [2012a], the effect of the form of the relationship is likely to be dependent on social context and meaning of unmarried cohabitation in the society. This is supported by Soons and Kalmijn [2009] who compared wellbeing (general life satisfaction) of married and cohabiting couples across Europe. The 'cohabitation gap' is lower in countries where cohabitation

is more institutionalised. Similar effect of the country setting is likely to be found for health.

The protective effect of marriage is usually explained in three ways, with social support, social control, and economic resources [Carr, Springer 2010; Hamplová 2012, Mirowsky, Ross 2003: 132-135]. Spouses benefit from the mutual emotional and psychosocial support they provide to each other. This contributes to their wellbeing and buffers stress. On the other hand, absence of such support or emotional strain related to marital break-down influence health negatively [Amato 2000]. Marriage also enhances health, because spouses follow a more organised lifestyle. They care for each other's health and health-related habits like smoking, alcohol consumption; risky behaviours etc. (e.g. [Duncan et al. 2006]). Finally, the beneficial effect of marriage is also linked to economic security it provides when spouses merge their incomes and share household costs [Mirowsky, Ross 2003: 133].

Furthermore, health advantages of marital and socioeconomic status cumulate. Research has, for instance, repeatedly shown that even the educational attainment of one's spouse has a positive effect on respondent's health, net of his/her own education [Huijts et al. 2010; Skalická, Kunst 2008]. The socioeconomic status and family arrangement may be thus seen as a continuum: the most educated and high-income people have best chances of forming happy and stable marriages while the chances of the lower socioeconomic groups for such family life are lower.[2] This will be elaborated in section 2.4.2

2.2.4 Interrelated social causes of health

The social causation of health is very complex and works at multiple levels. It has been suggested in previous section, that unmarried cohabitation is less beneficial for health than marriage, but the strength of its influence is likely to be dependent on how common and accepted cohabitation is in the respective country (cf. [Soons and Kalmijn 2009]). Macro-level forces influence the relation between health and individual social characteristics in many more ways. The level of educational homogamy, for instance, influences how strongly spouses' educational attainments affect each other's health

[2] I do not mean to imply that some forms of family are morally worse, I only refer to the above listed findings of an association between marriage and good health.

[Huijts et al. 2010]. Other important macro-factors include the perceived neighbourhood safety and community social capital [Kawachi 1999; Ziersch et al. 2005], level of income inequality and lowly redistributive social policy [Spencer 2004], poverty rates [Subramanian et al. 2002], liberal economy and low protection of employees [Mcleod et al. 2012]. To grasp the complexity of the relationship between society and health, Dahlgren and Whitehead [1991] suggest to conceptualize the predictors of health as a set of concentric layers. The inner layer includes individual characteristics like age, gender and genetic predispositions. The more distant rounds include social and community influence, living and working conditions, and general socioeconomic, cultural and environmental conditions. The influences from distant layers influence health of individuals and also alter the effects coming from the less distant layers [*ibid*.].

2.2.5 Causality or selection?

So far, I presented the social conditions and statuses as predictors of health. However, the association might be (and is) interpreted in both directions: either the social characteristics influence health or health is the cause of poorer or better socioeconomic outcomes and/or marriage chances. The selection of socioeconomic status and/or marriage on health is well documented; however, longitudinal studies show that selection cannot fully explain the association [Doornbos, Kromhout 1990; Dupre Meadows 2007; Lamb et al. 2004; Power et al. 2002].

The strong polarity of the two arguments (selection of social status on health vs. causal effect of social status on health) blunts if we look at the problem from a life-course and intergenerational perspective. Health and social status mutually influence each other during life course [Hertzman et al. 2001; Prus 2007; Ross, Wu 1995; Vagero, Illsley 1995]. Furthermore, both social status and health are, to a large extent, transmitted across generations. The next section shows that these processes are closely linked together.

2.3 Birth outcomes and the intergenerational transmission of social inequality

The association of social status and health has been observed at the very beginning of life, even before or shortly after birth. The main argument of this section is that birth outcomes serve as a means of the intergenerational transmission of social inequality. Before considering the social sources and implications of foetal and neonatal health in detail, the importance of birth outcomes as health indicators of infants has to be outlined. Birth outcomes include mortality, foetal growth and length of pregnancy.[3]

2.3.1 Birth outcomes as health indicators

The most common indicator of health at infant age (but not only) is mortality. The risk of death is the highest right after the birth and then declines. Therefore deaths at several stages are monitored. Foetal death/stillbirth refers to an abortion or birth of a dead foetus.[4] Early neonatal death refers to a death within first week (0-7 days) of the newborn's life. Perinatal mortality sums deaths that occurred during foetal and early neonatal period. Neonatal death refers to the event during first month (0-28 days) of the newborn's life. Post-neonatal death is a death at age between one month and one year (29-365 days). Finally, infant death refers to all such events that took place before the infant's firth birthday [Nguyen, Wilcox 2005]. While infant mortality is still considered a good indicator of population health [Reidpath, Allotey 2003], it is a very rare event in most current populations and cannot assess health of the majority of children who survive the first year of life precisely enough.

Therefore size at birth and length of pregnancy are used to assess the health condition of newborns. Normal length of pregnancy is between 37 and 42 completed weeks. Birth that occur at less than 37 full weeks of pregnancy are classified preterm [Nguyen, Wilcox 2005]. Beside gestational age, size at birth is important, because the pace of growth of the foetus is not the same in all pregnancies. Some foetuses suffer from a

[3] The terms 'length/duration of gestation' or 'gestational age' are used as equivalents to 'length of pregnancy'. They all refer to the time since the first day of mother's last menstrual period.

[4] The definition of *in utero* death as a stillbirth or abortion differs by country. The Czech system distinguishes the two by birth weight: A birth of a foetus lighter than 1000g is classified as an abortion, while stillborn foetuses with weight 1000 or more grams are termed stillbirths [Ministry of Health 1988].

condition termed intrauterine growth restriction (IUGR). It is usually defined as having birth weight that is too low for the newborn's gestational age (small for gestational age – SGA). 'Too small' is defined either as the low decile of the birth weight distribution of the given week of gestation or two standard deviations below average birth weight in the respective week of gestation [Goldenberg, Cliver 1997]. However, the definition does not measure the IUGR precisely. It marks as SGA also newborns whose growth has been not restricted, but are constitutionally small. This happens especially among birth at term, because the variation in foetal size tends to be small at early stages of pregnancy and then increases in the third trimester [Ananth, Vintzileos 2009]. On the other hand, some growth restricted, but constitutionally large, newborns does not meet the definition of SGA and are thus unreported (cf. [Ego et al. 2006]).

Gestational age and size relative to gestational age both predict mortality [Kramer, Demissie 2000; Slattery, Morrison 2002; Spencer 2003] and other health outcomes during childhood and adulthood. Shortened gestational duration and/or being small for gestational are conditions associated with impairment of neuro-cognitive development and sensory functions [De Bie et al. 2010; Kramer 2003; McCarton et al. 1996; Slattery, Morrison 2002] or deficient postnatal growth [Cooke et al. 2004; De Bie et al. 2010; Karlberg et al. 1996].

Birth weight itself (as a combined result of gestational age and foetal growth) is a robust and commonly used birth outcome. It has been questioned as a cause of ill health and risk of death in terms of medical aethiology [Basso et al. 2006; Wilcox 2001], but it remains to be the most widely used birth outcome [Kramer 2003]. The advantage of using birth weight (unlike gestational age or SGA) as a health indicator is also its precise measurement (cf. [Kramer 2003]). Birth weight is a strong predictor of infant's survival (e.g. [Basso et al. 2006; Melve, Skjaerven 2003; Spencer 2003], for Czech data see [Kraus 1985, Rychtaříková 1985, 1999; Rychtaříková, Demko 2001]). It is also strongly linked to health during infancy and later childhood. Birth weight has been found to influence, for instance, motor development [Kieviet, Piek 2009] or incidence of asthma [Örtqvist et al. 2009]. Birth weight is most often operationalized dichotomously to low versus normal. Low birth weight is defined as lower than 2500g [Nguyen, Wilcox 2005]. Very low (less than 1500g) or extremely low (less than 1000g) birth weight is sometimes distinguished as the health risks grow substantially in such

cases [Lemons et al. 2001; Vohr et al. 2000]. The relation between birth weight and most health complications (including mortality) has an inverted J-shape: the heavier newborn, the lower the risk of death until a threshold of about 4500g after which the risks rise [Spencer 2003].

Size at birth also has long-term health consequences. According to the theory of foetal programming (also called biological programming or Barker hypothesis), in utero period and infancy are critical stages of human development. The functions of organs and tissues are plastic at this early stage of life and are set ('programmed') in response to the environment. Any impairment in this stage thus may have long lasting consequences [Barker 1992, 1998]. The described correlates of birth weight in adulthood include a range of cardiovascular problems, type-2 diabetes or respiratory diseases [Barker 1998, 2001]. These associations hold also when adult lifestyle factors (smoking, alcohol consumption, exercise) are controlled for [Barker 2001]. Doblhammer [2004] was able to show an effect of birth weight on length of life, net of the socioeconomic characteristics of parents.[5]

2.3.2 Social causes and consequences of birth outcomes

Social characteristics of parents influence birth outcomes of their children. Children born to married couples fare better than children of cohabiting couples or unpartnered mothers [Luo et al. 2004; Raatikainen et al. 2005; Shah et al. 2011]. The family's socioeconomic status and parental educational attainment also have a strong positive impact on child health [Gortmaker, Wise 1997; Koupilová et al. 1998; Kramer et al. 2000; Raum et al. 2001; Wise 2003]. Also other factors which seem to be biological, such as maternal age or parity, can be understood in social terms because women with certain social characteristics are more likely to give birth at very young age or to have children of high parities (cf. [Rychtaříková 1999]). Institutional and macro-level influences like poverty rates, crime, group density, income inequality and social policy

[5] Doblhammer uses the fact that nutrition of pregnant women varied across year in past populations. This resulted in birth weight differences of babies born in different seasons. Children born in the first half of the year grew during the lean winter months and had then lower birth weight. This results in a half a year advantage in length of life for individuals born in the latter half of the year. The month of birth is not likely to be correlated with the family socioeconomic background, so the advantage can be attributed to the size at birth [Doblhammer 2004].

also exhibit an influence on child health [Auger et al. 2012; Masi et al. 2007; Spencer 2004].

As birth weight is considered a single most reliable indicator of a newborn's health (see above), I simplify the discussion of the social causation of birth outcomes to the causation of birth weight. Birth weight results from a very complex bio-psycho-social process. There are two immediate causes that lead to higher or lower birth weight: the length of pregnancy and intrauterine growth. Spencer [2003] has reviewed dozens of studies of the determinants of birth weight and constructed a theoretical model that links proximate (mediating) and indirect determinants of birth weight. The most proximate determinants, which directly influence intrauterine growth and/or gestational duration, work through biological pathways. They include maternal height and weight, maternal age and parity, genital infections, CRH release,[6] smoking (including passive smoking) and alcohol consumption, blood pressure, micronutrient intake, and genetic factors[7] [Spencer 2003: 134-141].

These risk factors may be conceptualised as biological, but exposure to them is socially patterned (see also [Kramer et al. 2000]). In Spencer's model, the links from the proximate to the more distant causes of birth weight lead from and/or through maternal education, maternal socioeconomic status (SES), the SES of the mother's background family, and maternal birth weight, which stems from a similar complex causal pathway (Spencer 2003: 134-141). For instance, the SES of the mother's background family influenced her birth weight and nutrition during childhood, which then affected her height, weight etc. [Spencer 2003: 134-141]. The mother's background family also influenced her educational chances and, consequently, her SES during adulthood. As shown in previous chapter, socioeconomic status influences maternal health and health-related behaviour, and her chances to find a well-off partner and marry him. It is thus important to realize that the effect of such variables as educational attainment or SES represents not only the effect of years spent in the educational process or the amount of money earned. They should be considered as structural factors that are connected with

[6] The release of the hormone Corticotropin is a stress-induced bodily reaction.

[7] The author included ethnicity in the same category as genetic factors, although the role of ethnicity is more social than genetic, which he acknowledges in chapter 4 of his book (Spencer 2003).

family background, labour market chances, life style (including health-related behaviour) etc.

Birth weight also has important consequences for social status. Conley and his colleagues [2003] found that, in the U.S., higher birth weight improved educational chances of children. The studied outcomes were: graduation from high school by age 19, having to repeat a grade, and being classified as learning disabled. These outcomes, consequently, influenced the chances of finding a well-paid job. These effects were observed net of the family's socioeconomic background [Conley et al. 2003]. The impairment of educational chances of children born with low weight is confirmed also by other studies [Black 2005; Morsing et al. 2011; Richards 2001; Spencer and Law 2007].

In sum, children are born with some health and social heritage, add to it during their life course and form families who further transmit this social and health heritage across generations. The authors who study these intergenerational processes tend to focus on the economic (or socioeconomic) aspect of the association between health and social status. For instance, Conley and his colleagues summarise their finding by pointing to families' economic and biological legacies: "*As low-birth-weight-and-low-income parents pass on to their children their birth weight and their economic status, they are increasing the chances that their children will find themselves in similar biological and economic legacies*" [Conley et al. 2003: 153]. However, the economic aspect of the social status is linked with family arrangement whose role in the process is less understood. These links are explained in the next section.

2.4 Changing families and its socioeconomic connotations

Family forms and processes have become more diverse over the past decades, which could have influenced the relationship between of various family arrangements and birth outcomes. This section focuses on the change of family life and the association between socioeconomic status and family arrangements.

2.4.1 Family change

The family arrangements to which children are born and in which they are raised are changing. Families are getting smaller, less stable and more diverse. Fertility has been declining since several decades in (but not only) the developed countries so that most of these countries now have a below-replacement level of fertility [Frejka, Sobotka 2008; Morgan 2003]. This trend can be attributed to postponement of childbearing to higher ages and retreat from higher-order births [Billari, Kohler 2004]. The causes are seen in adherence to individualist values [Lesthaeghe 1995], precarious economic conditions [Adsera 2011; Hoffman, Hohmeyer 2013], gender inequality and lack of policy that facilitates work-family balance [MacDonald 2000].

Families also show decreasing stability and increasing plurality of forms. Marriage rates have declined and divorce rates have grown in the recent decades [Kalmijn 2007; Sobotka, Toulemon 2008]. At the same time, various forms of nonmarital family arrangements, especially unmarried cohabitation, have become more prevalent [Bumpass, Lu 2000; Kennedy, Bumpass 2008; Kiernan 2002; Levin 2004; Smock 2000]. There are cross-country differences, related mainly to the level gender of gender equality and religiosity, but the trends are universal [Kalmijn 2007].

The spread of cohabitation deserves more attention. Cohabitation represents a new widely prevalent kind of family arrangement which contributes to the pluralisation of family trajectories even more because of its inner heterogeneity and lack of traditional norms of behaviour within thin kind of union. Cohabitation is usually defined by sexual intimacy, coresidence, and absence of marriage [Thornton et al. 2007: 79]. Such arrangement, however, may have plural meanings. There have been discussions whether it is more similar to marriage or single status in terms of partner's commitments and expectations [Seltzer 2004; Rindfuss, VandenHeuvel 1990]. A comparative study of 17 countries [Heuveline, Timberlake 2004] identified seven ideal types of cohabitation according to its typical duration, marital intentions of cohabiters and exposure of children to this family arrangement.

These shifts in family patterns caused children to experience heterogeneous family arrangements and more transitions in family structure during their growing up. An

increasing share of children is born to single mothers or experiences an episode of single parenthood due to parental separation [Bianchi 1994; Elwood, Jencks 2004, Sigle-Rushton, McLanahan 2004]. Children born to cohabiting parents often experience their parents marry or separate. An American study found that more than 40% of cohabiting parents and almost 60% of parents in a visiting relationship married or separated during the first year after birth in 1998-2000 [Osborne 2005]. Similarly, a recent comparative study of 11 European countries, for instance, found that only 40% (or even less – depending on the country) of cohabiting couples remained in cohabitation within three years after birth [Perelli-Harris et al. 2011]. The low stability of parental relationships (married or not) elevates the share of children who experience repartnering of their custodial parents and live with a step-parent [Bumpass et al. 1995]. Ermisch and Francesconi [2000], who used data from Great Britain from 1990s, for instance estimated that about three quarters of single mothers would form a stepfamily. Stepfamilies tend to be unstable and the adjustment of their members to the new family arrangement often takes years [Cherlin, Furstenberg 1994]. However, despite the pluralisation of family forms and processes, marriage still remains a prominent arrangement for childbearing and childrearing birth [Perelli-Harris et al. 2011].

2.4.2 Stratification of family arrangements and trajectories

The family processes described above are not followed equally by various social classes. Entering marriage is associated with reaching a certain standard of living and economic stability (often termed ‘marriage bar’). This standard is easier to achieve for higher for people with higher socioeconomic status. Men’s income and employment security has a positive influence of entering cohabitation or marriage or a transition from cohabitation to marriage [Oppenheimer 2003; Thornton et al. 1996; Xie et al. 2003]. Employment, income and education of women are also positively associated with marriage, although this effect is less clear than among men [Oppenheimer 1994, 1997; Sweeney 2002] (for instance, Xie et al. [2003] found no influence of women’s earning potential on their chances to marry). A similarly strong preventive effect of insufficient economic security does not apply to cohabitation [Clarkberg 1999; Jalowaara 2012; Oppenheimer 2003; Xie et al. 2003]. Besides influencing family form, higher education, income, or occupational prestige are also related to higher satisfaction in romantic relationships in general and a lower risk of divorce or separation [Conger et

al. 2010, Lichter et al. 2006].[8] Especially male unemployment has a disruptive effect on marital stability [Elwood, Jencks 2004]. In sum, socioeconomic status influences the likelihood of forming a stable and happy family.

The relationship between family arrangements and socioeconomic characteristics of people who form them, has been changing in relations to income inequality. Rising incomes inequality has been found to increase social stratification of marriage due to several reasons [McLanahan Percheski 2008]. Rising inequality in men's waged motivates women to search longer to find a better off partner and this leads to postponement of marriage (but not necessarily postponement of childbearing). Low income couples find reaching the marriage bar more difficult when income inequality grows. Higher income inequality also causes low-income men to be less attractive as marriage partners [*ibid.*]. Increase in incomes inequality has been also argued to promote childbearing in cohabitation and single motherhood [Buchholz et al. 2009, McLanahan Percheski 2008] (the effect of economic uncertainty on nonmarital childbearing will be further elaborated in the Chapter 4).

2.4.3 Family patterns and the reproduction of inequalities

We have seen above that marriage (or satisfactory family relationships in general) has a positive effect on health of children. It also influences a wide range of their socioeconomic outcomes. Research shows that children from two-biological-parent married families fare best in multiple educational outcomes, compared to children from other family arrangements (single-parent families, step-families) [Biblarz, Raftery 1999; Brown 2004; Ginther, Pollak 2004; Sigle-Rushton, McLanahan 2004; Sun, Li 2011].[9] These negative effects can be partly attributed to the lower socioeconomic characteristics and material deprivation of these families [Manning, Brown 2006; Sørensen 1994]. However, it cannot explain all differences between family types [Brown 2004; Hampden-Thompson 2009; Sun, Li 2011]. Part of the negative effect of non-marital family arrangements can be also explained by emotional strain associated

[8]The association of divorce with socioeconomic status in not universal but depends on social context. Härkönen and Dronkers [2012] found that female education influences divorce negatively in countries with high de-institutionalisation of marriage and high welfare expenditure.

[9] All alternative family arrangements does not seem to be equally harmful – se e.g. [Biblarz, Raftery 1999].

with parental breakdown and changes of family structure in general [Amato 2000; Brown 2006; Sun, Li 2011].

Moreover, children often mimic family and reproductive behaviour of their parents, such as timing of first birth [Hardy et al. 1998], family size [Axinn et al. 1994], or divorce [Amato 1996; Wolfinger 2000]. This contributes to the reproduction of the patterns of disadvantage across generations.

In sum, the family change and socioeconomic processes are closely (and increasingly) linked together. Income inequality has risen in the United States and Europe, including Central and Eastern Europe [Bandelj, Mahutga 2010; Mills 2009; McCall, Percheski 2010]. Changes in family structure has been as one of the sources of this trend and are increasingly acknowledged as an important channel of the reproduction of social inequalities in stratification research (see [Blossfeld, Buchholz 2009; Conger et al. 2010; McLanahan, Percheski 2008]). The influences of socioeconomic status and family arrangements on the outcomes of children should be therefore studied jointly.

2.5 Conclusion

The theoretical chapters argued that health and social status go hand in hand. They explained that health is closely linked to our social status and life style, wider social and economic conditions of our lives and the social relationships we are surrounded with. Health is not only a consequence of these social influences but also enhances, or limits, social achievements, social interactions, living conditions etc. This process is not limited to one's life, but extends across generations. Health of children is influenced by parental characteristics. This dissertation focuses on the role of family arrangement and its relation to socioeconomic status. The impacts of family arrangements and socioeconomic status of parents on health are interrelated, because family behaviours differ across social classes.

Any change in the association between socioeconomic factors and family processes may have far reaching stratification consequences that extend into next generations. Family forms and processes and their relation to socioeconomic statuses of parents has been changing in (but not only) all developed countries in the past decades. However,

investigations about whether and how these changes influenced the impact of family background on birth outcomes are very limited. Researchers are well aware of the importance of these social factors on the health of newborns but the consequences of family change are understudied. The few studied that focus on trends in the effect of living arrangements on birth outcomes provide mixed results. Some suggest narrowing disparities between family arrangements [Castro-Martín 2010; Shah et al. 2011] while others found no reduction in the disadvantage of nonmarital children [Luo et al. 2004; Moser et al. 2003]. Explanations of these trends mostly relate to changing meaning of nonmarital childbearing but are rarely tested empirically. Further research is needed to understand whether, how, and why does the influence of family arrangement on birth outcomes change. The following chapters are aimed at understanding how a change in the association of socioeconomic and family processes influenced the health inequality at the beginning of life in the Czech Republic.

3 OUTLINE OF THE RESEARCH

The research focuses on the association of family background and the health of newborns in the Czech Republic in 1990-2010. The post-socialist Czech Republic is a unique case for studying the interplay between health, socioeconomic status and family processes. Czech society after the fall of the egalitarian socialist regime is a context of rapid and profound social change which may have impacted on health in general as well as on the social inequality in health.

Many formerly socialist countries experienced a deterioration of populations health due to the dramatic societal changes of 1990s. They included decrease in real incomes, greater exposure to stress (connected for instance to job insecurity, unemployment, growing income inequality, weakening family stability), and more widespread stress-related behaviour (such as an upsurge in alcohol consumption), poor regulation of environmental risks, and deteriorating health care (see, e.g. [Adeyi et al. 1997; Grigoriev et al. 2010; Chen, Wittgenstein and McKeon 1996; Cockerham 1997; Marmot and Bobak 2000; Stuckler, King and McKee 2009]). The socioeconomic health gap also grew after 1989 [Shkolnikov et al. 1998], as the negative consequences of social transformation had a disproportionate impact on less educated people. In addition, disparities in mortality by marital status, migrant status, and ethnic origin increased in the post-socialist states, negatively impacting lone-parent families, illegal migrants, and ethnic minorities [Cornia and Paniccià 2000: 16-28; Pikhart et al. 2010].

People in the Czech Republic witnessed similar changes as individuals in other transforming societies. Those of productive age and young families were among the most strongly impacted [Blažek, Dzúrová 2000]. Some findings suggest that also the social shaping of infant health changed [Koupilová et al. 1998; Štípková, Kreidl 2011]. The processes behind these trends are, however, not well understood. The present research provides an insight into the social processes that are responsible for shaping health inequality in the generations born to the transforming society. Below, I state and discuss my research goals and then explain the analytical strategy. Before that, the context of the complex social and demographic change has to be described.

3.1 Context of the research

3.1.1 Socioeconomic changes

Following the break-up of the socialist regime, the Czech Republic went through a period of economic decline that had a particularly negative impact on people with lower levels of education. Real incomes dropped in the early 1990s and inequality in the distribution of earnings and incomes increased remarkably after 1990 [Večerník 1999, 2001]. There was an increase in intra-generational occupational mobility and a massive exodus of people from the labour market. Employment rates shrank and unemployment – previously almost non-existent – swelled [Večerník, Matějů 1999]. Employees experienced growing economic returns to education and increasing consistency between education, occupation, and earnings [Matějů, Kreidl 2001]. Socioeconomic risks became more stratified by education level and other statuses after 1989. These include the risk of unemployment and long-term unemployment [Frýdmanová et al. 1999; Hamplová, Kreidl 2006; Keune 2003], fear of unemployment [Mareš, et al. 2003], and the risk of material deprivation [Večerník 1999]. Similarly, the odds of downward occupational mobility became more strongly stratified by education and gender [Katrňák et al. 2008]. In addition, poverty rates burgeoned and the nature of poverty itself changed [Mareš, Rabušic 1996].

Social inequalities have also been shaped by social and family policy reforms. The reforms of the 1990s were directed towards less generous and income-tested welfare benefits. Furthermore, state regulation of food prices and the negative taxation of many goods was discontinued in 1991 and was, for a limited period of time, substituted by a direct welfare payment ('*vyrovnávací příspěvek*' in Czech). This payment was universal until 1992 and then continued as a means-tested benefit until 1995. A new tax system was introduced in 1993 that established tax benefits for parents and redefined the child allowance ('*přídavek na dítě*' in Czech) to depend on the age of the children [Krebs 2005].

Family policy is of particular significance for this issue. While the socialist regime generously and universally supported newlyweds and parents with subsidised loans and allowances, these benefits were discontinued after 1989. Hiršl [2004] showed that the

purchasing power of state support for families with children decreased dramatically after 1989. His 'model family', with two average incomes and two children, covered 53% of the standardised needs of children from state benefits (allowances, tax deductions) in 1989, while the figure was only 15% in 2002. Moreover, the childcare policy moved towards a more familist model. The number of state-supported day care institutions for pre-school children was reduced and standard maternity/parental leave was prolonged instead to encourage mothers to leave the labour market [Hašková; Uhde 2009; Saxonberg, Sirovátka 2006]. Conditions in the labour market have consequently become increasingly difficult for parents in general and for lone parents in particular. Numerous changes in family policy introduced in the 2000s expanded the choice-set available to parents, but frequent changes prevented family policy from offering stable and safe conditions for parents and their children [Kocourková 2008]. Together with the overall rise in economic inequality and job market uncertainty during the post-socialist period, the negative consequences of being born to the less favourable family arrangement may have increased.

3.1.2 Changes in family behaviour

Along with the numerous social changes, family behaviour transformed rapidly and dramatically. Marriage and parenthood were almost universal and usually took place in early twenties at the end of the state socialism. Family formation has then shifted to later phase in the life course and the heterogeneity of family forms has increased. The cohorts that grew to adult ages after 1989 started to postpone marriage and parenthood to later ages. Moreover, some of them even retreated from the traditional family and opted for alternative arrangements of from family live as such (for an overview of the shifts see [Sobotka et al. 2008]). This resulted in a sharp decline of period fertility in 1990s. The total fertility rate (TFR) was 1.8 children per woman in 1989 and remained that high for two more years. A sharp decline followed afterwards. The TFR dropped below 1.2 children in 1996 and remained that low until 2003 [CSO 2013]. The fertility decline was later compensated by the realization of the postponed births [Koucourková 2008] but it obviously could not last long. The TFR rose to almost 1.5 in 2008 and then started to decline slightly to 1.4 in 2011 [CSO 2013].

The ‘fertility crisis’ of 1990s has attracted vast attention of sociologists and demographers and evoked intense discussions on its the causes (see e.g. [Rychtaříková 1997, 2000; Rabušic 2001]). However another important change of family behaviour, the rise of non-marital childbearing, have long remained under-researched. It is of crucial interest in the present research because of its impact on the health of newborns. The spread of non-marital childbearing was tremendous. The non-marital childbearing rate (i.e. the share of children who were born outside marriage) rose from 8% to 40% in the two decades following the collapse of the state socialism (CSO 2013). The rising tendency to have children outside marriage cannot be interpreted as a sudden change of sexual behaviour. Non-marital conceptions were a commonplace during the socialist period, but usually lead to either induced abortion or marriage before birth. The proportion of extramarital conceptions that resulted in non-marital births was rather stable around 13-14% between 1960 and 1990 [Stloukal 1997]. The partnership transitions of unmarried women after getting pregnant changed after 1990, although, interestingly, the total number of non-marital conceptions has been relatively stable [Zeman 2006]. People have increasingly started to retreat from the ‘shotgun’ marriages [Stoukal 1997; Zeman 2007] and the link between marriage and childbearing has loosened [Chaloupková 2011].

3.2 Research goals

The aim of the present research is twofold. First, I analyze the changes in family background of children born in the first two decades after the collapse of the state socialism in the Czech Republic. Second, I inspect the relationship between family background and infant health. By family background, I mean socioeconomic status (measured with maternal education) and family arrangement (whether both parents are present and whether they are married). These two research topics are addressed in separate empirical parts of the dissertation, the analysis of family arrangements and the analysis of the birth weight depending on the family background.

3.2.1 The analysis of family arrangements

The first empirical part focuses on unmarried motherhood and is association with maternal socioeconomic status. It studies which women (with what level of education)

had children outside marriage at different stages of the post-socialist development of Czech society. The analysis is motivated by four research questions.

1. Unmarried motherhood is known to be more prevalent among women with lower socioeconomic status. Has this association changed between 1990 and 2010? And how?

2. What are the sources of the trend in the association between maternal education and unmarried motherhood?

3. Data on partnership situation of unmarried mothers are rather scarce, so it is not clear how many of the unmarried mothers have partners. What was the trend in the prevalence of single (unpartnered)[10] motherhood and motherhood in cohabitation?

4. Is single motherhood and motherhood in cohabitation associated with maternal education in the same way? And how have these associations changed in time?

3.2.2 The analysis of birth weight

The second empirical part of the dissertation studies the health of infants (measured with birth weight) as influenced by maternal family arrangement and socioeconomic status. As explained in previous chapter, the causal links between the family characteristics and birth weight are complex. It is thus important to keep in mind that the effect of such variables as educational attainment does not represent only the effect of years spent in the educational process, but reflects some labour market chances, earning potential, life style (including health-related behaviour), marriage market chances etc. Similarly, the effect of maternal marriage reflects a level of stability of her family situation, social support she receives, including support for healthy behaviour, accepted social status etc. My research focuses on the structural effects not on the particular pathways that link these statuses and health outcomes through detailed causal pathways.

[10] The terms 'single' and 'unpartnered' motherhood are used interchangeably and refer only to mothers who have no partners. Some authors use the term 'single' for mothers whose formal marital status is never married (cf. [Rychtaříková 2008]), but in this dissertation, single means unpartnered.

Children born to unmarried mothers, on average, face a health disadvantage. The analysis is organized around this disparity. The goal is to describe and explain the trend in the marital status gap in birth weight.

I have four partial questions.

1. What were the trends in the birth weight of children born to married and unmarried mothers? In other words, how has the marital status gap changed during the study period?

2. What are the sources of the trend? In particular, to what extent is the marital status gap dependent on the strength of the association between maternal marital status and education? This and four more explanations will be tested.

3. Is the disadvantage of unmarried status equal for children of single and partnered mothers?

4. Has the effect of partnered and single status on birth weight changed when the nonmarital family arrangements became more common?

3.3 Analytical strategy

The main data source that will be used to answer the above outlined questions is the birth register. It includes information about all births that took place in the Czech Republic in selected years during the study period (1990-2010). It provides a reliable measurement of health of the newborns (birth weight) which is comparable in time. This makes it a suitable source for studying the trend in health disparities. On the other, hand, the information on families to which the children are born is very limited. Especially regretful is a lack of an appropriate measurement of family situations of unmarried mothers. As family arrangement is of crucial interest in the analysis, I partially supplement the lacking data with another data source and partially handle the missing values with multiple imputation.

I approach the problem of family background and its impact on the health of infants through mothers and their characteristics. Decisions about childbearing and family

arrangements are usually joint decisions of couples. But the information about fathers is very limited, as well, so I focus on the effects of maternal characteristics. Maternal educational attainment and family situation and infant's birth weight are crucial variables in the analysis. The relationships between these variables may be dependent on the stage of maternal life course at which she had the child. So I work also with information about her age and parity (how many previous children she has). Both analytical parts are organized in multilevel settings. The relationships between individual maternal and infants' characteristics are considered to be clustered in time and regional contexts. Characteristics of these contexts are used to explain the time trends in the relationships of interest.

The two parts of analysis refer to different populations. The first part studies mothers while the second part studied infants. Each of the empirical parts has its own theoretical chapter which discusses the knowledge about the topic and outlines hypotheses which are then evaluated in the empirical chapters. The information about data and analytical methods is concentrated at the end of the text. The necessary methodological information is provided directly in the analytical chapters and for details readers are referred to the final methodological chapter.

Empirical Part I:

Spread of nonmarital family arrangements and their association with socioeconomic status

The first empirical part of the dissertation analyses the spread of non-marital childbearing as one of the most prominent features of the reproductive behaviour of Czech women. It focuses on the association of non-marital childbearing with social status, because of its possible consequences for the social inequality in the health of their children. The part contains five chapters.

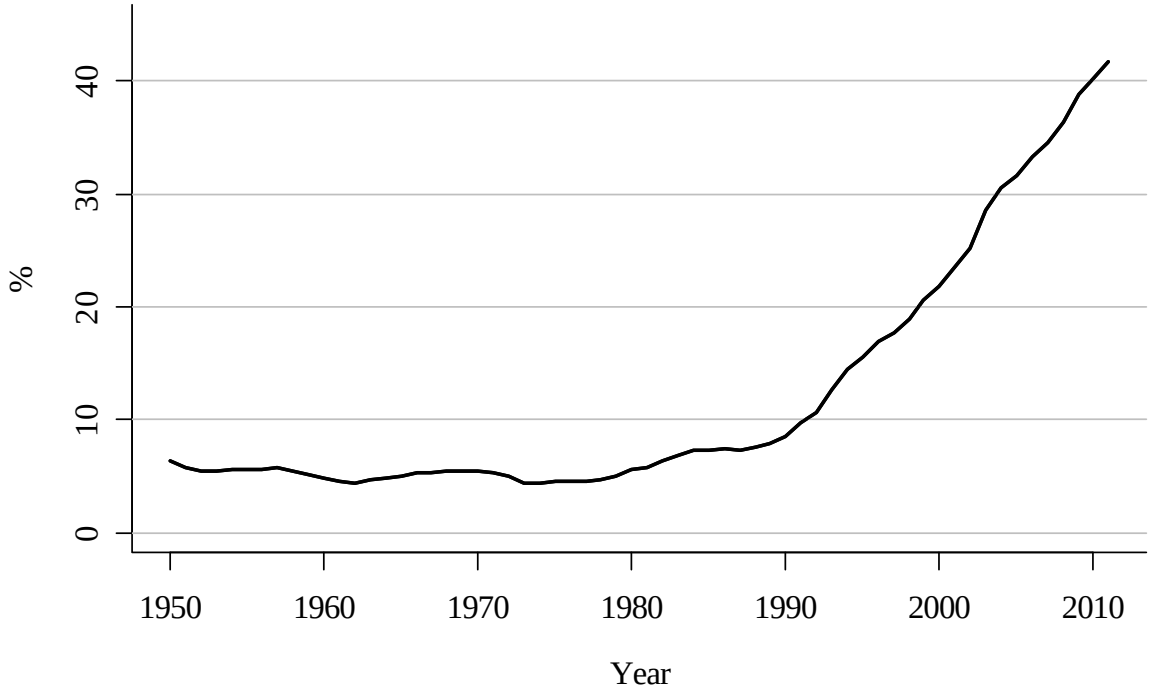
Chapter 4 outlines theoretical framework for the analysis. It points to a remarkable spread of non-marital childbearing and sets it in the context of a wider process of destandardisation of family trajectories. It then offers three explanations for this trend and discusses their implications for the social gradient in unmarried motherhood. Finally, it reviews current knowledge about non-marital childbearing in the Czech Republic and formulates research goals and hypotheses.

Chapter 5 provides a brief empirical insight into the spread of unmarried motherhood and illustrates the uneven spread of non-marital childbearing among socio-demographic groups and regions. This sets ground for a more deliberate analysis of the association of unmarried motherhood with socioeconomic status, which is done in Chapters 6 and 7. Chapter 6 contains the main evaluation of the hypotheses. It analyses the sources of the spread of unmarried motherhood. Chapter 7 then provides an assessment of the heterogeneity of unmarried status in terms of presence of fathers. It inspects whether both single and partnered unmarried motherhood are stratified by education in the same way.

4 SPREAD OF NON-MARITAL CHILDBEARING – THEORETICAL BACKGROUND

The rise of non-marital childbearing is one of the most striking features of the family change that took place in the post-socialist Czech Republic. Its prominence is best documented with a long-term data series. Figure 4.1 plots the proportion of live born children whose mother was not married. The share of children born to unwed women was oscillating between 4% and 7% since the WWII till the late 1980s. Non-marital childbearing rate has then risen to unprecedented level since the 1990s when it increased to 22% by 2000 and continued to 40% in 2010. The increase of another two percentage points in 2011 indicates continuation of the trend.

Figure 4.1. Proportion of children who were born outside marriage, 1950-2011. Live births, N=8,501,666.



Source: CSO 2012.

This chapter first puts the spread of non-marital childbearing in the context of destandardisation of family trajectories. Three explanations of the spread of non-marital childbearing and their impact on the social gradient in unmarried motherhood are then

discussed. Finally, the chapter reviews what was found by studies on non-marital childbearing in the Czech Republic, so far.

4.1 Destandardisation of family trajectories

Spread of non-marital childbearing is often interpreted as a part of the process of destandardisation and pluralisation of life trajectories. Researchers in Western societies show that transition to adulthood has become prolonged and more heterogeneous over past decades [Buchmann, Kriesi 2011; Furstenberg 2010; Settersen et al 2005; Shanahan 2000]. This life period is sometimes distinguished as a special stage of life course, the emerging adulthood [Arnett 2004]. The emerging adults are independent on their parents, but still do not meet all of the traditional expectations of adult status, which include finishing education, finding a stable job, entering marriage, and having children [Settersen et al. 2005].

The spread of childbearing outside marriage is symptomatic for this process of prolonged and destandardised transition to adulthood. Research that used Czech data supports this assumption. Generations born in since mid-1970s, who entered adult ages after 1989, have much more heterogeneous life starts than previous cohorts [Štípková, Kreidl 2012]. The traditional elements of the transition to adulthood are being postponed, spread in longer time periods or even foregone by an increasing number of young people [*ibid*.]. Especially the increasing heterogeneity of family formation is pointed to [Chaloupková 2010; Kreidl, Štípková 2012a].

Unmarried cohabitation plays a crucial role in this trend. Young generations increasingly enter cohabitation before or instead they contract marriage. Cohabitation gains prominence especially as an arrangement for first coresidential relationships [Paloncyová, Šťasná 2011; Kreidl, Štípková 2012b]. For instance, Kreidl and Štípková [2012] found that cohabitation was the first coresidential relationship for a majority of people born after 1975. Starting the family life with cohabitation is thus becoming a new norm. Some couples then even avoid marriage at all or reverse the traditional sequence of a marriage followed by childbearing [Chaloupková 2010, 2011; Paloncyová, Šťasná 2011].

Cross-national comparisons show that societies differ in what is the prevailing meaning of this family arrangement and at which stages of life course it occurs [Heuveline, Timberlake 2004; Perelli-Harris, Sánchez Gassen 2012]. Heuveline and Timberlake [2004] defined six ideal types of cohabitation. The Czech Republic of late 1990s belonged to the type in which cohabitation occurs mainly as a prelude to marriage. It has a relatively short duration before the couple split or marry. Childbearing in cohabitation is rather rare [*ibid*.]. A more recent analysis supports the idea of cohabitation being a relatively short and transitive period in family life course, which usually leads to separation or marriage within several years [Vohlídalová, Maříková 2011]. On the other hand, childbearing within pre-marital cohabitation cannot be considered a rare phenomenon anymore (cf. [Chaloupková 2011], see also below). Cohabitation also replaces marriage as a solution for unplanned pregnancies. The risk of entering marriage for unmarried women who got pregnant decreased rapidly since 1980s, but the risk of starting cohabitation increased sharply at the same time [Paloncyová, Šťastná 2011].

The pluralisation of family arrangements results not only from increasing prevalence of cohabitation, but also from a rising number of people who live outside coresidential relationships, including single parents [Chaloupková 2010]. The number of young people who live as singles grows and these people lead very heterogeneous intimate lives, ranging from sexual contacts with occasional lovers to long-term distance relationships [Tomášek 2006]. There are also voluntary unpartnered mothers, usually with high-status job, who intentionally got pregnant without having a coresident partner [Kozlová, Tomanová 2005].

The destandardisation of family trajectories attracted most attention in relation to their early stages but the increasing heterogeneity is typical also for later phases of family life course. Divorced people have become less likely to enter new coresidential relationships since 1980 and if they do, they increasingly prefer cohabitation over re-marriage [Kreidl, Hubatková 2012]. Very diverse partnership arrangements can be found also at later ages [Hamplová 2012b; Hasmanová Marhánková 2012].

4.2 Explanations of the rise of unmarried motherhood

The sources of the spread of unmarried motherhood deserve a more detailed discussion in relation the above described stratification of unmarried motherhood. Three explanations are offered. First, theory of individualisation links the spread of non-marital childbearing to a spread of liberal values and plurality of life-style choices. Second, another explanation links non-marital childbearing to economic uncertainty which makes people unable to meet economic standards for entering a marriage. Finally, I discuss the role of social policy which may have motivated mothers/couples to prevent marriage in order to reach higher allowances in certain periods.

4.2.1 Individualisation and pluralisation of lifestyles

Some authors [Kučera, Fialová 1996; Rabušic 2001; Sobotka et al. 2003] argue that the recent demographic shifts in the Czech population, including the increase of non-marital childbearing, are signs of approaching the Western-European values and lifestyle. According to them, these changes mimic the trends from the West, that were conceptualised in the theory of second demographic transition, and are just delayed and squeezed to a shorter time period.

The demographic change and concurrent shifts of values are interlinked in the theory. The theory was originally intended to explain demographic change in Western Europe since mid-1960s [Lesthaeghe 1995; van de Kaa 1987] and later applied also to populations of other region, including Central and Eastern Europe [Lesthaeghe, Surkyn 2002; Sobotka et al. 2008]. The demographic changes included drop in marriage, birth and death rates, rise in divorce rates, postponement of family formation to higher age, and a spread of alternative family forms, such as unmarried cohabitation or single motherhood. The theory connects these interrelated demographic processes to a shift in values. People became less willing to make long-term commitments, such as marriage or parenthood, and instead seek for self-fulfilment and more autonomy in their lives. Such value shifts are usually carried by educated social classes, who are more confident to go against social norms (cf. [Lesthaege, Surkyn 1988; Van de Kaa, 2001]). They are also more economically independent and thus less motivated to seek economic security in romantic relationships.

According to the second demographic transition theory, the change in family-related values was enabled by wider technological and cultural changes. The availability of reliable contraception allowed separation of sexual pleasure from childbearing. Gender equalization promoted economic independence of women. Widened means of communication and travelling contributed to relativisation of traditional values [Lesthaeghe 1995; van de Kaa 1987].

The shifts towards more individualist values are reflected also by sociologists who relate them to the nature of late-modernity or post-modernity. Giddens [1992] stresses the emancipation from traditional norms and individual autonomy in defining one's identity through experiments with romantic relationships. Beck and Beck-Gernsheim [1995] argue that the search for self-realization in career, which is symptomatic of the post-modernity, is at odds with stable marital life. Although stable family life might remain a desired goal for most people, it is increasingly hard to achieve given the demands of the globalizing job market. Employees are expected to be flexible and ready to subordinate their personal life to the demands of their jobs. This could work when only one person in a family is employed and the rest of the family provides care and support, as was typical in the past. However, current dual career couples face a much higher challenge in creating stable partnerships.

All of the above mentioned theorists of individualization [Beck, Beck-Gernsheim 1995; Giddens 1992; Lesthaege 1995; de Kaa 1987] emphasize the role of increasing labour market opportunities for women as one of the main sources of the change in attitudes towards marriage and family. Similar logic can be applied on the post-socialist Czech context. Czech women entered paid employment massively already in late 1940s when the communist regime was established. However, there were centrally planned jobs for everybody and job mobility was low. The income inequality was among the lowest in the world [Večerník 1998: 41], so the chances to get significantly better off were limited. Career prospects were especially limited for women. Women's main role was seen care for children and household. Their contribution to family budgets was considered supplementary and they were paid accordingly [Havelková 2010]. Participation in paid employment thus did not compete with family life. The job-market demands and rewards increased rapidly after the introduction of capitalism in the 1990s. The selection of candidates for jobs became more meritocratic, the importance and

economic rewards of education rose and the consistency between education, occupation, and earnings increased (e.g. [Matějů, Kreidl 2001]). People could also realize themselves by establishing their own enterprises. Inequality in the distribution of earnings and incomes thus increased remarkably after 1990 [Večerník 1999, 2001].

In sum, the individualisation perspective explains the rising number of women who bear their children without being married by growing individualism and pluralisation of lifestyle preferences. It expects that an increasing number of women (and men), who decide to have children among the many lifestyle options, do not perceive marriage as a useful institution. Instead, they prefer alternative family arrangements such as cohabitation, visiting relationships, or even planned single motherhood, which do not collide with their personal autonomy and independence.

4.2.2 Growing economic uncertainty

An alternative explanation for the rise of non-marital childbearing is the pattern-of-disadvantage theory [Perelli-Harris et al. 2010; Perelli-Harris, Gerber 2011]. Unlike the second demographic transition theory, it treats the spread of non-marital family arrangements as a reaction to economic uncertainty rather than a free choice of lifestyle. Increasing economic uncertainty has been witnessed worldwide since 1980s as a result of globalization processes [Buchholz et al. 2009][11] which made employees more vulnerable at the labour market. The increasing labour market uncertainty impacts especially on young people and makes them postpone family formation or opt for more flexible forms of relationship which does not require long-term commitments [Buchholz et al. 2009, McLanahan, Percheski 2008].

According to the pattern-of-disadvantage theory, people do not dismiss marriage. In contrary, they assign it with a high value and perceive it as a life-time goal and a symbol of achieving life stability. Unless they consider their life situations stable enough, they avoid marriage. The declining normativity of marriage plays a rather auxiliary role in

[11] The processes include internationalization and deregulation of markets which compete among each other with relaxing employment, tax and other regulations. The global interconnectedness and interdependence rise which makes the local markets more vulnerable to external random shocks. Employers then shift the increased risks to employees [Buchholz et al. 2009].

this perspective[12], unlike the second demographic transition theory. The key motive of the rise of childbearing outside marriage is the postponement of marriage for better times [Perelli-Harris et al. 2010].

The uncertainties and socioeconomic risks have increased significantly in the Czech Republic since 1989. The introduction of market economy brought a tougher competition for jobs and unemployment emerged. State-regulated prices of basic goods and housing were gradually relaxed [Večerník 1998: 123-129]. The state's support for families with children declined and placed more responsibility for the household's material conditions on the parents. Family policy has moved from widely available public support for parents towards a more familist model since 1989. The reforms of the 1990s were directed towards less generous and income-tested welfare benefits ([Krebs 2005], see also below). The size of parental allowances and tax deductions for families with children relative to average incomes dropped gradually [Hiršl 2004]. Families with children, especially single-parent families or those with three and more children, face an elevated risk of poverty [Hora et al. 2008]. Mothers (and women of childbearing age in general) became more vulnerable at the job market. The number of state-supported day care institutions for pre-school children was reduced and standard maternity/parental leave was prolonged instead up to the child's four years of age to encourage mothers to leave the labour market [Saxonberg, Sirovátka 2006; Hašková, Maříková, Uhde 2009]. Women face discrimination at the job market in terms of employment chances and salaries [Křížková, Vohlídalová 2008]. For instance, the gender gap in unemployment rate rose from 1.4 percentage points to 3.3 percentage points in the 1990s and then stabilised [Křížková, Vohlídalová 2008: 90].

Marriage and parenthood are traditionally associated with creating a separate household with a secure income. The rising economic burden that was placed on families during the post-socialist transition may have contributed to the spread of non-marital childbearing by increasing the perceived economic standards to be met by suitable candidates for marriage. Reaching sufficient income and stable job has become disproportionately difficult for people from low social strata, because the economic risks have become more stratified by education level and other statuses after 1989.

[12] Perelli-Harris and Gerber [2011] emphasize the role of feminist and liberal movements that empowered women to refuse marriage if their partners do not meet their standards.

These include the risk of unemployment and long-term unemployment [Frýdmanová et al. 1999; Hamplová, Kreidl 2006; Keune 2003], fear of unemployment [Mareš et al. 2003], and the risk of material deprivation [Večerník 1999]. Similarly, the odds of downward occupational mobility became more strongly stratified by education [Katrňák et al. 2008]. In addition, people with low education face an elevated risk of poverty not only because of unemployment, but also because they found themselves at the secondary labour market where they only find unstable and poorly paid jobs [Mareš, Sirovátka 2006].

The response to economic uncertainty has been found to be gender-specific in some European countries (including the Central Europe). While unqualified men who are unable to secure enough resources postpone or retreat from forming a family, their female counterparts stick to motherhood as a way of reducing life uncertainty [Buchholz et al. 2009]. Such strategy is well illustrated by a qualitative research of poor unmarried mothers in the U.S. Edin and Kefalas [2005] found that these women highly evaluate marriage and perceive it as a lifelong commitment. Yet, they rarely marry the fathers of their children. They fear an unwise marriage and condition it with economic and relationship stability. These high standards of marriage prevent them from marrying, but not from motherhood. For them, motherhood is a source of identity and self-esteem, a chance to proof their abilities as mothers, and a reason to avoid irresponsible behaviour (such as using drugs). They perceive motherhood as a positive change in their life which should not be delayed because of instable partnership situation or inadequate material conditions [Edin, Kefalas 2005].

The gender-specific patterns of family behaviour in the low social class seem to be present also in the Czech society. Despite the long tradition of female employment in the Czech Republic, a larger part of responsibility for securing sufficient income for new family is connected to male gender role. Hašková's [2009] finding from the analysis of qualitative interviews with (still) childless people over thirty shows that both potential fathers and their partners conditioned parenthood with the man's stable employment. It is not surprising then that the widespread trends of declining marriage rates were more pronounced among people, and especially men, with low socioeconomic status. Šťastná and Paloncyová [2011] studied first partnership formation between 1980 and 2008. They found that the risk of entering marriage

decreased most and the risk of entering cohabitation increased least among people with the lowest level of education. These results hold for both genders, but are much stronger among men [Šťastná and Paloncyová 2011].[13] Similarly, Pakosta [2009], who studied reproductive preferences, found a remarkable difference between men and women with elementary education. While these women, on average, desire for a large number of children, their male counterparts show the lowest preferences among all educational groups of men. The low reproduction intentions probably reflect the low chances of these men to provide for their potential families.

In sum, the economic uncertainty explanation argues that even women who prefer and highly appreciated marriage, increasingly end as unmarried mothers if they do not find a suitable partner or do not perceive their life situation stable enough. Rising economic insecurity prolongs the time needed to reach this stability of life arrangements and thus leads to growing prevalence of childbearing outside marriage.

4.2.3 Pragmatic reaction to social policy

The final explanation for the rise of non-marital childbearing are policy measures that favour unmarried mothers/couples against married couples. The socialist regime generously and universally supported newlyweds and parents with subsidised loans and allowances. The reforms of the 1990s were directed towards less generous and income-tested welfare benefits. Furthermore, state regulation of food prices and the negative taxation of many goods was discontinued in 1991 and was, for a limited period of time, substituted by a direct welfare payment (*vyrovnávací příspěvek*). This payment was universal until 1992 and then continued as a means-tested benefit until 1995 [Večerník 1998: 123-129]. A new tax system was introduced in 1993 that established tax benefits for parents and redefined the child allowance (*přídavek na dítě*) to depend on the age of the children [Krebs 2005]. This child allowance has become income-tested since 1995 when a complex reform of social policy was introduced [Krebs 2005: 275-279]. Since 1996, low-income households can ask for housing allowance (*příspěvek na bydlení*). Low-income households with children are entitled to child allowance and could receive

[13] See also Kreidl [2012] who described a strengthening stratification of the probability of entering marriage between the 1970s and the early 2000s. But he did not analyse the gender differences in this trend.

social allowance (*sociální příplatek*) before 2012.[14] All these benefits are tied to the relation between household income and living wage (*životní minimum*) for the given household composition.

Mothers can usually ask for more benefits when they are single (i.e. without sharing household with a partner). In the case of parental couples, it does not make a difference whether they are married or not. The incomes of all members of households are counted together when considering the entitlement for the benefits, without regard to formal marital status of the couple. Also the entitlement for child maintenance payments from the child's father is not related to existence of marriage once the fatherhood is established in the birth certificate. An unmarried mother of a child up to 2 years of age can also request maintenance payments for herself from the child's father.[15] Single mothers reach more social benefits because of the incomes of their households are lower than incomes of two-parent households. They were also entitled to slightly higher social benefit until 2010 (the difference was only 600 CZK, compared to partnered or married mothers [Soukupová 2006]).

Unpartnered mothers also received special protection in terms of maternity allowance until January 2009. Mothers are provided with maternity leave for 28 weeks. During this time, the mother's job is secure and she receives the maternity allowance (*peněžitá pomoc v mateřství*). The amount of the benefit depends on her pre-pregnancy salary. At the end of maternity leave a mother can continue to care for her child on parental leave and the financial aid during maternity leave is replaced by another benefit, the parental allowance. The parental allowance is not determined by the recipient's previous salary and the amount is usually lower than the maternity allowance (except for the lowest income groups). Until 2009, single mothers were entitled to receive the maternity

[14] In 2011, this benefit was restricted only to famillies who care about children with long-term illness or disability or to familied, i which the parent has a long-term illness or disability. The allowance was then cancelled in 2012.

[15] However, it has to be noted that requesting the maintenance payments from fathers is often unfeasible – see [Soukupová 2006].

allowance for 37 instead of 28 weeks. The extended entitlement to the maternity allowance was cancelled for women who gave birth in 2009 or after.[16]

However, misreporting the cohabitation status to get more welfare benefits may have serious consequences. Beside the ethical problem of lying to the offices and misusing social benefits, there is a risk of punishment when the true status is discovered. Social workers require the mother who claims to be single to proof her single status and are entitled to check the real state of art at her home at any time. This can be prevented by not reporting the child's father in the birth certificate [Soukupová 2006]. This also has several drawbacks. It makes the mother and her child more vulnerable in the case of separation. When the father of the child is not legally established, the mother cannot request child maintenance payments from the father if the couple splits. It also prevents her child from inheriting from the father in the case of his death.

On the other hand, marriage does not yield many benefits in terms of family income when compared to unmarried cohabitation. Married partners with children were allowed to merge their incomes for tax purposes in 2005-2007. This was beneficial in cases when their incomes differed substantially (for instance, when one of the parents was on maternity or parental leave). Since 2007, this was replaced by a tax deduction in the case that one of the married parents earned less than 68000 CZK per year.

It has been argued that some mothers who have partners intentionally do not enter marriage and pretend being single to increase the family income [Katrňák 2006; Soukupová 2008]. A survey showed that some mothers really admit economic benefits to be a reason that prevented them from getting married before childbirth [Soukupová 2007]. Soukupová [2006] calculated that, in 2005, living as a couple, but pretending single motherhood represented a substantial economic advantage for low-income couples, especially when the male partner or both partners are unemployed. Sivková [2012] reached similar conclusion of modest financial benefit for an unmarried couple that pretend to live apart. However, she doubts that this would be a substantial reason to avoid marriage. Sivková instead argues that the changes in the system of allowances and

[16] The maternity leave was cut to 28 weeks for single mothers already in 2007, but the amendment of the allowance was delayed, so the financial benefit remained until 2009.

tax deductions were so frequent that people are not likely to be able to follow their implications for their family budgets [Sivková 2012: 366].

4.3 Previous research on parenthood outside marriage in the Czech Republic

Several studies[17] have been conducted on unmarried motherhood since 1990s. Some of them analysed vital statistics [Hamplová, Řeháková 2006; Polášek 2006; Rychtaříková 2008; Stloukal 1997; Zeman 2006, 2007]. Others [Hamplová 2007a, 2007b, Chaloupková 2007, 2011; Soukupová 2007] worked with survey 'Social and economic conditions of motherhood 2006' that targeted mothers with at least one child younger than ten years. The mothers reported retrospectively about their family situations since their first child was born.

4.3.1 Family arrangements of unmarried mothers

Unmarried mothers are a heterogeneous category in terms of their relationships to the child's fathers. Data about the partnership arrangements of unmarried mothers are very scarce. To the best of my knowledge, only Hamplová [2007a] was able to distinguish unmarried mothers who lived with partners from those who are unpartnered. She found that the proportion of both unpartnered and cohabiting first-time mothers has increased between 1995 and 2006. The share of first-time mothers who lived with a partner without legal marriage doubled in that time (it rose from 11% to 21%). The share of unpartnered mothers grew less steeply, but still significantly: from 10% to 17% [Hamplová 2007a: 49-51]. Cohabiting mothers thus make up more than a half of unmarried first-time mothers.

Alternatively, the partnership situation of unmarried mothers can be approximated by their willingness to provide information about fathers. It is likely that mothers who report the required information about child's father live with the father or maintain other kind of relationship. This approximation was applied by Zeman [2007] who analysed birth register data after the paternal data was first requested from unmarried mothers in

[17]Two books [Hamplová 2006, Hamplová et al. 2007] contain chapters by different authors who use different data and methods of analysis. I refer to these authors when quoting specific chapters.

the first half of 2007. There were 34% unmarried mothers out of which 70% identified child's father. Children with no legally recognized fathers thus made up only 10% of all children [Zeman 2007: 25-26].

4.3.2 Social stratification of non-marital childbearing

Non-marital childbearing has stopped being concentrated to age below 20 years and has spread within all social (educational) groups and regions since 1989 [Zeman 2006]. However, it is distributed unevenly across social strata. Poorly educated women are (and have been since the end of 1980s) more likely to have children as never married [Rychtaříková 2008] or unmarried in general [Zeman 2006]. The association persist even when other demographic characteristics of the mothers (age, parity) are taken into account [Hamplová, Řeháková 2006; Hamplová 2007a]. Paternal socioeconomic characteristics play a similar role [Hamplová 2007a].

The mere existence of a coresidential relationship (whether legalized by marriage or not) is stratified by education, as well. Hamplová [2007a] found that having a partner (married or cohabiting) is more common among the mothers with a higher level of educational attainment. The same educational gradient was found also in the likelihood of being married among the mothers who had a partner at the time of first childbearing [*ibid*.]. Acknowledging child's father was found to be stratified by maternal education, as well [Zeman 2007].

The social classes (defined by attained education) not only have different likelihood of being unmarried when giving birth, but also report different reasons for their unmarried status. This was analysed by Chaloupková [2007]. She focused on the reasons why women became unmarried mothers and identified three clusters of them: involuntary, liberal and pragmatic unmarried mothers. Involuntary unmarried mothers preferred marriage but an unfavourable partnership situation prevented them from marriage. They either did not have a partner at all or had a partner who was reluctant (or legally incapable because of a marriage with another woman) to contract marriage with them. In contrast, liberal unmarried mothers did not considered formal marriage important and did not report partnership issues as a reason for not entering marriage. Finally, pragmatic mothers typically had an unstable relationship with their child's father and,

unlike involuntary unmarried mothers, did not evaluate marriage as important institution. They saw no benefits in being married and, in contrary, found unmarried status advantageous both from financial reasons and in terms of personal autonomy [Chaloupková 2007].

Belonging to the clusters of involuntary and liberal unmarried mothers was highly stratified by education. Mothers with low level of education were overrepresented in the former and highly educated mothers in the latter [Chaloupková 2007]. It suggests that unmarried motherhood (in a cohabitation or without a partner) has not only different prevalence but also different meaning across social classes. Mothers with lower levels of education tend to prefer married motherhood but at the same time face more difficulties in finding a partner for this family arrangement. This is in line with the economic uncertainty explanation of unmarried motherhood. In contrast, highly educated women who happen to be unmarried mothers are more likely to have chosen this option, as suggested by individualisation theory.

Different educational groups of unmarried mothers also follow different family trajectories following first birth. A substantial part of women who become mothers as unmarried enter marriage shortly after birth. Polášek [2006] estimates that about 40 % of first-time mothers who gave birth as never married in the early 1990s would never marry. The estimated proportion decreased to a half for never married mothers who had first children in the early 2000s [Polášek 2006: 43]. Chaloupková [2011] found that about 40% of cohabiting mothers and 20% of single mothers married after their first child was born (the events refer to period 1995-2006). The likelihood of entering marriage after non-marital birth is positively associated with maternal education [Chaloupková 2011, Polášek 2006]. Especially university education shows to be a strong predictor of marriage after non-marital first birth. This educational group of unmarried mothers was the only one that did not experience a decline of the likelihood to marry between 1990 and 2005 [Polášek 2006].

4.3.3 Changing attitudes towards non-marital childbearing

Marriage lost its normativity as a living arrangement since the fall of state socialism. This is well documented by value surveys. European Values Study, for instance, shows

that in 1999, compared to 1991, people reported less agreement that a woman needs children in order to be fulfilled and an increasing share of people perceived marriage as an outdated institution [Rabušic 2001a]. The shifts were observed cross-sectionally as well as within cohorts [ibid.]. Similarly, Chaloupková and Soukupová [2007] analysed data from International Social Survey Programme 1994 and 2002 and found a decreasing support for the opinion that couples should marry when they intend to have children and a growing confidence that one parent is able to bring up a child as well as both parents would do.

The spread of liberal values may support the individualisation explanation of the increasing prevalence of non-marital childbearing. But the mere coincidence of the value and demographic change does not mean that the former causes the latter. People may as well adjust their values according to the family transitions they experience (cf. [Lesthaege, Surkyn 2004]).

4.3.4 Limitations of previous research

The above described results provide important assessment of the patterns of unmarried motherhood. The main finding is a strong association of unmarried (and especially unpartnered) motherhood with low socioeconomic status. However, they provide limited evidence on the time trend in the socioeconomic gradient of unmarried motherhood. There are three specific gaps in the current knowledge which will be overcome in the present analysis.

First, and most important, none of the studies provides a deliberate assessment of the time trends of the association between extra-marital birth and maternal socioeconomic status. Zeman [2006, 2007] describes the deepening disparity by education, but does not perform a multivariate analysis. Growing disparity among social classes may reflect different exposure to marriage and divorce by age and parity. Rychtaříková [2008] uses multivariate models showing a net association, but considers only two time points and focuses on never married status only.

Second, the assessment of the trends in living arrangements that go farther beyond formal marital status has shown to be an issue given to the lack of suitable data. The

only available dataset (Socioeconomic conditions of motherhood – see Hamplová 2007a) relies on data about first birth only and does not allow a detailed analysis of time trend given to its relatively small sample. We thus do not know what was the pace of spread of motherhood without a partner and in cohabitation and how strongly these arrangements have been related to maternal socioeconomic status.

Third, the role of structural (economic) context of unmarried motherhood is understudied. Hamplová and Řeháková [2006] found that regional economic context influences patters of non-marital childbearing. But they rely only on relatively recent data. Another important structural factor, the social policy and benefits provided for single mothers, has been studied rather hypothetically. Most of the studies [Sivková 2012; Soukupová 2006] use the method of model families. The only exception is Soukupová [2007]. She found that mothers, who admitted financial benefits as a reson to avoid marriage before birth tended to delay marriage right after the entitlement for prolonged maternity allowance.

4.4 Research goals and hypotheses

4.4.1 Research goals

The goal of the analysis is to inspect the time trend in the association of unmarried motherhood with maternal socioeconomic status. The partial research goals are following.

1. The first goal is to describe how the association between maternal socioeconomic status (education) and non-marital childbearing changed between 1990 and 2010.

2. Next goal is to assess the sources on non-marital childbearing among various educational groups of mothers. Three sources will be considered, the spread of liberal values, the economic insecurity and the social policy.

3. Third goal is to explore the trend in the prevalence of single (unpartnered) motherhood and motherhood in cohabitation.

4. Finally, the fourth goal is to describe and analyse whether both single and partnered motherhood outside marriage are associated with maternal education in the same way and how this association changed in time.

4.4.2 Hypotheses

Three explanations for the rise of non-marital childbearing were outlined above, the individualisation explanation, the growing economic uncertainty explanation, and the policy reaction explanation. I formulate three hypotheses that stem from these explanations.

4.4.2.1 Individualization hypothesis

The individualization hypothesis operates with the value shift as the main reason for increasing number of women who bear their children without being married. It expects that an increasing number of women (and men), who decide to have children among the many lifestyle options, do not perceive marriage as a useful institution. Instead, they prefer alternative family arrangements, such as cohabitation, visiting relationships or even planned single motherhood, which do not collide with their personal autonomy and independence.

If the individualisation hypothesis is valid, unmarried motherhood should spread in time, irrespective of economic situation. If there is any relationship to the economic conditions, it should be positive: the better the economic prospects, the more independent women are and the more they opt for individualised family arrangements. This effect should be stronger among the more educated groups who are most inclined to the individualist values and who have most resources and life-style alternatives. According to these assumptions, the educational gradient in unmarried motherhood should diminish.

4.4.2.2 Economic uncertainty hypothesis

The hypothesis of economic uncertainty reflects the growing economic vulnerability of families and expects that some mothers/couples retreat from marriage because they

cannot reach sufficiently stable economic situation which is a traditional condition of marriage.

If this is the main source of the rise of non-marital childbearing, extra-marital childbearing should increase with worsening economic conditions (which will be measured with unemployment rate), because uncertainty about jobs should make mothers/couples delay marriage or avoid unpromising relationships at all. This effect should be most pronounced among poorly educated women, because the economic uncertainty rose disproportionately more among unqualified workers. The educational gap in non-marital childbearing should thus widen.

4.4.2.3 Policy adjustment hypothesis

The policy adjustment hypothesis expects that changes in policy should influence the risk of non-marital childbearing in the following way. The introduction of the income-tested system of allowances should raise unmarried motherhood, especially among the lower educational groups, whose households are more likely to have incomes close to the living wage. The principle of income-testing was introduced in two steps. First partial reforms started already in 1991 and a complex reform was introduced since 1996. Educational gradient should thus deepen after the introduction of income-tested allowances.

The cancellation of the prolonged maternity allowance for single mothers in 2009 should decrease the prevalence of unmarried motherhood. This should affect especially the more educated mothers, whose incomes tend to be higher and who thus receive higher maternity allowance. The educational gradient in unmarried motherhood should then weaken in 2009-2010.

5 SPREAD OF NON-MARITAL CHILDBEARING – AN EMPIRICAL DESCRIPTION

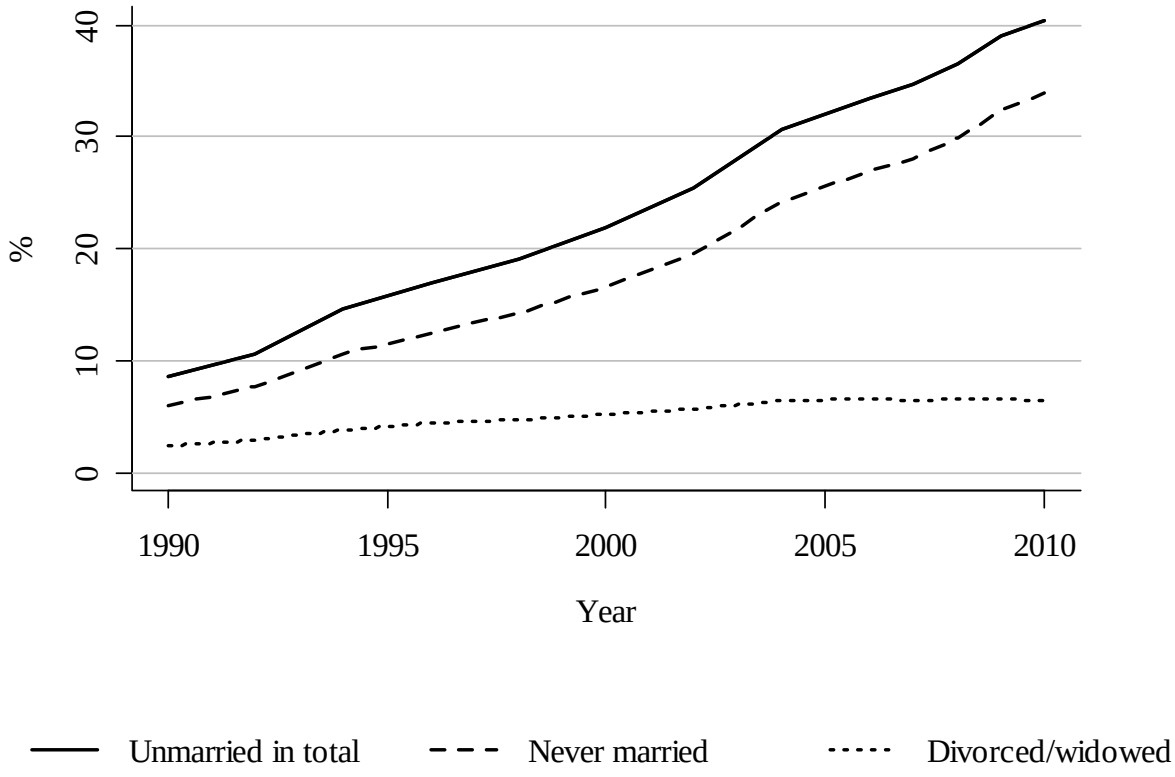
Chapter 4 pointed to the remarkable spread of non-marital childbearing in the first two decades after the fall of the socialist regime. This chapter provides a more detailed insight into this development before the hypotheses outlined in previous chapter are tested.

Figure 5.1 splits the unmarried mothers by legal marital status. It distinguishes never married mothers from those who had experienced marriage, i.e. they were divorced or widowed[18] when giving birth. It shows that the almost five-fold rise of non-marital childbearing rate after 1989 is a result of rising proportion of mothers who have never been married. The share of mothers whose status is never married increased more than 5.5 times (from 6% to 34%). On the other hand, the proportion of mothers who were divorced or widowed has been much lower. It rose from 2% to 6-7% between 1990 and 2004 and then remained stable.

The general trend described in Figure 5.1 merges experiences of mothers at various stages of life course and with various socioeconomic backgrounds who have different risks of having a child outside marriage. Most unmarried mothers can be typically found among young women with low education who got pregnant for the first time. The prevalence of non-marital childbearing is also elevated among older women (say above 35) who are still childless or who already have a child (or children) from a previous marriage that ended by divorce. The overall trend in non-marital childbearing depends on how the prevalence of non-marital childbearing changes within such groups as well as on the size these groups within a population. For instance, Hamplová [2007a] showed that the risk of unmarried motherhood rises with declining education of the mother (see Chapter 4). If the number of poorly educated mothers rose in a population, the total prevalence of non-marital childbearing would increase without anything else being changed. It is therefore important to distinguish the composition effects (i.e. the effects of the changing size of the specific sub-groups) from the change in the behaviour of these sub-groups.

[18] These two categories were merged together because the number of widowed mothers is very small and relatively stable in time (around 300 per year).

Figure 5.1. Proportion of unmarried mothers in total, and split by legal marital status, 1990-2010 (selected years). Mothers, N= 1,378,350.

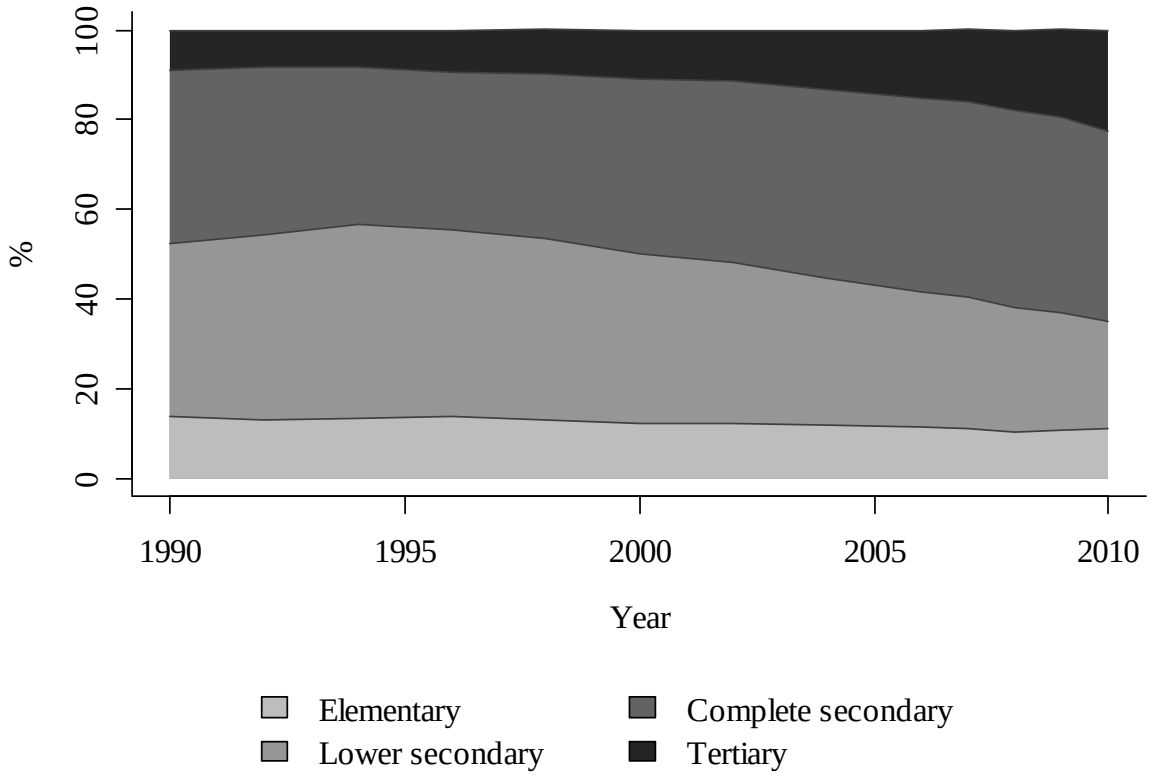


Source: CSO (Birth register), Author's computations.

5.1 Composition of mothers by education, age and parity

The next three figures describe educational, age and parity composition of mothers. Figure 5.2 shows that the educational structure of mothers reflects educational expansion. More than half of all mothers had no more than lower secondary (vocational) education in 1990. The share of mothers with only the mandatory elementary level had declined by only 3 percentage points (from 14% to 11%) till 2010. The decrease of mothers with vocational training was more pronounced. Their share dropped from 39% to 24%. On the other hand, mothers with higher education became more prevalent. Mothers with complete secondary education made up 39% in 1990 and by 2010 had become the modal category with 43%. University educated mothers were the rarest category in 1990 (9%). Their share rose only modestly in 1990s, but then doubled in 2000s (to 22% in 2010).

Figure 5.2. Distribution of mothers by education, 1990-2010 (selected years). Mothers, N=1,370,604.



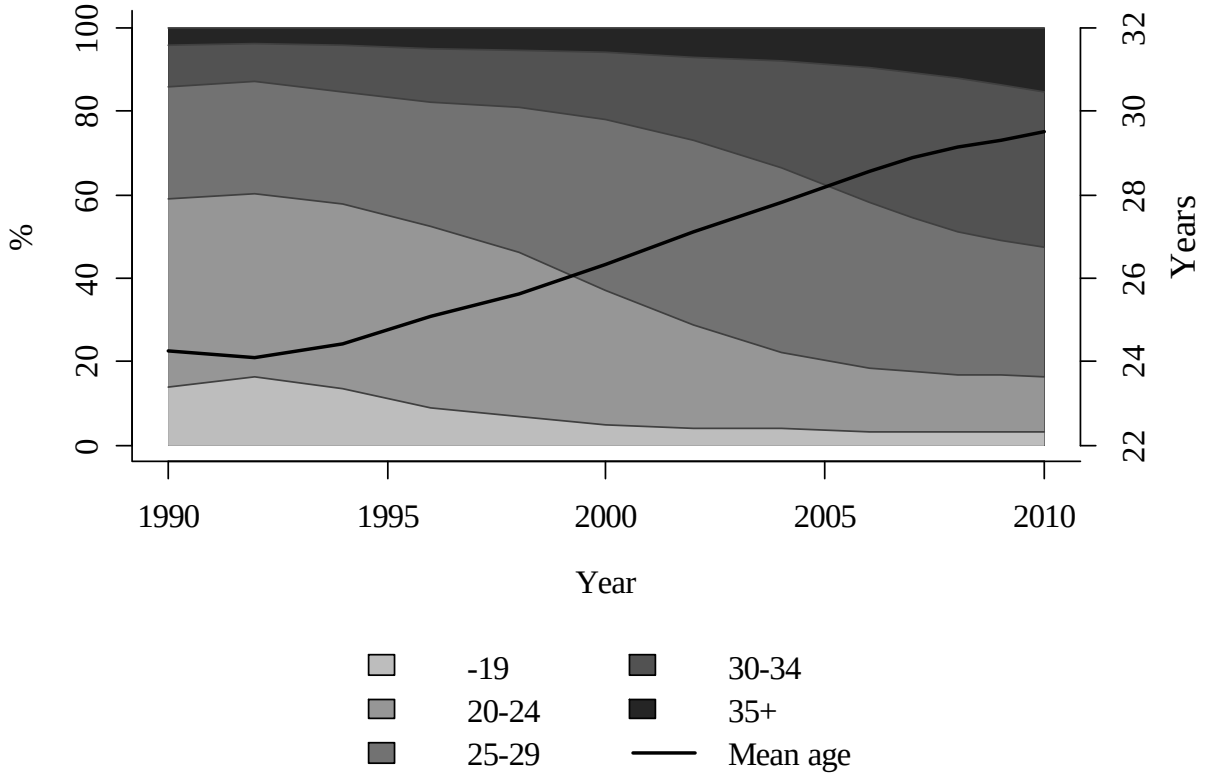
Source: CSO (Birth register), Author's computations.

The change of the composition of educational categories is profound and reflects the expansion of educational opportunities after 1989 (especially the higher education expanded, cf. [Matějů, Simonová 2003]). However, the very mild decline in the share of the lowest educational category is surprising and, unlike the shares of the other educational groups, inconsistent with the trends in the educational composition of general population. Censuses identified a steeply declining trend in the share of the population with elementary education. The figure dropped from 33% to 18% between 1991 and 2011 [CSO 2013]. The slow diminishing of mothers with the lowest educational level suggests that these women adhere most to childbearing. This is confirmed also by studies of family values and fertility preferences [Hašková 2009; Šťastná 2009].

Figure 5.3 documents the postponement of motherhood to later ages. The mean age of mothers was only 24 years in 1990. It remained such low for the first half of 1990s and

then rose steeply to reach almost 30 years in 2010. In the early 1990s, 60% of mothers were younger than 25 years and more than 80% of mothers were younger than 30 years. The age structure stagnated or even got slightly younger in the early 1990s. This resulted from the fact that a large number of women who grew to the childbearing age started to delay births and thus left the 'early ones' in the population of mothers. In 2010, women aged 30 and more years made up more than half of all mothers (52%) and the category of 30-34 years had become the most prevalent (in contrast to the most prevalent category of 20-24 years in 1990). On the other hand, mothers under age 20 almost disappeared. Their share declined from 14% to less than 3%.

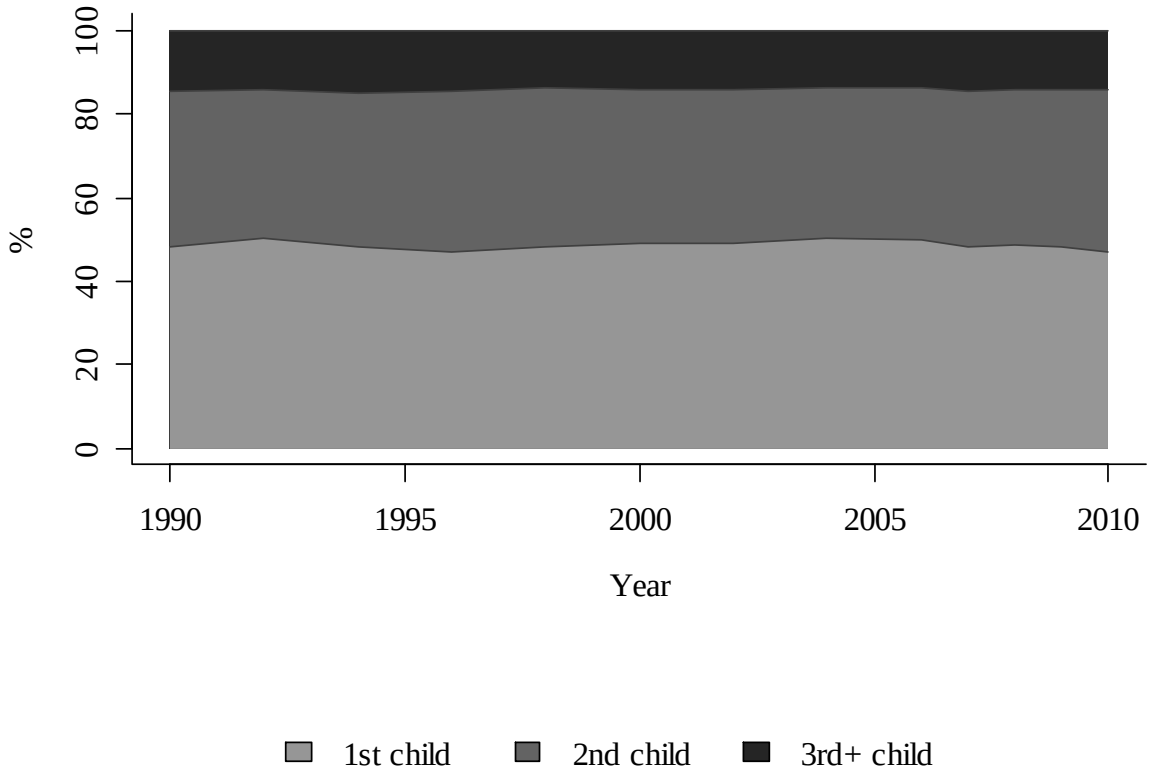
Figure 5.3. Distribution of mothers by age and mean age of mothers (right axis), 1990-2010 (selected years). Mothers, N= 1,378,350.



Source: CSO (Birth register), Author's computations.

Figure 5.4 presents the distribution of mothers by parity which remained remarkably stable during the whole study period. Around half of all mothers have been giving birth to their first children. The second parity has made up 36-38% and the share of mothers of third or higher parity has been 14-15%.

Figure 5.4. Distribution of mothers by parity, 1990-2010 (selected years). Mothers, N= 1,378,350.



Source: CSO (Birth register), Author's computations.

These trends in the composition of mothers cannot explain the growing prevalence of non-marital childbearing. Unmarried motherhood is more common among women with lower level of education. The rising education of mothers should then, everything else being constant, rather hinder the non-marital childbearing. The rising age of mothers can contribute to the trend in two ways. First, the virtual disappearance of the category of very young mothers (below age 20) and considerable reduction in the share of mothers younger than 25 should decrease the total prevalence of non-marital childbearing. Second, the rising share of older mothers (35 years or older) could contribute to the trend in non-marital childbearing, but this age category still made up only 15% of mothers in 2010 and then could not explain the 40% level of non-marital childbearing in 2010. The parity composition of mothers did not change and so it could not contribute to the trend in non-marital births. In sum, the rise of non-marital childbearing in the past two decades can hardly be explained by the change in the composition of mothers by social status (education) and life-course stages (age and

parity). Their marital behaviour changed instead. This will be illustrated in the next section and analysed in detail in following two chapters.

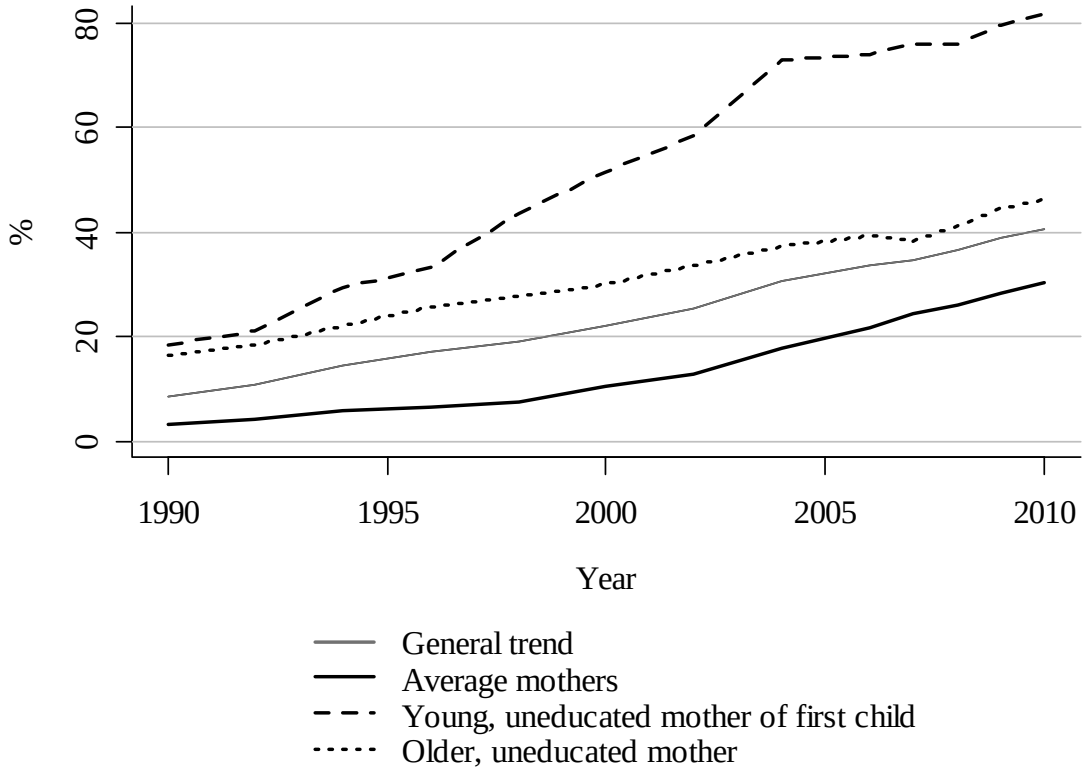
5.2 Uneven spread of non-marital childbearing

This section provides a brief descriptive insight into the spread on non-marital childbearing among various social groups. Figure 5.5 plots the proportions of unmarried mothers among groups who are considered typical candidates for such behaviour. The first group of typical candidates for unmarried motherhood is defined as having elementary or lower secondary level of education, being at least 3 years younger than average age of mothers at the given year and having no previous children. The second group of typical representatives of unmarried motherhood includes women who have at least one previous child, are 3 or more years older than average at the given year and have not attained more than lower secondary education. For comparison, the figure plots also the risk of unmarried motherhood among average mothers. The representative of an average mother is defined as a mother at typical childbearing age (a five-year interval centred around average age of mothers at the given year) with complete secondary education. No specific parity is considered. We can see that non-marital childbearing spread in all of these exemplified groups. Mothers who have average characteristics were at lower risk of unmarried motherhood during the whole study period, but the rise of the figure is remarkable. Only 3% of them were not married in 1990 while the share was 30% in 2010. The increase among the younger group of typical representatives of unmarried motherhood was even steeper. The share of unmarried women in this group was rather high (18%) already in 1990. By 2010, a vast majority (81%!) of these mothers were not married. Non-marital childbearing among the older group of typical candidates for unmarried motherhood also increased, but more moderately: from 16% to 46 %.

The non-marital childbearing also differs by a wider socio-demographic and economic context of regions in which the mothers live (see also [Hamplová, Řeháková 2006]). This is illustrated by Figure 5.6. It shows the non-marital childbearing rate in 14 regions

of the Czech Republic.[19] There are considerable and growing differences between them. The share of unmarried mothers ranged between 4% and 18% in 1990 and between 31% and 59% in 2010. Having children outside marriage has been persistently more common in the North-western belt of regions (regions Karlovarský, Ústecký, and Liberecký). The share of unmarried mothers in these regions was between 11% and 18% in 1990 already and it has increased to 46-59% by 2010. The capital Prague also showed an elevated incidence of non-marital childbearing in 1990 (10%), but it has risen to below-average 35% by 2010. The regions along South-western and North-eastern borders have a higher non-marital childbearing rate since 2000s. On the other hand, the belt of regions between central Bohemia and South Moravia seems to be most resistant to the spread of non-marital childbearing.

Figure 5.5. Non-marital childbearing rate among selected groups of mothers, 1990-2010 (selected years). Mothers, N=1,370,604.

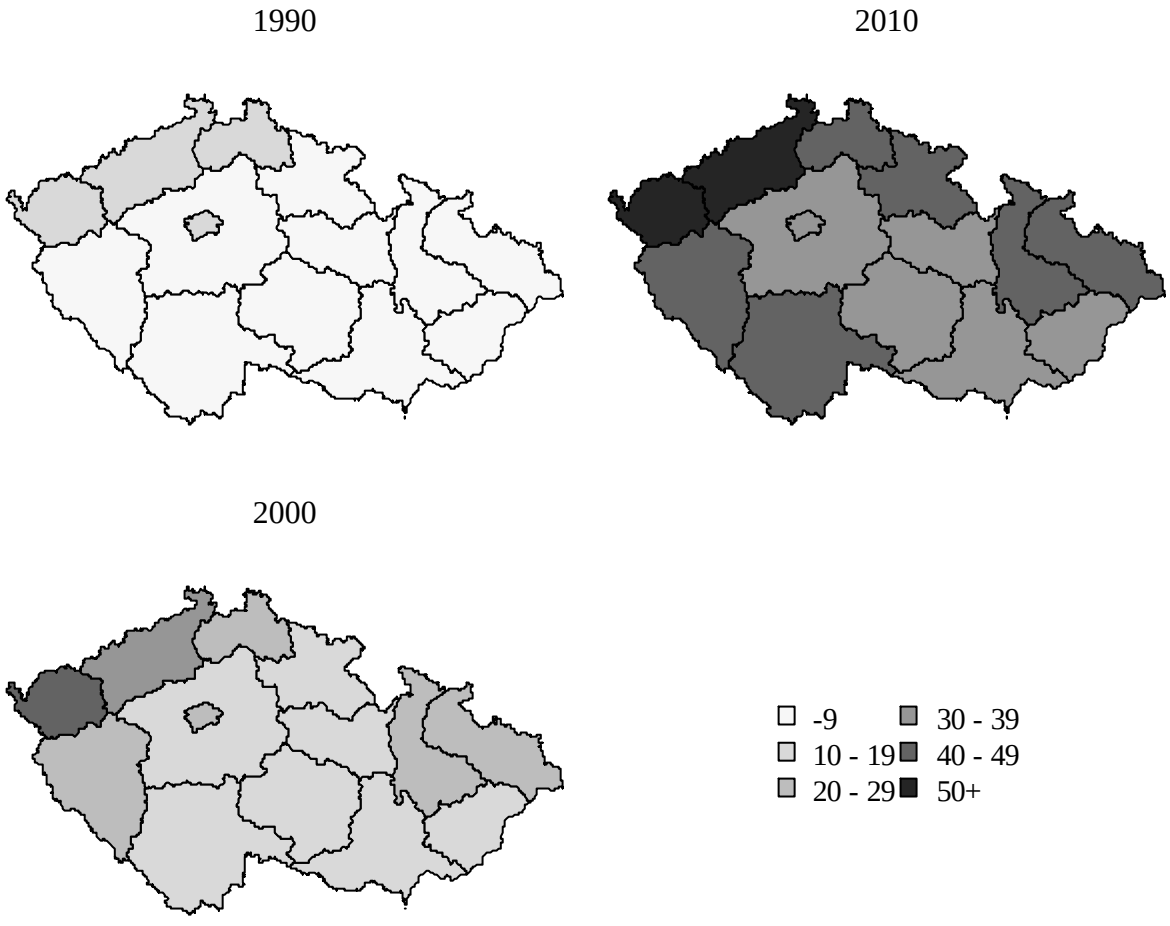


Source: CSO (Birth register), Author's computations.

[19] The current administrative system of 14 regions (NUTS-3 level) was introduced in 2000. The time series was created based on lower-level (NUTS-4) units whose borders did not change by the 2000 reform. See also Chapter 15.1.3.

The data presented in this chapter showed that the increase in non-marital childbearing cannot be explained by shifting composition of mothers by education, age and parity. In contrary, the rising education and age of mothers rather prevented the non-marital childbearing rate from being even larger. Non-marital childbearing did not spread evenly among socio-demographic groups and regions. The differences were illustrated on just few examples of maternal characteristics. The next two chapters provide a more deliberate multivariate analysis which assesses the effects of multiple variables at the same time. The analysis focuses on the association of unmarried motherhood with socioeconomic status.

Figure 5.6. Non-marital childbearing rate in regions, 1990-2010 (selected years). Mothers, N= 1,378,350.



Source: CSO (Birth register), Author's computations.

6 TREND IN THE EDUCATIONAL GRADIENT OF UNMARRIED MOTHERHOOD

This chapter addresses first two research goals formulated in Chapter 4. It focuses on the educational gradient in non-marital childbearing and its change in time. I first describe the trend in the educational disparity and then estimate multivariate models which control for the possibly confounding effect of other maternal characteristics and allow testing the explanations for the spread of unmarried motherhood (gradual spread of values, socioeconomic pressure, and policy).

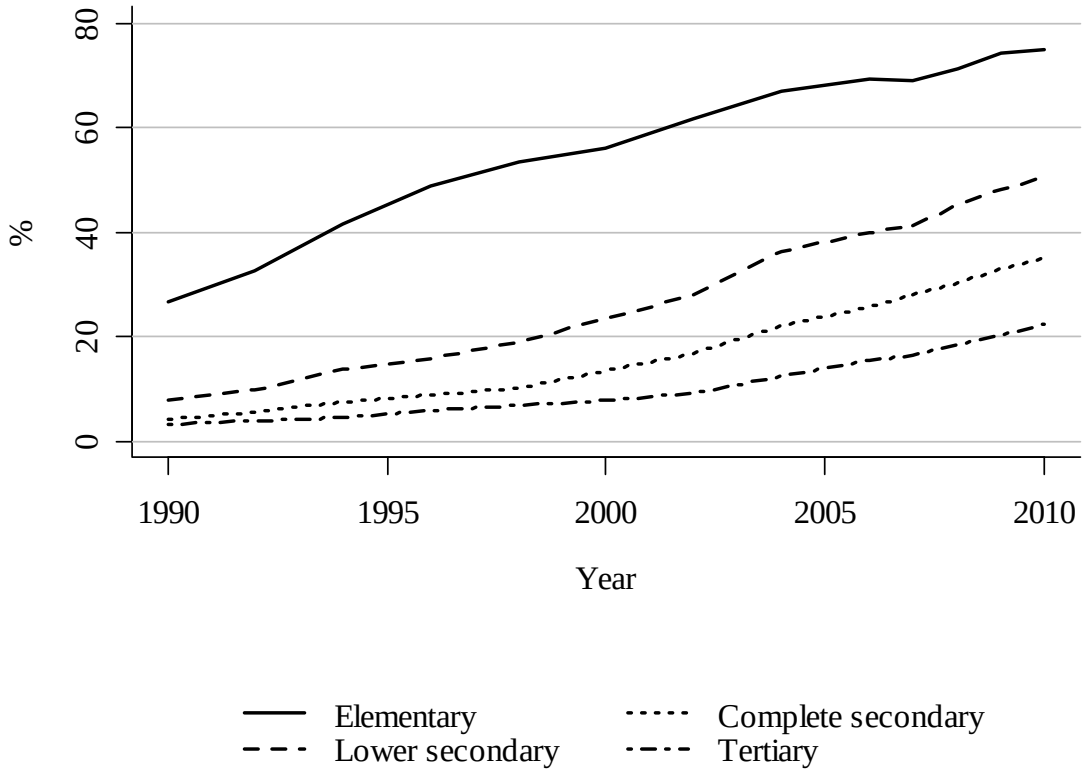
6.1 Descriptive analysis

Figure 6.1 presents shares of unmarried women among educational groups of mothers. It documents the striking educational gradient that was already described in Chapter 4 (see also [Zeman 2006] who described the trend in 1995-2006). Mothers who attained only the lowest level of education are far more likely to have a non-marital birth than the other educational groups. The share of unmarried mothers among the group with elementary education was 27% in 1990 and rose to 75% in 2010. Mothers with the second lowest educational attainment, the lower secondary (vocational) schooling, show a much lower level of non-marital childbearing rate. It was less than 8% in 1990 and then started to rise immediately to reach 51% in 2010. The two highest educational groups showed similarly low levels of non-marital childbearing rate during 1990s. Only 3-4% of these highly educated mothers had a child without being married in 1990. The share remained below 10% until 1998 among mothers with complete secondary education and until 2004 among university graduates. The figure for mothers with higher levels of education then rose more steeply in the last years. More than one third and almost one quarter of mothers with complete secondary and tertiary education (respectively) were not married when bearing a child in 2010. The gap between the lowest and the highest educational group thus widened remarkably, especially around the middle of the study period.

The educational gradient can be described in relative terms with odds ratios (see Chapter 15.2.1 for explanation). This is done in Figure 6.2. It relates the odds of unmarried motherhood in all educational groups to the odds among mothers with

university education. This reference category was chosen for an easy interpretation. Highly educated mothers have lowest odds of not being married, so all remaining educational groups have the odds ratio higher than one, which is easier to interpret than fractions between 0 and 1.

Figure 6.1. Non-marital childbearing rate by education, 1990-2010 (selected years). Mothers, N=1,370,604.

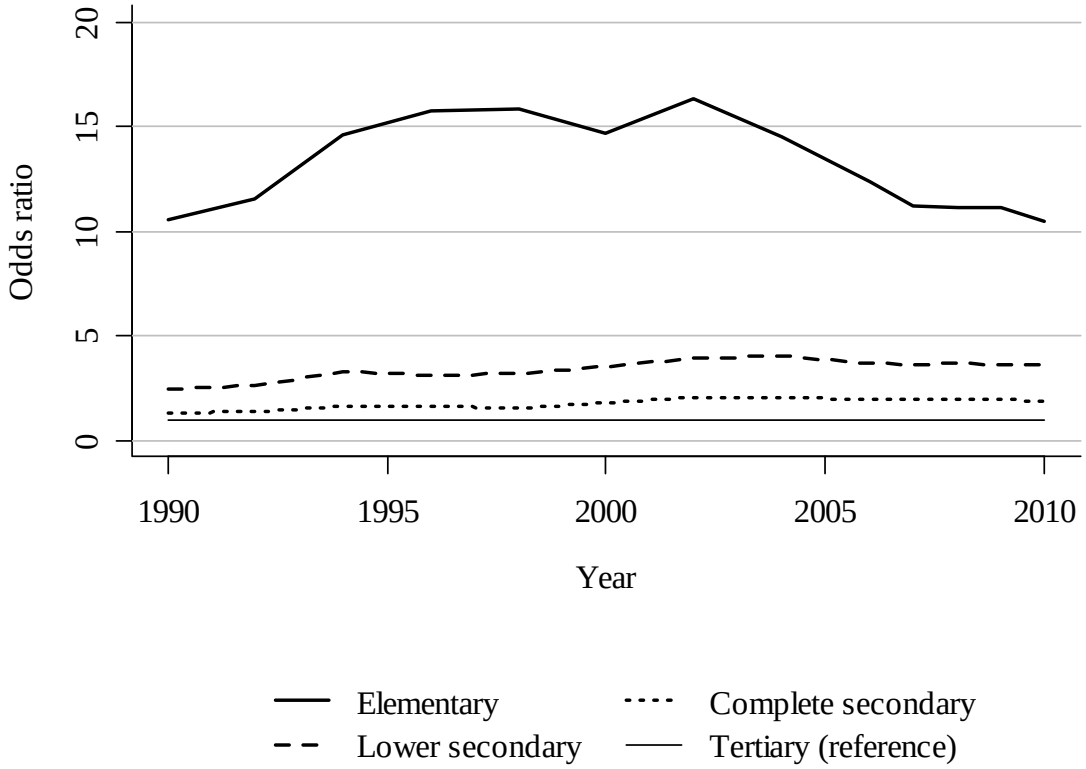


Source: CSO (Birth register), Author's computations.

Figure 6.2 shows that the disparity between groups with the lowest and the highest education widened dramatically during 1990s. It rose from 11 in 1990 to 16 in 2002. The gap then declined back to its original value till 2010. However, we have to keep in mind that the baseline odds among university graduates increased substantially meanwhile (it grew from 0.03 to 0.29 between 1990 and 2010). So eleven times higher odds in 2010 results in a much higher absolute difference than in 1990 (recall Figure 6.1). The disparities among mothers with higher educational attainment are much narrower, but still large. The odds of unmarried motherhood were 2.5 times higher for mothers with vocational training (lower secondary education) compared to mothers with

tertiary education in 1990. The odds ratio was only 1.3 for mothers with complete secondary education in the same year. The disparities in unmarried motherhood between mothers with secondary (lower or complete) and tertiary education were growing in 1990s and then stabilized. Since 2002, the odds ratio for mothers with lower secondary education has been between 3.5 and 4 and the value for complete secondary education stabilized at almost 2. Again, it has to be noted, that the absolute differences are even higher because of the growing odds of unmarried status in the reference category of highly educated mothers.

Figure 6.2. Non-marital childbearing rate by education, 1990-2010 (selected years) – odds ratios. Mothers, N=1,370,604.



Source: CSO (Birth register), Author's computations.

6.2 Model building

The figures from previous section document a growing educational gradient in unmarried motherhood but fail to account for other maternal characteristics which are correlated with both non-marital childbearing and education. This will be done with

multivariate analysis which uses the logit of unmarried motherhood as the dependent variable (see Chapter 15.2.2 for details on the method).

Maternal education is the main predictor of unmarried status in the present analysis. Two more characteristics of the mother, her age and parity, are controlled for because they are associated with both marital status and education. Childbearing usually takes place after education is completed (cf. [Chaloupková 2010, Kreidl Štípková 2012]) and more educated mothers are thus, on average, older. Including the effect of maternal age will therefore probably explain part of the effect of education. The age norms of motherhood shifted substantially during the study period. Therefore I include a relative measure of maternal age in the model. It has three categories. The first category indicates that the mother's age is equal to the 20^{th} percentile of the age distribution in the respective year or lower. This category thus includes approximately 20% of mothers who were the youngest when they gave birth. Analogically the upper category indicated maternal age that is equal to or higher that the 80^{th} percentile. The middle category thus includes approximately 60% of cases within the range of 'normal' (meaning most common) age of childbearing (see also Chapter 15.1.2).

The effect of maternal education can be confounded also by the number of children she already has. Deciding about first child differs from deciding about higher-order children. Once the experience of motherhood has been gained, the material conditions and partnership situation rise in importance for considerations about more children [Šťastná 2007]. Hence higher-order births should occur more frequently in a stable partnership or marriage. However, the effect of birth order may not be the same for women in all educational categories. As I explained in Chapter 4, more educated women, on average, want smaller families and tend to have more satisfying careers. This may prevent them from having additional children, especially if they miss an optimal partner.

Beside individual maternal characteristics, supra-individual (macro) effects are important, as well. Previous chapter showed that the likelihood of having a child outside marriage differs by region and that regions followed different trajectories of the spread of unmarried motherhood. The effect of the spatial-temporal contexts may result from a wide range of characteristics like structure of job market (including the number of jobs

and types of job available), wages, availability and quality of housing, religiosity, urbanization etc. Hamplová and Řeháková [2006] showed that the regional economic conditions were important predictors of unmarried motherhood in early 2000s. Therefore I control for the macro effects of spatial-temporal contexts in which the women had their children. The contexts are defined as region-years. There are 14 regions and 13 years (the time series between 1990 and 2010 does not include all single years). This gives 182 contexts. I estimate multilevel models with random intercepts. The context-specific intercepts capture the variability in measured and unmeasured characteristics of contexts. In some of the models presented below, the intercept is further split into the effects of observed context-level variables which explain part of the context-level variation and the remaining unexplained effect (adjusted with a random component). The variables measured at the context level are continuous measure of time (year), economic situation (unemployment rate), and the policy regime related to unmarried motherhood. The time is measured either as a categorical variable or continuously. The continuous measure of time allows to test whether the probability of unmarried motherhood increased gradually in time, which would support the idea of value shift which makes mothers dismiss marriage. The economic situation is measured as the average unemployment rate in the given region during three years before the birth occurred (including the year of birth). The policy regime distinguishes four periods: 1990-1991 (universal benefits, longer maternity allowance for single mothers), 1992-1995 (partially income-tested benefits, longer maternity allowance for single mothers), 1996-2006 (income-tested benefits, longer maternity allowance for single mothers), 2009-2010 (income-tested benefits, unified length of maternity allowance).

Table 6.1 lists all models estimated in this chapter along with their goodness of fit statistics. The models are compared by the classical likelihood-ratio test and the Akaike's information criterion (AIC). The first set of models (M1 to M4) focuses on the individual-level predictors and interactions between them. The subsequent models explain part of the context-level variability by explanatory variables measured at the contextual level (M5 and M6) and tests whether influence of these macro-factors differs by level of maternal education. Tables 6.2 and 6.3 present coefficients estimated by selected models in the respective sections below.

Table 6.1. Goodness of fit statistics of the random-intercept models of unmarried motherhood. Mothers, 1990-2010 (selected years), N(individuals)=1324905, N(contexts)=182.

	Chi2	DF	p-value	AIC
Models with individual-level variables only				
M0: Variance components model	--			1351500
M1: Education	80379	3	<0.00001	1264893
M2: M1 + Age + Parity	116599	7	<0.00001	1215235
M3: M2+ Education x Parity	115920	13	<0.00001	1213654
M4: M3+ Education x High age	116174	16	<0.00001	1211106
Models with context-level variables				
M5: M2 + Year + Unemployment rate + Policy	117290	12	<0.00001	1214771
M6: M5 + Unemployment rate x Policy	117355	15	<0.00001	1214763
Models with cross-level interactions				
M7: M6 + Year x Education	119777	18	<0.00001	1213852
M8: M6 + Unemployment rate x Education	118221	18	<0.00001	1214279
M9: M6 + Policy x Education	118849	24	<0.00001	1214200
M10: M6 + Unemp. r. x Policy x Education	119086	36	<0.00001	1213907

	Likelihood ratio test			Difference in AIC
Comparison of models	Chi2	DF	p-value	
M1 vs. M0	86613	3	<0.00001	-86607
M2 vs. M1	49666	4	<0.00001	-49658
M3 vs. M2	1593	6	0.004	-1581
M4 vs. M3	2554	3	<0.00001	-2548
M5 vs. M2	357	5	<0.00001	-464
M6 vs. M5	14	3	0.0026	-8
M7 vs. M6	917	3	<0.00001	-911
M8 vs. M6	490	3	<0.00001	-484
M9 vs. M6	582	9	<0.00001	-563
M10 vs. M9	317	12	<0.00001	-293
M10 vs. M8	408	18	<0.00001	-372

Source: CSO (Birth register), Author's computations.

The residual intra-class correlation (*rho*), reported at the bottom line of the tables, measures correlation between contexts. It also evaluates what proportion of the total

variability can be explained by the variability at the macro-level, represented by random intercepts. Zero value of *rho* would mean that the clustering of observations is irrelevant for explaining the variability of the data.

6.3 General pattern

First step of the analysis is to evaluate to what extent we can explain the educational disparities in unmarried motherhood by other maternal characteristics. Model M1 is a baseline model that describes the educational differences in unmarried motherhood. The AIC favours M1 over the baseline model M0 which does not contain any predictors and only splits the variation between the two levels (it is called Variance components model). Model M2 adds further individual level predictors (maternal age and parity) which help to improve the model fit. Both likelihood-ratio test (almost zero p-value) and the AIC (decline by tens of thousands) strongly support M2 (see Table 6.1). The coefficients of both M1 and M2 are shown in Table 6.2. The coefficients of maternal education represent the educational differences in an average context. The intercept of 0.018 corresponds to the value of probability equal to 0.50.[20] The values for the other educational groups can be then obtained by adding the respective coefficients to the constant. For instance, the logit for university graduates if 0.018-2.34=-2.32.

When maternal age and parity are held constant in M2, the contrast between the lowest and the highest educational group even increases: the value of the coefficient rises from -2.34 to -2.45. This extremely large coefficient indicates that mothers with elementary education have almost 12 times (1/exp(-2.45)=11.94) higher odds of being unmarried than mothers with tertiary education. The educational gap is the widest between elementary and any higher level of education. Having at least vocational training (the lower secondary education) decreases the odds of unmarried status more than three times (1/exp(-1.16)=3.19) in comparison to the elementary education.

Maternal age and parity also have independent effects on the mother's marital status. Being a young mother increases the logit by 0.48. This equals to odds ratio of 1.62 which represents a 62% increase of the odds of unmarried status. Similarly, unusually high maternal age increases the odds by 54% (exp(0.43)=1.54). The effect of parity on

[20] exp(0.018/(1+exp(0.018)) = 0.50.

unmarried status is even stronger. First-time mothers are 2.6 times more likely (exp(0.94)=2.56) to be unmarried rather than married in comparison to mothers of second children. The difference is much lower for third versus second parity (beta coefficient 0.21 which equals to the odds ratio 1.23).

Table 6.2. Coefficients estimated in models of unmarried motherhood. Mothers, 1990-2010 (selected years), N(individuals)=1324905, N(contexts)=182.

	M1	M2	M3	M4
Fixed effects				
Maternal education (Elementary=ref.)				
Lower secondary	-1.091***	-1.157***	-1.300***	-1.352***
Complete secondary	-1.713***	-1.818***	-2.058***	-2.211***
Tertiary	-2.338***	-2.448***	-2.753***	-3.070***
Maternal parity (Second child=ref.)				
First child		0.939***	0.614***	0.578***
Third+ child		0.214***	0.014	0.174***
Maternal age (Middle= ref.)				
Low		0.478***	0.495***	0.473
High		0.429***	0.444***	-0.129
Maternal education x Parity				
Lower sec. x First			0.243***	0.264***
Complete sec. x First			0.435***	0.522***
Tertiary x First			0.566***	0.734***
Lower sec. x Third+			0.284***	0.172***
Complete sec. x Third+			0.211***	-0.023
Tertiary x Third+			-0.261***	-0.533***
Maternal education x High age				
Lower sec. x High age				0.434***
Complete sec. x High age				0.764***
Tertiary x High age				0.979***
Intercept	0.0178	-0.638***	-0.474***	-0.384***
Random effect				
SD(Intercept)	0.898***	0.923***	0.919***	0.915***
Rho	0.197***	0.206***	0.204***	0.203***

Note: *** p<0.01, ** p<0.05, * p<0.1

Source: CSO (Birth register), Author's computations.

Models M3 and M4 test whether the educational gradient in unmarried motherhood is equally strong among mothers of different age and parity. Model M3 allows the effect

of education to differ by the number of children the mother already has. Likelihood ratio test which compares models M2 and M3 suggests that adding the interaction effect improved the goodness of fit of the model. Test criterion of 1593 with 6 degrees of freedom results in almost zero p-value. Also AIC favours M3 over M2 (see Table 6.1). Model M4 let the educational gradient differ for older mothers compared to mothers of usual age. I do not interact maternal education with the youngest age, because some of the categories would not have a reference in reality (it is not possible to find an unusually young mother with tertiary education in some years). Also the interaction added in model M4 is statistically (and substantively) significant (test criterion 2554 with 3 degrees of freedom, p-value close to zero; substantial decrease in AIC).

The interaction coefficients show that the educational gradient in unmarried motherhood is lower among first-time mothers. According to model M4, the absolute gap (between elementary end tertiary education) in the logit of unmarried status is 3.07 for mothers of second children and 2.34 (-3.07+0.73) for mothers of first children. The educational gradient among mother of third children shrinks only for mothers with elementary and lower secondary education, but likelihood of being unmarried drops for mothers of third children who have at least complete secondary education. The odd of unmarried status for university graduates is 36 times (1/exp(-3.6)=36.6) lower than the odds of mothers of three and more children with only elementary education. This extremely high number reflects the fact the highly educated mothers with more than two children are very rare. If a highly educated woman prefers to have a large family (which is unusual), she is much more likely to do so in a marriage. Unlike, all other educational groups, highly educated mothers of third or higher-order children are less likely to be unmarried than mothers of second children (the interaction term -0.53 inverts the direction of the main effect of third parity which is 0.17). The interaction between education and higher maternal age shows that the educational gradient in unmarried motherhood declines with age. The disparity in the logit of unmarried status between the lowest and the highest education is decreases from 3.07 to 2.07 when comparing mothers who are older than is usual at the given year.

Even though the educational gradient in unmarried motherhood varies by mother's parity and age, it is strong in all categories. The main purpose of the analysis is to identify trends in the size of the educational gradient in time. So I turn back to the

model with main effects only (M2) and analyse trends in the main effect in the subsequent parts of the analysis.

6.4 Explanation of trends

This section evaluates whether the rise of non-marital childbearing can be explained by the three factors offered by the hypotheses (the gradual spread of liberal values, economic uncertainty, and social policy), and whether all these factors influenced all educational groups in the same way. Table 6.3 presents models estimated for this purpose.

I use three characteristics of the contexts which embody the hypothesised mechanisms of the spread of non-marital childbearing. They are included in Model M5. First of these context-level predictors is a continuous measure of calendar year where zero (the reference point) stands for year 1990. This variable assumes that, although the regions may have followed different paths of the prevalence of non-marital childbearing (as captured in the random intercepts), there is a common overall trend. In other words, the contexts that correspond to one year are similar to each other and this similarity is captured in the effect of year. Furthermore, this trend is supposed to be gradually increasing which simulates the gradual spread of individualistic values expected in the individualisation hypothesis. Unemployment rate allows relating unmarried motherhood to the economic conditions in the given context and thus testing the growing economic uncertainty hypothesis. Finally, there are three binary indicators of the four policy regimes that advantaged single mothers in different ways.

Inclusion of these variables significantly improves the fit of the model. In statistical terms, this is confirmed by the likelihood ratio test. Its criterion is 357 with 5 degree of freedom which corresponds to virtually zero p-value. Also AIC declined substatianlly (by 464; see Table 6.1). Coefficients estimated by Model M5 can be found in Table 6.3. The purpose of inclusion of the contextual variables is to explain the macro level variability. The three variables explained a substantial part of it. Compared to M2 (see Table 6.2), the variability of the random intercepts is reduced by two thirds (from 0.9 to 0.34) and the residual intra-class correlation drops from 0.21 to only 0.04. The random

effect now captures the context-specific characteristics unexplained by the three contextual predictors.

Table 6.3. Coefficients estimated in models of unmarried motherhood. N(individuals)=1324905, N(contexts)=182

	M5	M6	M7
Fixed effects			
Maternal education (Elementary=ref.)			
Lower secondary	-1.158***	-1.158***	-1.515***
Complete secondary	-1.819***	-1.819***	-2.169***
Tertiary	-2.450***	-2.450***	-2.597***
Maternal parity (Second child=ref.)			
First child	0.939***	0.939***	0.938***
Third or higher order child	0.214***	0.214***	0.216***
Maternal age (Middle= ref.)			
Low	0.478***	0.478***	0.490***
High	0.429***	0.429***	0.418***
Year (1990=ref.)	0.124***	0.123***	0.098***
Unemployment rate (Mean=6.5=ref.)	0.022**	0.027***	0.028***
Policy (Advanced income-testing=ref.)			
Universal benefits	0.049	-10.27	-9.95
First income-testing	0.054	-0.583***	-0.592***
Equal length of maternity allowance	0.023	0.006	0.002
Unemployment rate x Policy			
Unemp. r. x Universal benefits		-1.669	-1.611
Unemp. r. x First income-testing		-0.192***	-0.191***
Unemp. r. x Equal mat. Allowance		0.008	0.008
Year x Maternal education			
Year x Lower secondary			0.0315***
Year x Complete secondary			0.0302***
Year x Tertiary			0.0174***
Intercept	-2.047***	-2.042***	-1.761***
Random effect			
SD(Intercept)	0.344***	0.331***	0.329***
Rho	0.035***	0.032***	0.032***

Note: *** p<0.01, ** p<0.05, * p<0.1.

Source: CSO (Birth register), Author's computations.

As expected, the logit of unmarried status increases with time. The pace of the increase is assumed to be linear – it increases by 0.12 each year. Without rounding, this gives 2.6

in 20 years (logit of 2.6 results in odds ratio 13.5). This very large effect suggests a strong support for the individualization hypothesis. The effect of the unemployment rate is weaker, but operates in the expected direction: the higher the unemployment rate, the more likely unmarried motherhood is. The logit of unmarried motherhood increases by 0.02 with each percentage point of unemployment rate. The unemployment rate ranged between less than 1% and 18% across the time-spatial contexts, so the total difference between the contexts is 0.36 (0.02*18). This is in line with the growing economic uncertainty hypothesis. The policy regimes do not seem to influence marital behaviour of mothers substantially. There were four policy regimes that advantaged single mothers in different ways. The policy of advanced income testing of social benefits lasted the longest, so it is set as the reference category. The size of the effects is negligibly low (and they are not statistically significantly different from zero) and does not conform the expected effects of policy regimes. The odds of non-marital childbearing should be lower during the period with universal benefits and firstly introduced principles of income testing. Policy adjustment hypothesis thus does not yield support at the first glance.

The period under study is a time of rapid and profound social change. Families may have adjusted to the new economic and labour market conditions gradually, together with reforms of social and family policy. Model M6 tests whether the effect of unemployment rate was stable under all policy regimes, i.e. it adds interaction between these two macro-variables. This improves the model fit, although not as persuasively as in the previous step of the model building. The likelihood-ratio test with criterion 14 and 3 degrees of freedom results in p-value 0,003 (see Table 6.1). Also AIC declines.

The coefficients estimated in model M6 shift the interpretation of both effects. Table 6.3 shows that the effect of unemployment was reverse before the reforms of social policy were completed. High unemployment strongly encouraged marriage of mothers in the period of universal benefits and paternalistic policy at the very beginning of 1990s. The effect of unemployment on the logit of unmarried motherhood was -1.64 (=0.03-1.67) during the policy regime of universal benefits. The effect then rapidly decreased to -0.17 (=0.03-0.19; computed without rounding) during the early policy reforms of the first half of 1990s. Finally, the effect reversed to be positive, as expected by the hypothesis of growing economic uncertainty. A percentage point rise of the

unemployment rate resulted in a 0.03 rise of the logit of unemployment after the policy reforms were completed in 1996. These results suggest that mothers gradually learned to involve economic considerations in their decisions about entering marriage.

The effect of policy changed, as well. The signs of the coefficients correspond rather well with the policy adjustment hypothesis: complex introduction of income-testing of social benefits after 1995 supported mothers to remain unmarried. The value of the coefficient is somewhat overestimated in the first period of universal benefits (it refers to year 1990) because it assumes an average unemployment rate (6.5%). However, the unemployment had emerged only recently in 1990 and did not exceed 1.3% in any of the regions. The coefficient of -10.27 is thus rather unrealistic (and statistically insignificant). It interacts with the unemployment rate negatively (-1.67) implying a stronger adherence to marriage under economic insecurity. It has to be noted that these effects capture also the legacy of the socialist policies, because some women who gave birth in 1990 made their marital decisions before the 1989 revolution. This suggests that the paternalist policies with universal benefits and support for newlyweds stimulated marriage.

This has, however, reversed soon, when the support for families started to be income-tested. The effect of policy on unmarried status of mothers was still negative and negatively interacting with unemployment during the early reforms, but this did not continue after the 1996 reforms. Since then, the policy of income-tested benefits implies an increase of the logit of unmarried motherhood by 0.58 (it corresponds to odds ratio 1.79), compared to the period of early reforms. The cancellation of prolonged maternity allowance in 2009 does not seem to influence marital behaviour of mothers (the coefficient is lower than 0.01).

In general, the results indicate that all three hypotheses are valid. The strong net effect of time provides persuasive evidence in favour of the individualization hypothesis. The logit of unmarried status increased from -2.31 to -0.41[21], i.e. by 1.9. The linear effect of time predicts an increase of 2.5 (0.12*21) during the 21 years of the study period. This result suggests that, the non-marital childbearing would grow even faster if there were

[21] The probability of unmarried status increased from 0.09 to 0.40 between 1990 and 2010. This corresponds to logit in 1990= log(0.09/(1-0.09))=-2.31 and logit in 2010=log(0.4-(1-0.4))=-0.41.

no other influences. The hypothesis of growing economic uncertainty yields weaker support. Mothers started to adhere to unmarried motherhood under economic pressures only since the second half of 1990s, after reforms of social policy were undertaken. Even after that, the effect is weaker than the effect of continuous time. The unemployment rate rose by 6 percentage points between 1996 and 2010 (from 4% to 10%) This predicts an increase in the logit of unmarried motherhood of 0.18 (0.03*6). The policy adjustment hypothesis is also partly supported by the data. The cancellation of universal benefits provided a rather strong motivation to consider avoiding marriage to reach more benefits since early 1990s. On the other hand, equalization of maternity allowance in late 2000s did not support marriage.

The final step in the analysis is to test whether these three explanations were equally important for all educational groups of mothers. Model M7 extends M6 by allowing the effect of continuous time to differ by maternal education. Table 6.1 shows that this interaction statistically significantly improves model fit (test criterion 917 with 3 d.f., $p<0.0001$, AIC is reduced by 911). The interaction coefficients, presented in Table 6.3, show that the linear spread of unmarried motherhood was least pronounced among mothers with elementary education (coefficient value 0.10) and most pronounced among mothers with secondary education, either lower or complete (0.13=0.10+0.03). The coefficient for mothers with tertiary education is 0.12 (=0.10+0.02). The slower spread of non-marital childbearing among women with the lowest level of education implies narrowing of the educational gradient if this was the only source of the spread of unmarried motherhood. Although the generally strong linear effect of time is in line with the individualisation hypothesis, the education-specific effects do not fully conform the original expectations. The hypothesis assumed that the spread of unmarried motherhood would be most pronounced among mothers with the highest educational attainment. As expected, the effect of time is the weakest in the lowest educational groups and then rises for mothers with secondary education, but mothers with tertiary education deviate from this pattern slightly.

Models M8 to M10 focus on the interaction between unemployment rate, policy and maternal education. The effects of unemployment rate and policy, respectively, are allowed to differ by maternal education in models M8 and M9. As both of these models improved the prediction of the data (see Table 6.1), also the most complex model (M10)

with three-way interaction was estimated. Model M10 is favoured by the goodness of fit statistics (p-value of the likelihood-ratio tests approaches zero, AIC declines by hundreds; see Table 6.1) over both M8 and M9.

Selected coefficients estimated by model M10 are listed in Table 6.4. The top panel describes the strength of the effect of unemployment in each combination of maternal education and policy regime. All educational groups follow the pattern of reversing effect of unemployment rate which was described by model M6: precarious economic situation supported marriage in the early stages of post-socialist reforms, but then turned to be positively associated with non-marital childbearing. This turn in the marital behaviour was most pronounced among mothers with secondary of education. For instance the value of the coefficient went from -1.97 (=-1.53-0.46) to 0.02 (=0.06-0.04) among mother with lower secondary education, but from only -0.50 to 0.02 among university graduates. If we focus on the period after the policy reforms were undertaken, it is not conclusive which educational group is the most sensitive to macro-economic conditions. Mothers with elementary education respond the least (the coefficient is only 0.013) and mothers with lower secondary education the most (coefficient 0.04=0.01+0.03). However, this educational pattern reverses after the equalization of maternity allowance in 2009. A 10% increase in unemployment rate would elevate the logit of unmarried status by 0.58 among mothers with elementary education (the educational differences are statistically significant but the main effect of unemployment among mothers with elementary education is not) and only by 0.02-0.03 among university graduates.

The effects of policy by education, assuming average unemployment, are shown in the bottom panel of Table 6.4. The effects of policy are again most pronounced among mothers with the secondary education. The reforms of mid-1990s (whose effect lasted the longest) increased the logit of unmarried status by 0.66-0.69 (=-0.29-0.40) among them (The same figure was only 0.29 in the group with the lowest education and 0.31 (=-0.29-0.02) among the most educated; moreover the influence of the early 1990s' reforms is not statistically significant for these groups). This low size of the coefficient among the mothers with elementary education is rather surprising if we consider that the incomes of the lowest educational group are more often close to the minimum wage and

thus eligible to social benefits. Mothers with university degree are the least responsive to the policy reforms which is in line with the expectation.

Table 6.4. Selected coefficients of Model 10.

	Maternal education			
	Elementary	Lower secondary (interaction term)	Complete secondary (interaction term)	Tertiary (interaction term)
The effect of unemployment rate				
Policy				
Universal benefits	-1.530	-0.463	0.316	1.025
First income-testing	-0.110**	-0.096***	-0.085***	-0.023
Advanced income-testing	0.0133	0.025***	0.011***	-0.009***
Equal length of maternity allowance	0.058	-0.035***	-0.036***	-0.029***
The effect of policy (Advanced income-testing=ref.)				
Universal benefits	-9.458	-2.926	1.869	6.522
First income-testing	-0.294	-0.398***	-0.368***	-0.018
Equal length of maternity allowance	-0.340***	0.347***	0.382***	0.380***
Main effect of education	Ref.	-1.197***	-1.854***	-2.479***

Note: *** p<0.01, ** p<0.05, * p<0.1.

Source: CSO (Birth register), Author's computations.

The recent cancellation of financial advantage of unpartnered mothers did not influence behaviour of any educational group, except the elementary level. This reform decreases the logit of unmarried status by 0.34 among mothers with elementary education. This relatively mild effect supports the expectation that this policy change reduces the economic advantage of unmarried motherhood. However, absence of a similar effect among mothers with higher education (who have higher salaries and thus higher maternity allowance) is surprising.

In sum, this chapter showed that the educational gradient in unmarried motherhood has been strong during the whole study period. The disparities have widened remarkably,

especially in 1990s. Non-marital childbearing started to spread among mothers with elementary education first, which widened the educational disparities in 1990s. The gap between the lowest and the highest educational category then stabilized (or even decreased when expressed in relative terms) in the 2000s due to the delayed onset of the spread of non-marital childbearing among mothers with higher education.

The analyses undertaken in this chapter provided some evidence for all of the three examined hypotheses. There is a strong support for the individualization hypothesis. Unmarried motherhood was spreading gradually in time. The trend was stronger among more educated groups, except for mothers with tertiary education. A tentative explanation is that highly educated women, who are hypothesised to hold highly individualist values, tend to increasingly retreat from motherhood and are thus not present in the dataset. Those highly educated women who become mothers are then selected from the traditionally oriented. This selection is likely to be weaker among the other educational groups. Their career prospects and other life-style options are more limited, and they have thus less to lose by childbearing. Another explanation for the deviant pattern among highly educated mothers is that the trend is just delayed among them. Women who spend longer time in education also take more time before they have children (cf. [Kantorová 2004]). Highly educated women who are postponing motherhood because of their education and career building may eventually increasingly have children outside marriage and the educational gap may further closing.

The growing economic uncertainty hypothesis and the policy adjustment hypothesis both relate to the economic conditions and of marriage and motherhood. The analysis showed that labour market situation (the unemployment rate) and social policy influence marital behaviour of mothers jointly. The economic uncertainty hypothesis expected a positive association between non-marital childbearing and unemployment rate. This assumption was showed to be valid only after the paternalistic policy of universal social benefits was removed. These policy reforms also strongly supported non-marital childbearing. However, contrary to the expectation, the recent cancellation of some advantages for unpartnered mothers in 2009 did not discourage mothers from extramarital births (except for the group with the lowest education). Both the effect of economic uncertainty and policy of income-testing are most pronounced among mothers with secondary education. Mothers with tertiary education respond the least to the

policy reforms (as can be expected) but were rather strongly influenced by the unemployment rate until recently. Marital behaviour of mothers with elementary education does not seem to reflect the economic pressures (labour market uncertainty and social policy) as much as the behaviour of the other educational groups until 2009. However, the cancellation of prolonged maternity leave for unpartnered mothers in 2009 lead to an increased importance of economic uncertainty and somewhat stronger adherence to marriage in this educational group.

The next chapter provides a more detailed insight in partnership arrangements of mothers with different socioeconomic background.

7 UNMARRIED MOTHERHOOD WITH AND WITHOUT A PARTNER

This chapter focuses on the heterogeneity of unmarried motherhood. Some of the unmarried mothers have coresident partners and live in marriage-like relationships while others are single mothers. The next section describes the trends in unpartnered and partnered motherhood. The following two sections then analyse the educational gradient in whether an unmarried mother has a partner or is single.

7.1 Trends in single and partnered unmarried motherhood

So far, the evidence about the prevalence of different kinds of family arrangements of unmarried mothers has been very scarce. This chapter aims to fill this gap. The availability of information about partnership status of unmarried mothers is limited in the birth register. The trend in the partnered and single motherhood is therefore reconstructed with multiple imputation and then evaluated with an additional data source.

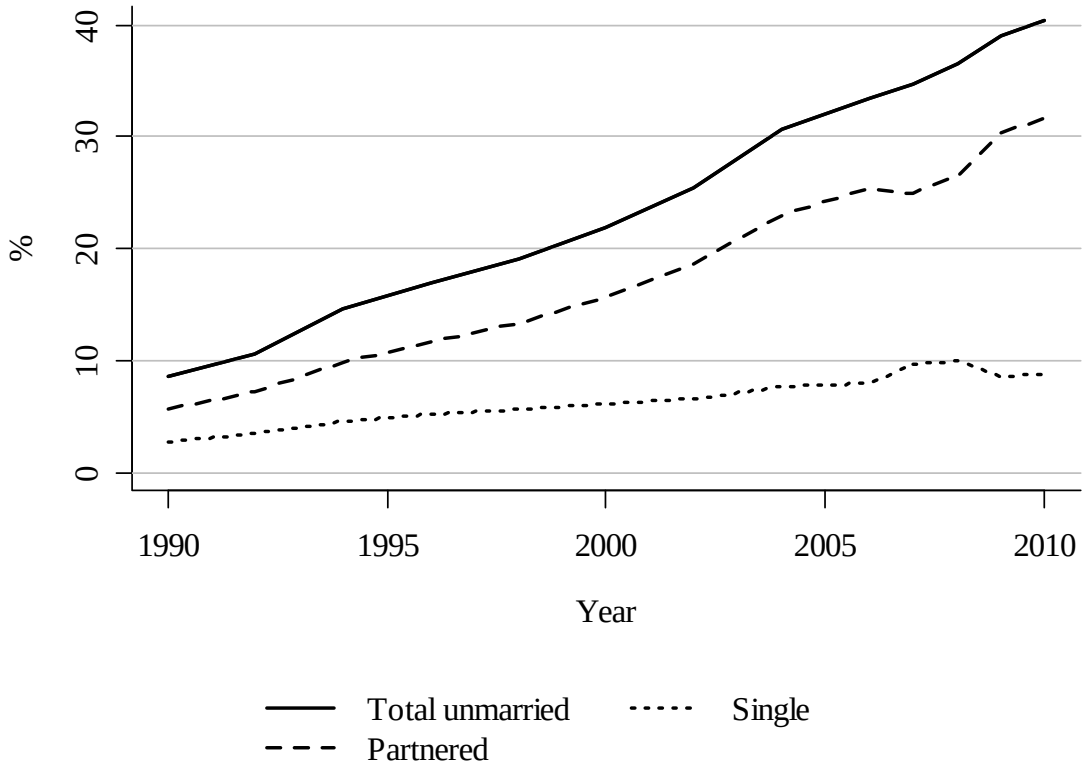
7.1.1 Birth register and multiple imputation

Birth register does not provide information about living arrangements of mothers, but it has been recording the information about fathers of non-marital children since 2007. No information about fathers of non-marital children was requested before 2007 (see Chapter 15.1.4 for details). Whether the mother provided paternal data or not can be used as a proxy for her partnership situation. Those who did not report paternal data are likely to have no partner. Those who provided paternal information are likely to either live with the child's father or maintain a kind of relationship with him or at least willing to establish a relationship between the father and the child.

The description of the trend in partnered and single motherhood is crucial for understanding the trend in the effect of marital status on infant health. Therefore I used multiple imputation to supplement the missing information about the legal establishment of paternity before 2007. This method allows to fill-in the missing data based on the values of observed variables. It is a rather complex procedure which involves random processes. Several versions of the likely values of missing data are

simulated and the results are then merged (see Chapter 7.1 for details). The results of this procedure are plotted in Figure 7.1 along with the observed data for 2007-2010. The figure shows trend in the share of unmarried mothers in general and split to single and partnered.

Figure 7.1. Mothers by marital and partnership status – trend reconstructed by multiple imputation, 1990-2010 (selected years). Mothers, N=1,370,604.



Source: CSO (Birth register), Author's computations.

I will first interpret the observed data in 2007 -2010. Non-marital childbearing rate rose from 35% to 40% during this short time interval. Splitting the unmarried mother sby the availability of paternal data shows that the rising trend is driven by the increase in the share of mothers who are unmarried but acknowledge the child's father, i.e. the partnered ones. They made up 25% in 2007 and the share has grown to 32% by 2010. On the other hand, the share of unmarried mothers whose child's father is unknown stagnated or even slightly decreased. Their share was 10% in 2007-2008 and then decreased by one percentage point to 9% in 2009-2010. The drop occurred exactly when the policy of prolonged payment maternal allowance was cancelled for single mothers.

This suggests that the policy adjustment hypothesis might work differently than expected. Previous chapter showed that the policy incentives were not strong enough to prevent couples from marrying, but might influence the willingness of unmarried mothers to acknowledge fathers. While the general trend of unmarried motherhood is strictly linear, the share of unmarried mothers who acknowledged father shows a bump between 2008 and 2009 and a corresponding decline can be observed for those who did not report fathers. A more rigorous test of whether this can be interpreted as a reaction to maternal allowance policy is applied below.

A variable indicating the period 2007-2008 as special was included in the imputation model, because I wanted the imputed values to reflect rather the influences that predict the 'honest' declaration of fathers in 2009-2010 than the biased reporting in 2007-2008. The trend in 1990-2006 thus connects rather to the trend in 2009-2010 leaving the 2007-2008 values bump up for single mother and drop down for partnered mothers. The long-term trend suggests that both groups of unmarried mothers have expanded in time. The proportion of single mothers more than tripled (3% to 9%), while the share of partnered mothers rose at a much faster pace (6% to 32%) during the study period.

7.1.2 Evaluation of the imputed data with Labour Force Survey

I also use another data source, the Labour Force Survey, to evaluate the credibility of the multiply imputed data. I have access to data series of 1993-2009. This survey focuses on households and provides a sufficiently large sample to study unmarried motherhood. I identified households which included an infant (a member with 0 completed years of age). There were 8316 such households. Each household was coded as including both married parents of the infant, both unmarried parents of the infant, or a mother of the infant but no father. Households without the infant's mother were excluded. Details of the procedures are described in Chapter 7.1. The identification of infant's parents was difficult before 2002, when only relationship of each person to household heads were recorded. If the infant's mother or father were not listed as household heads in the roaster, it was not always clear, what are the relationships between the infant and other household member. The decision whether there are both parents was impossible in 17% of cases in 1993-2001, which were deleted from the

analysis. The newer data series since 2002 includes identification of parental and partner relationships between all household members, so there are no missing data on mother's family arrangement in this period. The final dataset includes 7624 observations.[22]

Figure 7.2 plots the proportion of unmarried mothers identified in the LFS. It also splits unmarried mothers into cohabiting and single.[23] The grey lines depict the respective proportions from the birth register. The comparison with birth register shows that the share of unmarried mothers is somewhat underestimated in most of the time points. The underestimation ranges up to 5 percentage points except for three more pronounced deviations in 2000, 2006, and 2008. The oscillations around the linear trend probably result from a random noise in the data. However there is still a systematic underestimation of the general trend. While the birth register proportion of unmarried mothers rose from 13% to 39% between 1993 and 2009, the LFS proportion increased from around 10% to below 35% in the same period. A plausible explanation is the lag between birth of the child and data collection which may have taken up to one year. Some originally cohabiting couples probably got married since childbirth. They are probably couples who postponed wedding because of the bride's pregnancy.[24] The shape of the general trend of unmarried motherhood is driven mainly by the size of the groups of cohabiting mothers. This supports the idea that the underestimation results from cohabiting mothers who marry within one year after childbirth. The share of cohabiting mothers grew remarkably from 3-4% to around 20%.

The proportion of mothers who did not have a coresident partner increased, as well, but on a slower pace. It rose from between 5 and 8% in 1990s to around 15% in late 2010s. Most of the increase occurred after 2000. When compared to the birth register proportions of unmarried mothers it implies that around 60% of unmarried mothers

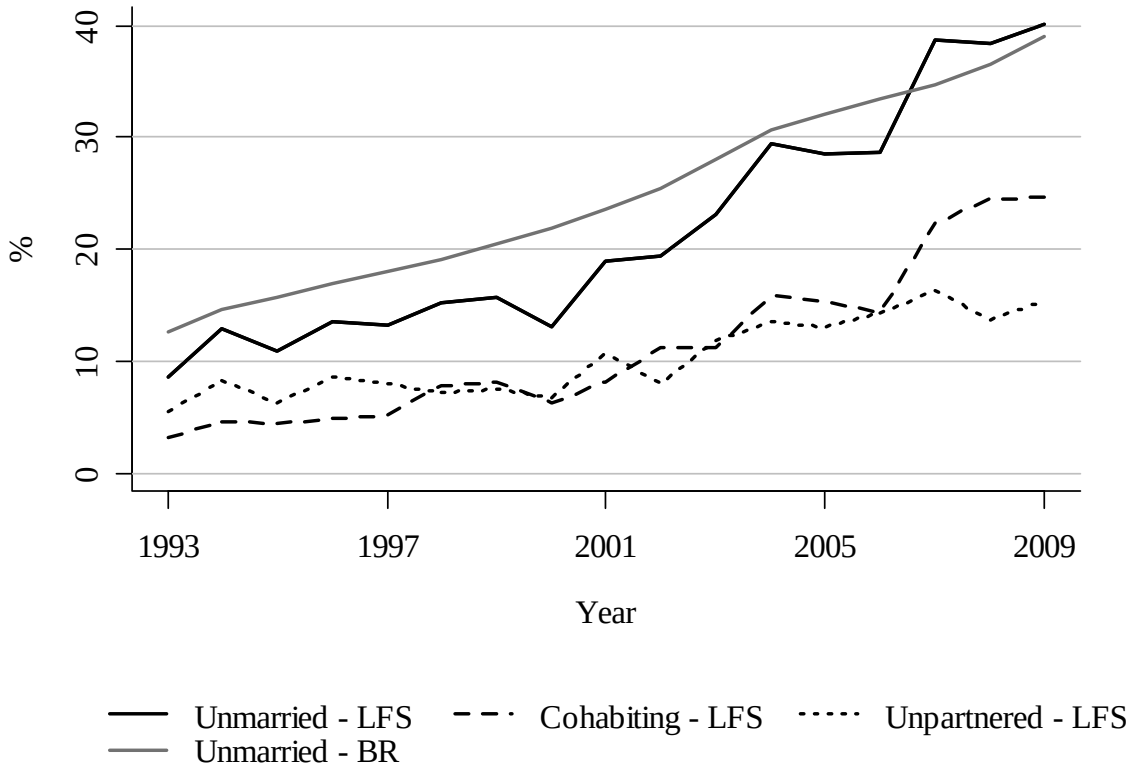
[22] Chapter 7.1 provides a sensitivity analysis which shows that the deletion of households which did not allow to decide whether both child's parents are present is not likely to bias the proportions of each family arrangements.

[23] The data were weighted according to the birth register composition of mothers by ecuation, age and parity. The exact proportions with their 95% confidence intervals can be found in Table 11 in Chapter 7.1.

[24] Chaloupková [2007] showed that some unmarried mothers admitted that unwillingness to marry when pregnant was a reason to postpone wedding.

lived without partners in mid-1990s, while single mothers made up only less than 40% two decades later.

Figure 7.2. Proportion of unmarried mothers (in total and by cohabitation status) compared to birth register proportion of unmarried mothers, 1993-2009. Households with mothers and infants from the LFS, N=7624; Mothers from the birth register (1992-2009), N= 1,130,156.



Source: CSO (Birth register) and LFS, author's computations.

The trend in single motherhood depicted in Figure 7.2 does not seem to reflect the oscillations present in the trend of cohabiting motherhood, which are likely to be caused by post-partum marriages. When compared to the trend resulting from the multiple imputation of missing data from birth register (see Figure 7.1), the pace of the increase is similar. The proportion of single mothers suggested by the birth register (i.e. mothers who did not report fathers) is lower, because some of the mothers who live without partners still acknowledge child's father. But it is important that the gap tends to be stable at 5 percentage points.

While most of unmarried mothers were unpartnered in 1990, unmarried motherhood twenty years later is predominantly a two-parent family arrangement. According to the LFS the proportion of cohabiting mothers among unmarried mothers increased from about 40% to more than 60%. The imputed proportion of unmarried mothers who provide information about child's father increased from 68% to 78%. Not all of them live with the child's father, but acknowledgement of the father indicates that the he at least takes part of the parental responsibilities.

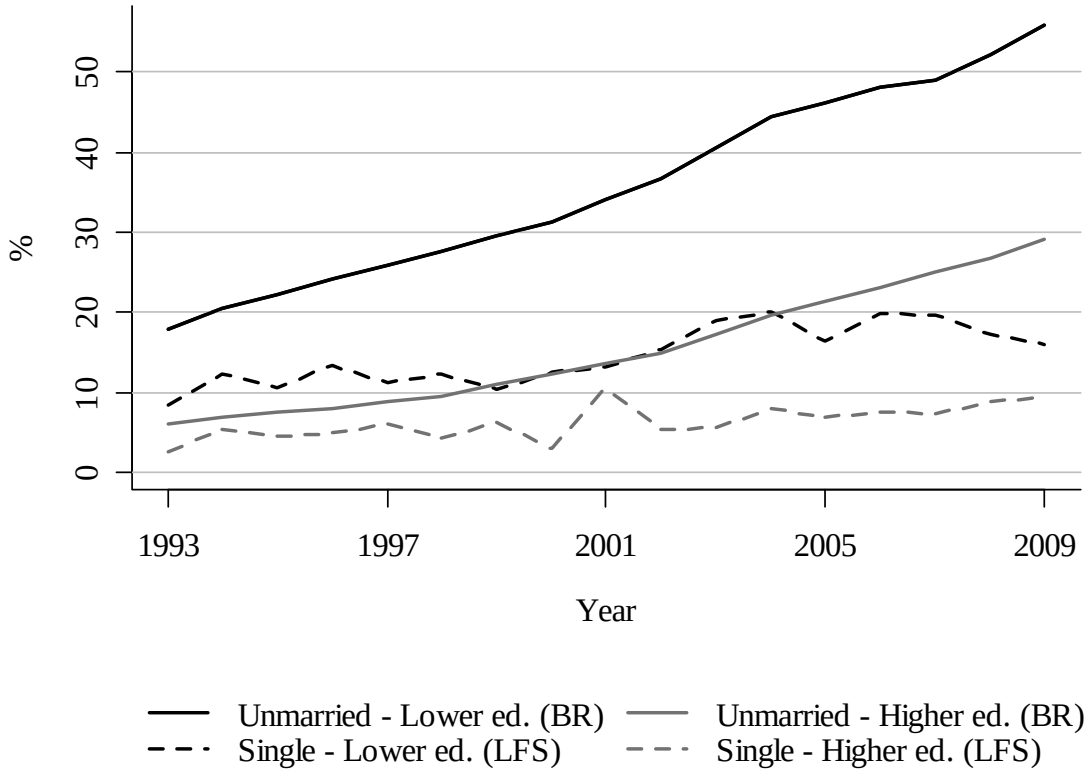
The next two sections focus on the educational gradient in unpartnered motherhood using the two sources of data. First, the LFS data are analyzed. The purpose of the analysis is to inspect time trend in the educational gradient in single motherhood and to assess if the measurement of family arrangement by father acknowledgement in birth register gives similar results as the measurement by household composition. The character of the data does not allow to use the multilevel approach. Simple logistic regression is used instead. Second, the short period with observed data on partnership situation from the birth register allows analysis of unpartnered motherhood analogical to that of the previous chapter. I do not use the imputed data for multivariate analysis. The multiple imputation a very powerful tool of handling missing data, but analysing the same relationships which were used for imputation of the values could be misleading. Therefore I use them only for the description of trend presented above.

7.2 Trend in the educational gradient in unpartnered motherhood (analysis of LFS 1993-2009)

The labour force survey allows analysing the educational gradient in single motherhood. Although the number of observations in LFS is rather large, the number of mothers with elementary or university education is only around 20 in some years. As unpartnered motherhood is a rather rare phenomenon, this number is not sufficient. Therefore I simplified education to only two categories: lower (elementary and lower secondary) and higher (complete secondary and tertiary). Figure 7.3 plots the share of single mothers among those with lower and higher education. It is supplemented with the total proportion of unmarried mothers from birth register to put the trends in the context of spreading non-marital childbearing. The figure shows an increasing trend among both educational groups. The share of mothers without coresident partners approximately

doubled among mothers with lower education (from 10% to 20%). The proportion among mothers with higher education rose from a lower value, but at the same pace (from about 5% in mid-1990s to almost 10%). The absolute difference increased by 5 percentage points. There are some oscillations in the time series. It is hard to decide whether they are random variations in the data or meaningful deviations from the main trend. I am inclined to the formed interpretation. There are no clear breaks at the points of changes in policy (1996, 2009).

Figure 7.3. Proportion of single mothers (LFS) compared to birth register proportions of unmarried mothers, 1993-2009. Households with mothers and infants from the LFS, N=7624; Mothers from the birth register, N= 1,130,156

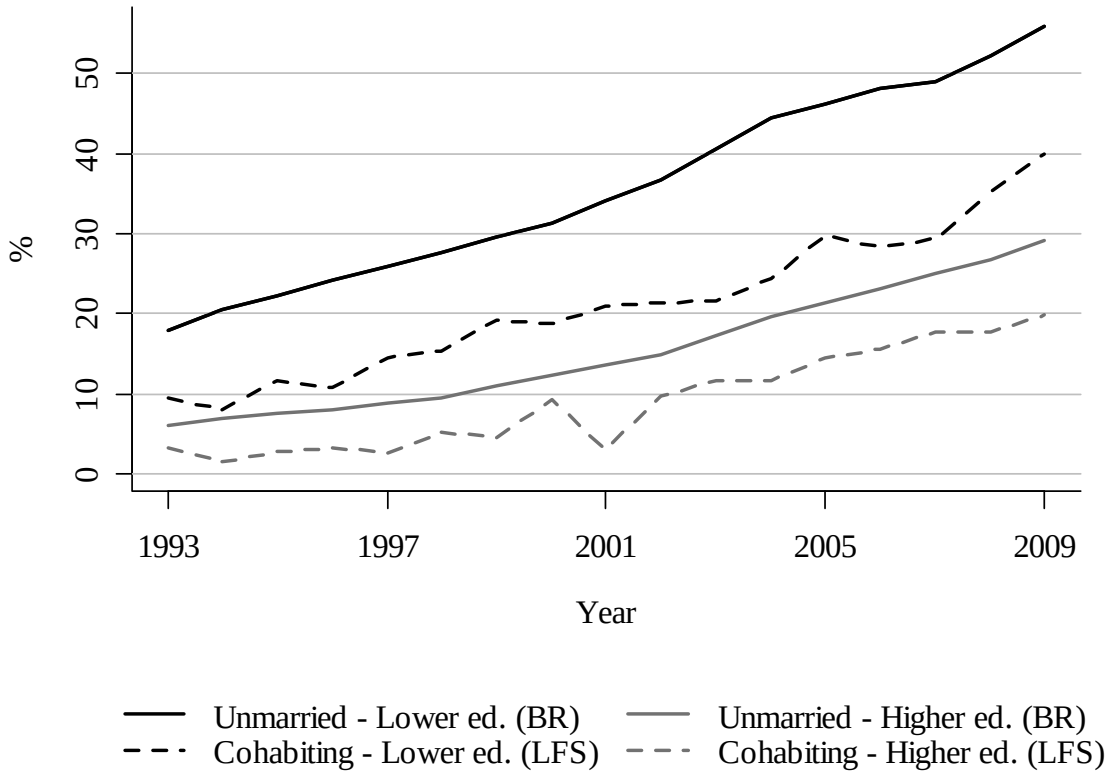


Source: CSO (Birth register) and LFS, author's computations.

Figure 7.4 describes the trend in the share of mothers who cohabit with their partners without marriage by education. The proportion of cohabiting mothers was computed as a difference between the proportion of single mothers (plotted in Figure 7.3) and the birth register proportion to avoid using the biased estimates of cohabiting mothers directly from the LFS data. The proportion of mothers who cohabit rose from 3% to

20% among mothers with higher education and from 9% to 40% among mothers with lower education. The educational gap in cohabiting motherhood has widened in absolute terms (the difference increased from 6 to 20 percentage points), especially in the first part of the time series.

Figure 7.4. Proportion of cohabiting mothers (LFS+BR) compared to birth register proportions of unmarried mothers, 1993-2009. Households with mothers and infants from the LFS, N=7624; Mothers from the birth register, N= 1,130,156.



Source: CSO (Birth register) and LFS, author's computations.

I estimated a series of logistic regression models with single status as dependent variable. They are listed in Table 7.1. Model M1 includes only the effect of maternal education. Model M2 adds age and parity, which significantly improves the model fit. (likelihood-ratio test criterion is 179 with 4 d. f. gives almost zero p-value, AIC declines by 160). The educational gradient in unmarried motherhood is differs by age and parity (see previous chapter). Models M3 and M4 test whether these interactions apply also to single motherhood. Model M3 allows the effect of education to vary by parity. Likelihood-ratio test indicates the interaction as significant at the common 0.05 level (p-

value 0.004). Model M4 adds interaction between education and higher age, which also leads to a better fit. Models 5 and 6 investigate time trend in single motherhood. Model 5 includes a variable with six periods (1993-1995, 1996-1998, 1999-2001, 2002-2004, 2005-2007, 2008-2009) to avoid oscillation of the trend in single years. The trend shows to be highly significant by both likelihood-ratio test and comparison of AIC. Model M6 allows the educational gap in single motherhood to change in time. This does not improve the model. The likelihood-ratio test is statistically highly insignificant (test statistics 5.51 with 5 degrees of freedom leads to p-value 0.368) and AIC increases by 5. Also the values of the interaction coefficients (not shown) are unstable and do not indicate any consistent trend. The educational disparity in the odds of single motherhood thus seems to be relatively stable in time both as a crude effect (see Figure 7.3) and net of age and parity composition of mothers.

Table 7.1. Goodness of fit statistics of logistic regression models of unpartnered motherhood. Households with a mother and infant 1993-2009, N=7624. Mothers, 2007-2010, N=337207.

	Chi2	DF	p-value	AIC
Models on the LFS data (non-resident father)				
M1: Education	128	1	<0.00001	4749
M2: M1 + Age + Parity	291	5	<0.00001	4589
M3: M2+ Education x Parity	302	7	<0.00001	4583
M4: M3+ Education x High age	316	8	<0.00001	4570
M5: M4 + Period	352	13	<0.00001	4544
M6: M5 + Period x Education	357	18	<0.00001	4549
Models on the LFS data (non-registered father)				
M2_br: Education + Age + Parity	16142	5	<0.00001	183521
M4_br4: M2_br + Education x Parity + Education x High age	16876	8	<0.00001	182793

	Likelihood ratio test			Difference
	Chi2	DF	p-value	in AIC
M2 vs. M1	179.09	4	<0.00001	-160
M3 vs. M2	8.36	2	0.004	-7
M4 vs. M3	12.2	2	0.002	-12
M5 vs. M4	36.49	5	<0.00001	-26
M6 vs. M5	5.41	5	0.368	5

Source: CSO (Birth register) and LFS, author's computations.

Coefficients of selected models are presented in Table 7.2. Higher education decreases the logit of single motherhood by 0.87 (i.e. the odds of being single are more than two times lower for mothers with higher education; exp(0.87)=2.39). The size of the

coefficient does not change when maternal parity and age are held constant in Model M2. Model M5 indicates that the educational gap gets stronger with progressing parity. First parity reduces the effect of education by 0.72 (i.e. it approximately halves the gap that is 1.49 among mothers of second children) and third parity increases it by 0.30. The effect of maternal education is much stronger in old age (interaction coefficient 0.76).

Table 7.2. Coefficients estimated in lofgistic regression models of unpartnered motherhood. Households with a mother and infant, 1993-2009, N=7624. Mothers, 2007-2010, N=337207.

	M1	M2	M5	S2	S4
Maternal education (Lower=ref.)					
Higher	-0.873***	-0.822***	-1.492***	-1.123***	-1.385***
Maternal parity (Second child=ref.)					
First child		0.650***	0.416***	0.543***	0.454***
Third+ order child		0.243*	0.293**	0.580***	0.681***
Maternal age (Middle= ref.)					
Low		0.861***	0.846***	0.805***	1.065***
High		0.347***	0.079	0.101***	-0.100***
Higher education x Parity					
Higher education x First			0.715***		0.438***
Higher education x Third+ child			-0.295		-0.525***
Higher education x High age			0.763***		0.594***
Period (1993-1995=ref.)					
1996-1998			0.215		
1999-2001			0.291**		
2002-2004			0.577***		
2005-2007			0.630***		
2008-2009			0.642***		
Period x Maternal education					
1996-1998 x Higher					
1999-2001 x Higher					
2002-2004 x Higher					
2005-2007 x Higher					
2008-2009 x Higher					
Intercept	-1.826***	-2.511***	-2.716***	-2.422***	-2.398***

Note: *** p<0.01, ** p<0.05, * p<0.1; Lower education means elementary or lower secondary; higher education means complete secondary or tertiary.
Source: CSO (Birth register) and LFS, author's computations.

Model M2 also showed that maternal parity and age have strong independent effect on the absence of a coresident partner. Single motherhood is more typical for first-time mothers or mothers with more than two children rather than for those who give birth to their second children. First parity increases the logit of single motherhood by 0.65 and third or higher parity by 0.24. Even stronger is the effect of age. Young age more than doubles the odds of being a single mother (the coefficient 0.86 corresponds with odds ratio 2.36). The effect of older age is 0.3.

The trend in single motherhood captured by Model M5 is upward. The odds of single motherhood are by 90% higher in the period 2008-2009 than in the period 1993-1995 (coefficient 0.64 gives odds ratio 1.90).

One of the purposes of this analysis is to compare the results to the analysis of unpartnered motherhood on register data for period 2007-2010, which only approximates the absence of mother's partner by her willingness to provide paternal information. The two sources of data are approached with different method and categorize maternal education differently. To allow direct comparison, I estimated models analogical to M2 and M4 with the birth register data on period 2007-2010. They are added in Table 7.2 as columns M2_br and M4_br. The size of the coefficients differ somewhat, but the interpretation does not.

The main effects (without interactions – see Model M2_br) are rather similar. The educational gap in single motherhood seems to be stronger in the birth register. The coefficient for higher education is -0.82 in M2 and -1.12 in M2_br. This is can be related to the different measurement. More educated mothers might be more likely to report father even though they do not live with him, because they are probably more aware of the legal consequences. The effect of first parity is similar in models M2 and M2_br (0.65 and 0.54) but the effect of third or higher parity differs more (0.24 vs. 0.58), although it remains in the same direction. Having more than two children thus seems to be more strongly associated with providing no paternal information rather than to living in a household with absent father. This may point to the abuse of social security system. Families with more children have higher minimum living wage which a single (real or misreported) mother cannot reach with her maternity allowance and so she can easily ask for additional allowances. Low maternal age is associated with much

higher risk of single/unmarried motherhood in both models (coefficients 0.86 and 0.81). Unusually high maternal age has low but still positive effect in both models (0.35 in M2 and 0.10 in M2_br).

The interaction terms added in models M4 and M4_br confirm consistency of the pattern of rising educational disparities with progressing parity and show that the association of high age with single status apply only to mothers with higher education. Older and educated mothers have a much higher chance of being single than their less educated counterparts. This holds for both measures of single status. For lower educational group, being an older mother does not elevate the likelihood of single motherhood at all (the coefficient in M4 is close to zero and statistically insignificant) or even slightly decreases it (the coefficient in M4_br is -0.10), compared to mothers in typical childbearing age. The coefficient for older mothers with higher education rises to 0.86 in M4 and to 0.59 in M4_br.

In sum, although the size of the coefficients differs across the two measurements of unpartnered status, their interpretation does not. The approximation of the family arrangement by declarations of child's father can thus be questioned in terms of the precise size of the effects but the meaning of the effects can be considered trustworthy.

The analysis of the trend in the LFS data showed that educational disparity in single motherhood is remarkably stable. There will always be some women who, intentionally or perhaps rather not, get pregnant with a casual sex partner, a married lover, or in a relationship which shortly shows to be not viable. Although there is an educational disparity in this experience, it does not seem to have been influenced by the rapid and profound changes of family behaviour of the last decades. The absence of trend in the educational gap in single motherhood suggests that the changes in the association of unmarried motherhood and educational attainment were driven by changing relationship between these variables and childbearing in unmarried cohabitations.

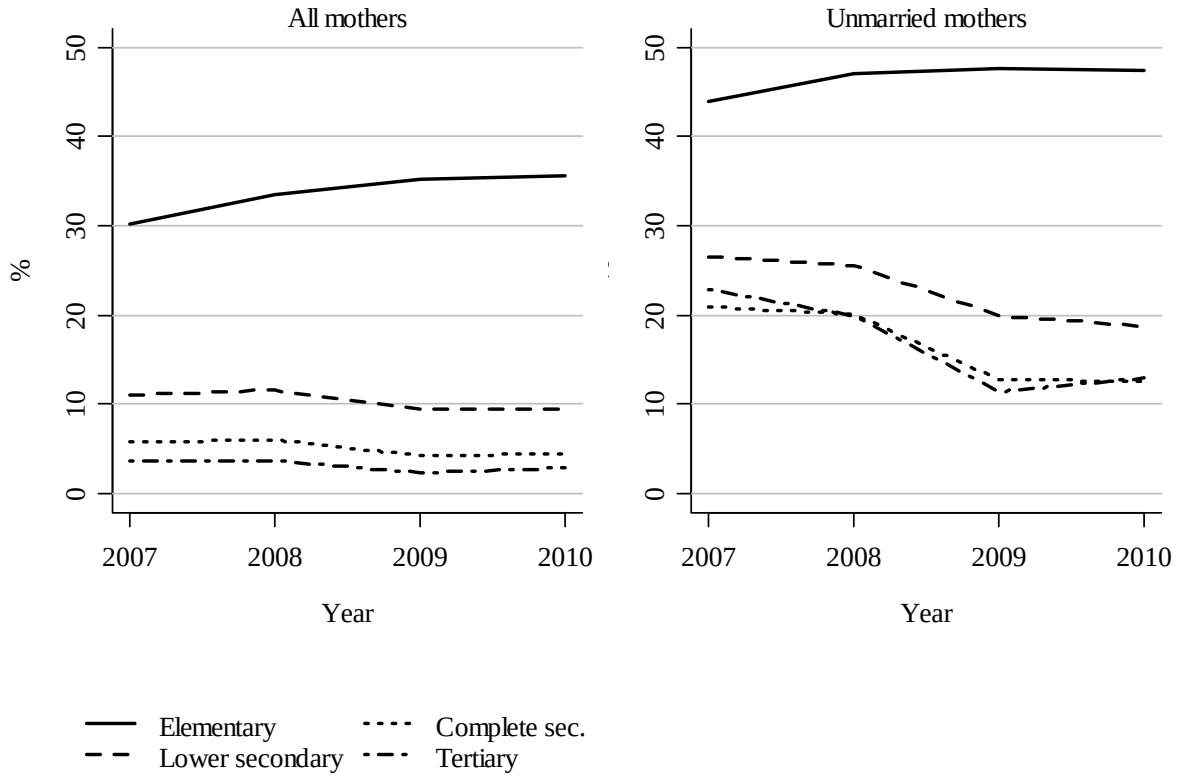
7.3 Partnership situation of unmarried mothers (analysis of birth register 2007-2010)

This chapter provides an analysis of partnership situations of unmarried mothers in 2007-2010, i.e. all married mothers are excluded from the analysis. The models describe the odds of being single (or, more precisely, to not report child's father) among unmarried mothers.

7.3.1 Descriptive analysis

Figure 7.5 presents the proportion of single mothers (those who did not provide paternal information) in 2007-2010 by education. The two panels show the shares of single mothers in total population (the left panel) and among unmarried mothers (the right panel). There are more single mothers in the lower educational groups. The gap between mothers with elementary and any higher level of education is large. About one third of all mothers with lowest educational attainment were unpartnered (did not acknowledge child's father) in late 2000s. In contrast, the share is 10% among mothers with lower secondary education and only 2-3% among university graduates. The educational gradient is clear also when we focus only on unmarried mothers (see the right panel of Figure 7.5). Once unmarried, almost half of mothers with elementary education is not able or willing to report who is the child's father, while the same figure is between 10% and 20% in the highest educational group. There is a marked drop of the share of unpartnered mothers between 2008 and 2009 in all educational groups, except the lowest. This revives the policy adjustment hypothesis, which was not supported by the analysis of unmarried motherhood in general. The break of the trend corresponds to the change of maternity allowance which stopped being provided for a longer time to unpartnered mothers. The financial profit of pretending single status was the highest among mothers with highest incomes. The strong response among the higher educational groups is in line with the policy adjustment hypothesis. Models in the subsequent section will test this result formally.

Figure 7.5. Proportion of unpartnered mothers by education, 2007-2010. Unmarried mothers, N= 461,272.



Source: CSO (Birth register), Author's computations.

7.3.2 Model building

I estimated models which correspond to those from the analysis of unmarried motherhood in general to allow direct comparison of the strength of the effects. The contexts are now only 56 (4 years*14 regions). The estimated models are listed in Table 7.4. Two sets of models are presented in the next two sections. First the individual-level influences and their interactions are inspected. Model M1 contains maternal education as the only predictor. Model M2 adds maternal age and parity. Both of these steps improve the model fit (likelihood-ratio tests yield an almost zero p-value and AIC decreases significantly). Model M3 interacts maternal education with parity. Difference between M2 and M3 is statistically significant at the common 0.05 level (the p-value is 0.004) and also by AIC. The interaction between education and higher age, added in model M4 improves the model, as well.

Table 7.4. Goodness of fit statistics of the random-intercept models of unmarried motherhood. Unmarried mothers, 2007-2010, N(individuals)=163655, N(contexts)=56.

	Chi2	DF	p-value	AIC
Models with individual-level variables only				
M0: Variance components model	--			162113
M1: Education	9035	3	<0.00001	153078
M2: M1 + Age + Parity	9692	7	<0.00001	152286
M3: M2+ Education x Parity	9718	13	<0.00001	152279
M4: M3+ Education x High age	9798	16	<0.00001	152165
Models with context-level variables				
M5: M2 + Year + Unemployment rate + Policy	9694	10	<0.00001	152289
M6: M5 + Unemployment rate x Policy		1	<0.00001	152290
Models with cross-level interactions				
M7: M5 + Year x Education	9776	13	<0.00001	152207
M8: M5 + Unemployment rate x Education	9910	13	<0.00001	152095
M9: M5 + Policy x Education	9794	13	<0.00001	152185

	Likelihood ratio test			Difference
	Chi2	DF	p-value	in AIC
M1 vs. M0	9041	3	<0.00001	-9035
M2 vs. M1	799	4	<0.00001	-791
M3 vs. M2	19	6	0.004	-7
M4 vs. M3	120	3	<0.00001	-114
M5 vs. M2	3	3	0.352	3
M6 vs. M5	0.4	1	0.540	2
M7 vs. M5	87	3	<0.00001	-81
M8 vs. M5	200	3	<0.00001	-194
M9 vs. M5	110	3	<0.00001	-104

Source: CSO (Birth register) and LFS, author's computations.

Second, the influence of the contextual factors is analysed. As in the previous analysis of unmarried motherhood, there are three contextual variables: continuous time as a measure of gradual spread of liberal values, unemployment rate as a measure of economic uncertainty and a dummy variable for policy indicating the change in maternity allowance in 2009. Model M5 stems from M2 and extends it with the three

macro-variables. The likelihood-ratio test does not favour M5 over M2. The test-criterion is 3 with 3 degrees of freedom is highly insignificant (p-value 0.35). AIC is 3 points higher in M5 than M2. The effect of policy and year in fact duplicate each other, so the model is not parsimonious. However, it is theoretically important to separate the effects and inspect whether they apply to all educational groups equally. So I keep and develop M5 further. The analysis of unmarried motherhood from Chapter 6 found that the effect of unemployment depends on the policy regime. Although the effect did not change significantly at the policy change in 2009, the decisions about reporting father in the birth certificate might be more sensitive than unmarried motherhood as such. Therefore Model M6 includes interaction between unemployment rate and policy. This does not help to improve model fit, compared to M5 (likelihood-ratio tests yields p-value 0.54, AIC increases by 2). The subsequent models thus extend Model M5. Models M7 to M9 allow include interactions between education and the three contextual variables. All of these interactions are statistically significant.

7.3.3 General pattern

Models M1 to M4 focus on the individual effects. Their coefficients are shown in Table 7.5. Unlike the previous section, the educational attainment is categorized in the original four categories to allow comparison with the analysis of unmarried motherhood in general. Model M1 includes education as the only predictor. Single motherhood among unmarried mothers is stratified more weakly than unmarried motherhood as such, but the effect is still very strong. The gap in the logit of single motherhood between the highest and the lowest educational category is 1.61. The odds of having no partner are five times (exp(1.61)=5.00) higher for mothers with elementary education, compared to university graduates. Maternal age and parity explain only a small part of the effect (the gap between the lowest and the highest education decreases to 1.38 - see model M2). Model M2 also shows that single motherhood is more common for mothers who already have more than two children (beta coefficient 0.44). First and second parity are not substantially different (the effect of first parity contrasted to second parity is lower than 0.1). Maternal low age elevates her risk of being single (beta coefficient 0.32). Higher maternal age does not make a big difference (the coefficient is lower than 0.1).

Table 7.5. Coefficients estimated in models of unpartnered motherhood among unmarried mothers. Unmarried mothers, 2007-2010, N(individuals)=163655, N(contexts)=56.

	M1	M2	M3	M4
Fixed effects				
Maternal education (Elementary=ref.)				
Lower secondary	-1.093***	-0.984***	-0.928***	-0.880***
Complete secondary	-1.551***	-1.379***	-1.329***	-1.363***
Tertiary	-1.610***	-1.380***	-1.390***	-1.623***
Maternal parity (Second child=ref.)				
First child		0.0595***	0.118***	0.121***
Third+ child		0.437***	0.465***	0.460***
Maternal age (Middle= ref.)				
Low		0.322***	0.328***	0.315***
High		0.0967***	0.0972***	0.103**
Maternal education x parity				
Lower secondary x First			-0.108***	-0.140***
Complete secondary x First			-0.0750*	-0.0555
Tertiary x First child			0.0116	0.135**
Lower secondary x Third+			-0.00822	0.0643
Complete secondary x third+			-0.0934	-0.116*
Tertiary x third+			-0.227*	-0.326**
Maternal education x High age				
Lower secondary x High age				-0.226***
Complete secondary x High age				0.071
Tertiary x High age				0.380***
Intercept	-0.214*	-0.568***	-0.603***	-0.595***
Random effect				
SD(Intercept)	0.925***	0.931***	0.931***	0.932***
Rho	0.207***	0.209***	0.209***	0.209***

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: CSO (Birth register) and LFS, author's computations.

Models M3 and M4 allow the effect of education to vary by parity and age, respectively. According to model M3, the educational gradient in single motherhood strengthens with progressing parity. The differences are rather small between first-time and second-time mothers. But the gap between the lowest and the highest educational category rises from 1.39 at second parity to 1.62 (=-1.39-0.23) at third or higher parity. Model M4 shows that at the same time, the educational gradient attenuates with advancing maternal age. The odds of single status of mothers who are older than is usual do not differ by education as much as among mothers at typical childbearing age.

Higher age even turns to be slightly protective against single motherhood among women with lower secondary education. For instance, the coefficient for tertiary education is reduced from 1.62 to 1.24 at high age. However, these interaction effects are rather small, considering the large size of the main effects of education.

7.3.4 Context-level effects

Model M5 turns back to the main effects (see model M2) and adds macro-level variables. The coefficients are shown in Table 7.6. In general, the macro-level effects are rather small and do not help to explain the variability between contexts. The standard deviation of the random intercepts declined only slightly (from 0.93 to 0.90) and the residual intra-class correlation did not change neither between models M2 and M5. The coefficients of continuous effect of year is negative (-0.09) indicating that unmarried mothers decreasingly tend to be single rather than partnered, net of the effect of policy change which made single motherhood less advantageous in terms of eligibility for benefits. Unemployment rate has virtually no effect (the value of the coefficient is only 0.007). The policy change influenced the logit of single motherhood moderately. Equalization of the conditions of maternity allowance reduced the odds of not reporting child's father by 27% (exp(0.24)=1.27). The economic uncertainty (which has a large variability across contexts) does not seem to influence whether unmarried mothers have partners worth being acknowledged as fathers.

The context-level covariates do not explain single motherhood among unmarried mothers in general, but they might be important only for some groups of unmarried mothers. Models M7 to M9 (see Table 7.6) interact the macro-level effects with educational attainment. The negative effect of time is stronger for mothers with higher than elementary education. The logit of single motherhood declines by only -0.01 per year in the lowest educational category and by -0.16 per year among university graduates (see model M7). Interaction between maternal education and unemployment rate (see model M8) shows an educational gradient, as well. Economic uncertainty promotes partnered status among unmarried mothers with elementary education (a 10% rise of unemployment would decrease the logit of single status by 0.51), has very small effect on partnership situation of mothers with secondary education and lowers the odds of single status among university graduates. For them, a 10% rise of unemployment

would increase the logit of single status by 0.39 (=(-0.05+0.09)*10). Model M9 confirms the interpretation of the maternity allowance effect suggested by Figure 7.5. The cancellation of the prolonged payments for single mothers motivated highly educated unmarried mothers to report fathers (the effect on the logit of single status is -0.03-0.39=-0.42), but there is no effect on mothers with elementary education.

Table 7.6. Coefficients estimated in models of unpartnered motherhood among unmarried mothers. Unmarried mothers, 2007-2010, N(individuals)=163655, N(contexts)=56.

	M5	M7	M8	M9
Fixed effects				
Maternal education (elementary=ref.)				
Lower secondary	-0.984***	0.776***	-1.088***	-0.862***
Complete secondary	-1.379***	1.177***	-1.546***	-1.196***
Teriary	-1.380***	1.388***	-1.554***	-1.164***
Maternal parity (Second child=ref.)				
First child	0.060***	0.058***	0.054***	0.059***
Third+ child	0.437***	0.435***	0.446***	0.436***
Maternal age (Middle= ref.)				
Low	0.322***	0.322***	0.325***	0.322***
High	0.097***	0.096***	0.097***	0.097***
Year (2007=ref.)	-0.094	-0.011	-0.094	-0.097
Unemployment rate (Mean=8.4=ref.)	-0.007	-0.007	-0.051	-0.006
Policy - equal length of allowance	-0.236	-0.234	-0.24	-0.025
Year x Maternal education				
Year x Lower secondary		-0.095***		
Year x Complete secondary		-0.137***		
Year x Tertiary		-0.148***		
Unemp. rate x Maternal education				
Unemp. rate x Lower secondary			0.038***	
Unemp. rate x Complete secondary			0.072***	
Unemp. rate x Tertiary			0.090***	
Policy x Maternal education				
Lower secondary x Equal allowance				-0.221***
Complete sec. x Equal allowance				-0.340***
Tertiary x Equal allowance				-0.386***
Intercept	1.296	-0.261	1.339	1.219
Random effect				
SD(Intercept)	0.904***	0.894***	0.910***	0.893***
Rho	0.199***	0.195***	0.201***	0.195***

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: CSO (Birth register) and LFS, author's computations.

The analyses of this chapter showed that the general trends in unmarried motherhood (which were analysed in Chapter 6) do not apply equally to both unpartnered and partnered motherhood outside marriage. Both groups of unmarried mothers became more prevalent but the arrangement with a coresident partner has spread more intensively. Unpartnered motherhood is also more stable in terms of its educational stratification. So the widening educational gradient in unmarried motherhood is mainly caused by a more intensive shift from marriage to cohabitation among mother with lower levels of education.

Family arrangement of unmarried mothers can be imprecisely but reasonably well approximated by their willingness to declare child's father. Unmarried mothers with lower level of education are much less likely to do so than more educated mothers. Contextual factors (spread of liberal values, economic uncertainty and social policy changes) did not universally influence the reporting about fathers. Their effects are education-specific. When the economic pressures increase, unmarried mothers with low education avoid marriage (see Chapter 6) and stick partnered motherhood outside marriage. This supports the economic uncertainty hypothesis. On the other hand, they do not respond to the policy change that cancelled prolonged maternity allowance for unpartnered mothers. Their likelihood to establish paternity rises at the lowest pace of all educational groups (net of the effect of economic uncertainty and policy).

The importance of the macro-level factors rises with maternal education. More educated unmarried mothers are increasingly more likely to have a child with established paternity. The effect of labour market uncertainty has a positive effect on single motherhood (higher uncertainty promotes unpartnered status). This is consistent with the economic uncertainty hypothesis, but the educational pattern is surprising. The effect of policy change is significant among the most educated for whom the financial lost brought by the new policy is the largest. This is in line with the hypothesis of policy adjustment.

8 CONCLUSION OF EMPIRICAL PART I

Having children without being married has become commonplace during the two decades after the collapse of state socialism. The present analysis showed that the more than four-fold increase in non-marital childbearing rate was driven predominantly by a rising share of mothers who bear children in cohabitation. The incidence of unpartnered motherhood increased, as well, but at a slower pace. The spread of childbearing in cohabitation transformed the meaning of unmarried motherhood. Most of unmarried mothers lived without a partner in 1990. Unmarried motherhood then gradually transformed into a two-parent arrangement. More than 60% of unmarried mothers were cohabiting in the late 2000s and more than three quarters of them established paternity which suggests that they maintained a kind of relationship to him (or were at least willing to support some relationship between the father and his child).

The rise of unmarried motherhood was fuelled by all three hypothesised factors (the gradual value shift, the rising economic uncertainty, and the social policy reforms) but the gradual value shift was the most influential. The spread was onset by the new life orientations and preferences rather than economic pressures. This is in line also with the fact that the nonmarital childbearing rate started to slightly rise already in the 1980s (see Figure 4.1). This is in line with arguments of Rabušic and Možný [1992]. They observed that 31% of couples who were about to enter first marriage in Brno 1985 had spent a period in cohabitation and that the figure had risen to 37% by 1990. The authors attribute the trend to widening opportunities for individualised lifestyles [*ibid*.]. Similarly, Gerber, and Berman [2010] relate the retreat from marriage in post-Soviet Russia to changing attitudes to family formation rather than to economic hardship. The ideational change as the main source of family changes (decrease in marriage, spread of cohabitation and nonmarital childbearing) in Central and Eastern Europe is preferred also by Thornton and Philipov [2009]. They argue that people started to look up to Western Europe (instead of the East that was admired before) as to a model to be followed, including the family behaviour.

According to Giddens [1992], the individualisation of family life is based on ‘everyday social experiments’ with love, sex, and intimacy. The social climate of re-gained freedom opened way to such experiments with family life after 1989, be they inspired

by admiration of the West or widening lifestyle opportunities. These influences prevailed even though structural pressures promoted marriage in the early 1990s (see below).

The effect of the spread of individualist values was the most pronounced during the whole period. Mothers increasingly tended to bear children outside marriage, irrespective to economic conditions and policy measures. The recent data with a detailed measurement of family arrangements suggest that the tendency was stronger for two-parent than for single-mother non-marital family arrangement. These findings support the individualization as an important source of the shits in marital behaviour of mothers. The effects of continuous time are stronger among mothers with higher education (although the most educated deviate a little – see below) which is also predicted by the individualization hypothesis.

Rising economic uncertainty and social policy reforms also contributed to the spread of non-marital childbearing later during the study period. Their effects are closely related to each other. Cancellation of the support for newlyweds and universal benefits for families in the early 1990s strongly motivated mothers to remain unmarried. This result confirms the arguments of some authors [Katrňák 2006; Soukupová 2007, 2008] that the rise of unmarried motherhood was supported by introduction of family policy which was generous to single mothers but did not support married parents. They based these claims mainly (but not only) on evaluation of financial benefits available to unmarried mothers. My analysis shows that this can be supported also by behavioural outcomes. The cancellation of the prolonged payment of maternity allowance for single mothers in 2009 did not promote marriage (except for a weak effect among mothers with the lowest level of education) but made more mothers establish paternity of their children. This refers to mothers with secondary and especially university education, who usually have larger salaries and thus had the largest financial benefit of being treated as unpartnered by the authorities. The results thus suggest that this policy change prevented unmarried couples from misusing social benefits by pretending single motherhood.

The policy reforms also modified the relationship between non-marital childbearing and economic uncertainty. Higher labour market insecurity was associated with lower odds of non-marital childbearing until the social and family policy reforms were completed in

1996. This relationship reversed afterwards. The economic uncertainty thus contributes to explaining the spread of non-marital childbearing only since the second half of the 1990s. The first half of the 1990s can be thus considered a transitory period with many inertial traits in both marital behaviour of parents and family and social policy. Then a new regime of economic vulnerability of families caused many mothers (or their partners) to be hesitant about marriage. The unemployment rate reached higher values and the transformation of the job market (including massive releases of employees and rising income inequality) took place in the late 1990s (cf. [Večerník 2001]). This raised the bar of economic security perceived as necessary for entering marriage.

The positive association between unemployment and unmarried motherhood even strengthened recently (after 2009). This could be a consequence of economic crisis or a feedback effect of the elevated marriage bar. McLanahan and Percheski [2008] explain that when couples postpone marriage for economic reason (as Czech parents did since the mid-1990s), it raises the economic standard of married couples even higher and promotes further postponement of marriage.

Although unmarried motherhood has spread in all educational groups, there is a persistent educational gradient in unmarried motherhood in general and in unpartnered motherhood in particular. Women with lower socioeconomic status (approximated by educational attainment) are more likely to bear a child as unmarried or even unpartnered. The effect of education is not the same at all stages of life course, but the educational gradient is ubiquitous. The educational gradient in unmarried and unpartnered motherhood becomes stronger with progressing parity. Unmarried status is common for first-time mothers of all educational groups, but only less educated women tend to have more children outside marriage. This applies to unpartnered motherhood, as well. The narrower educational gap among first-time mothers conforms the findings that unmarried mothers with higher educational attainment are more likely to enter marriage after their first child was born [Chaloupková 2011]. On the other hand maternal age attenuates the educational differences. Older mothers with different levels of education are more similar to each other in terms of marital status, because highly educated mothers increasingly adhere to unmarried (especially unpartnered) motherhood as they get older. This is probably caused by age limits of childbearing. Bartošová [2009] conducted qualitative interviews with women who remained childless

until thirty (only some of them had children eventually). Her childless interviewees who wanted to have children but waited for the right partner realised that they are lowering their originally high expectations about the potential father as they approach the limits of their reproductive age. Some of them even claim that they are ready to become unpartnered mothers rather than remain childless [*ibid*.]. Although the influence of education on unmarried motherhood varies by maternal age and parity, lower education is associated with higher likelihood of unmarried status at every stage of life-course.

The socioeconomic gradient in unmarried motherhood was not stable over the study period. The educational disparities were growing in 1990s. The disparity between the lowest and the highest educational category seem to be even narrowing at the end of the study period (this hold when expressed in relative terms, but the absolute disparity persists). The educational gap in motherhood without a partner showed to be rather stable, so the rising disparity in unmarried motherhood is driven by a faster spread of childbearing in cohabitation among mothers with lower education. Highly educated mothers started to catch up later.

The meaning of unmarried motherhood and the sources of its rise differ by maternal socioeconomic status. Previous research shows that women with low education tend to appreciate marriage as the best arrangement for childbearing [Chaloupková, Soukupová 2007]. But they have the highest chance to be unmarried when giving birth. Once unmarried, they are also most likely to have no partner. The rise of unmarried motherhood among unqualified women followed a gradual increase in time, net of economic situation and policy regime. Although the effect is the weakest among the educational groups, it is strong and suggest that they are not unaffected by the spread of individualist values. It is possible that the liberalization of attitudes towards non-marital childbearing made them do so increasingly not because they preferred the unmarried family arrangements, but because the norms that would penalize it attenuated. Similar interpretation of the influence of individualist values is offered also by [Možný 2002]. Mothers with elementary education responded relatively weakly to the economic situation until recently. However, the recent data suggest that they started to prefer unmarried partnership over marriage under precarious labour market situation. They are also mostly insensitive to social policy (except a sudden change in marital behaviour in the early 1990s). Unmarried motherhood of poorly educated women may be a result of a

realistic judgement of their marriage prospects. Marital partners tend to come from the same social class [Blossfeld, Bucholz 2009; Smits et al. 1998; for Czech data see Katrňák 2008]. This is supported also by my previous analysis which showed that the educational homogamy of Czech married parents did not decrease between 1990 and 2008 and even rose among lowest educational group [Štípková 2012]. Unlike their desires, lower-class women's chances of meeting a partner who would share their reproductive intentions and would be able to secure the material needs of the family are limited.

Women with secondary education form the majority of mothers. They respond to the gradual spread of liberal values the most intensively and are also very sensitive to policy changes. Their probability of being unmarried also reacts on economic uncertainty. When the unemployment rate rises, they increasingly tend to have children outside marriage, probably as a temporary solution until they feel their life situation is stable enough. The risk of unpartnered motherhood for mothers with lower secondary education drops as they get older (and rising age does not elevate the risk of single motherhood substantially for mothers with elementary and complete secondary education). Qualitative studies show that postponing parenthood to later age is often perceived (at least retrospectively) as waiting to meet the right partner, secure sufficient material conditions, or feel ready and mature enough [Hašková 2009, Bartošová 2009]. This protection effect of age is, however not present among mothers with university education (see below).

Mothers with high education are the least likely to have children outside marriage and if they do so, they are the most likely to have a partner. The onset of the rising trend of non-marital childbearing was delayed among them, because women who entered adulthood in 1990s (and were thus exposed to the new individualist values) and got university education postponed childbearing [Kantorová 2004]. The delay of childbearing may explain why the effect of individualization is weaker than among mothers with lower secondary education (but still very strong). Another explanation of the lower effect is that the most educated women are most likely to realise their lifestyle preferences outside family life. Those of them who decide to have children could be more oriented towards traditional values. The rise of non-marital childbearing among mothers with tertiary education is decreasingly related to the economic conditions and

also relatively weakly tied to social and family policy reforms. The only policy change they responded to significantly is an elevated willingness to establish paternity when single motherhood stopped being advantaged by higher maternity allowance.

The second empirical part of the dissertation studies how have this extensive transformation of family arrangements to which children are born influenced their health and health inequalities between children born to these family arrangements.

Empirical Part II

Birth weight and its relation to family background

Family arrangement of pregnant women influences foetal development and infant health. Parental marriage is universally found to have a positive impact on birth outcomes. Studies from European countries, the United States and Canada show that non-marital children, compared to children of married mothers, face a higher risk of foetal death and stillbirth [Arntzen et al. 1996, Balayla 2011, Carlson et al. 1999], preterm birth [El-Sayed 2012, Kramer et al. 1998, Koupilová et al. 1998, Shah et al. 2011], low birth weight [Castro Martín 2010, Kirchengast et al. 2007, Koupilová et al. 1998, Shah et al. 2011, Vågerö et al. 2007], and infant death [Arntzen et al. 1996, Balayla 2011, Koupil et al. 2006, Rychtaříková and Demko 2001, Salihu 2004].

As I showed in the first empirical part of the dissertation, the prevalence and meaning of non-marital childbearing changed significantly during the past two decades. The second part of the dissertation studies whether and how the health advantage of marriage changed during the period of rapid spread of non-marital childbearing. It has five chapters.

The theoretical Chapter 9 discusses the ubiquitous finding that maternal marriage has a positive influence on birth outcomes. Three sources of the marital status gap are described, the self-selection of married mothers, the supportiveness of marriage in comparison to other family arrangements, and the social acceptance of non-marital childbearing. I then review what is known about the influence of social factors in birth outcomes in the Czech Republic. Special attention is paid to trend in the strength of the effects. Finally, the goals hypotheses for the subsequent analysis are introduced.

Chapter 10 focuses on the general trends in birth outcomes. It justifies the birth weight as health outcome of interest in the subsequent analysis. Two measures of birth weight are used throughout all parts of the analysis, a continuous measure reported in grams and a binary indicator of low birth weight. Chapter 11 provides descriptive and multivariate analysis of the marital status gap in birth weight. Chapter 12 then analyses

whether the effects of unmarried status identified in the first part of the analysis hold equally for children born to partnered and unpartnered unmarried mothers.

9 FAMILY ARRANGEMENTS AND BIRTH WEIGHT – THEORETICAL BACKGROUND

Chapter 2.3 explained that birth weight results from a very complex bio-psycho-social process. I pointed to the Spencer's [2003] explanatory framework that links birth weight to multiple more or less direct causes. Spencer [2003] pays no special attention to the role of partnership arrangements in his model; he subsumes this within a broader variable of socioeconomic status. His causal framework is useful for understanding the complexity of the process, but it needs to be simplified and focused on the effect of maternal marital status for the purpose of the present analysis. This is done in the next section. The subsequent section then reviews Czech research on birth outcomes and their social causes.

9.1 Explanations for the health disadvantage of non-marital children

There are three streams of explanations for the marital status disparity in birth weight or infant health in general. They include selection to marriage, the direct effect of marriage, and social acceptance of non-marital childbearing [Shah et al. 2011].

9.1.1 Selection to marriage

The selection argument suggests that the positive effect of marriage is due to the self-selection of married mothers from social and demographic groups whose children have better health prospects. Married mothers usually come from a more well off social background, are better educated, healthier, and lead a healthier life style. Health-related behaviour, especially diet and smoking during pregnancy, have a strong effect on the foetal growth [Cnattingius 2004; Kramer 2000, 2003]. Maternal working conditions are important, as well. Birth outcomes are negatively influenced by physically demanding occupation, especially prolonged standing [Croteau 2007; Mozurkewich et al. 2000; Saurel-Cubizolles 2003], shift work and night work [Bodin et al. 1999; Fortier et al 1995; Mozurkewich et al. 2000] (however, [Zhu et al. 2004] found a very limited effect of shift work in Denmark). Exposure to continual noise at the workplace also impairs birth outcomes [Hartikainen et al. 1994; Hrubá et al. 1999]. All of these factors are

correlated with maternal education or other measures of socioeconomic status [e.g. Kramer 2000; Villabí et al. 2007].

The selection argument claims that it is the selection of married mothers from higher social strata what makes them more likely to have a healthy child. When the family's socioeconomic characteristics, that are associated with marital status, are taken into account, the positive effect of marriage on various health outcomes declines, but it does not disappear in most outcomes [Balayla 2011, Castro Martín 2010, Shah et al 2011]. Socioeconomic election thus explains only part of the health disadvantage of marital children.

Beside socioeconomic status, the demographic characteristics of married and unmarried mothers may confound the effect of marital status on birth outcomes. These include especially maternal age and parity. Children born to mothers at the margins of the reproductive ages face an elevated risk of worse health outcomes [Yang et al. 2006]. First-born children are usually smaller than second-order children for physiological reasons. The average birth weight then decreases for newborns of third and higher parities [Spencer 2003; Yang et al. 2006]. Marital status of mothers is closely related to the stage of their family trajectories. Unmarried motherhood is typically associated with wither early stages of family life or with repeated family formation after divorce. Higher prevalence of very low or very high maternal ages, and first or higher than second parity, among unmarried mothers explains part of the marital status gap in birth outcomes [El Sayed 2012; Luo et al. 2004].

9.1.2 Direct effect of marriage

If the effect of marriage cannot be fully explained by the selection, there has to be something beneficial about this family arrangement itself. Beside marriage, a positive effect on birth outcomes can be found also for stable unmarried relationships. Children of unpartnered mothers fare worse than children of cohabiting mothers, although

cohabitation is not as protective as legal marriage [Blondel, Zuber 1988; Doucet et al. 1989; Luo et al. 2004; Shah et al. 2011; Young, Declercq 2010].[25]

Relationship characteristics seem to be responsible for the differences between formal marriages and informal relationships. Married people usually report a higher level of partnership quality than cohabiters [Brown, Booth 1996; Skinner et al. 2002; Lee, Ono 2012] or couples living in other forms of non-marital relationships [Strohm et al. 2009]. Spouses invest more in the relationship, especially in comparison to cohabiters without plans to marry [Poortman, Mills 2012]. Cohabitations are also more likely to break up than marriages [Kiernan 2006; Liefbroer, Dourleijn 2006; Osborne et al. 2007]. Bird et al. [2000] showed that the marital status disparity in low birth weight risk can be explained by relationship type and duration.[26] Similarly, Bloch et al. [2010] found a positive effect of relationship quality on birth weight in a study of low-income unmarried mothers. On the other hand, having an abusive partner influences birth outcomes negatively. For instance, physical violence by a partner was found to impact on preterm labour and birth weight (as well as delivery complication and maternal postpartum hospitalization [Cokkinides et al. 1999; Shay-Zapien; Bullock 2010].

Spouses provide each other with emotional, psychosocial as well as economic support and promote healthy lifestyle [Carr, Springer 2010; Hamplová 2012] (see also Chapter 2.2). This effect shows to be very important for pregnant women and their birth outcomes. Kiernan and Pickett [2006] found that close ties between parents contribute to avoiding smoking during pregnancy (and also support positive post-partum outcomes: breastfeeding and absence of maternal depression). Marriage showed to be most supportive with unmarried relationships lagging behind. The least favourable outcomes were observed among mothers without coresident partners or without partners at all [*ibid*.].

[25] However, some studied (e.g. [Young, Declerq 2010]) also found no difference between marriage and cohabitation.
[26] This result applies to the American non-Hispanic white population. Different patterns were found in other ethnic groups.

Experiencing stress during pregnancy has a damaging effect on the foetal development [Hoffman, Hatch 1996; Sable, Wilkinson 2000].[27] The effect of stress in pregnancy is direct and also indirect, because higher level of psychosocial stress is positively associated with risky health behaviour like smoking and drug or alcohol use [Sable, Wilkinson 2000; Woods et al. 2010]. Unsatisfactorily partnership situation is among the strongest correlates of stress in pregnancy. The quality of parental relationship was found to influence the level of experienced stress and smoking [Kimbro 2008]. Sable and Wilkinson [2000] identified several life events that exacerbate perceived stress of pregnant women and lead to a higher risk of low birth weight. They included also factors related to the partnership situation, e.g. having got back with a partner after a breakup or physical fight with the partner [*ibid.*]. Violent behaviour of a partner was found to elevate stress also by Woods et al. [2010].

In sum, supportive relationships prevent stress and stimulate healthy behaviour during pregnancy. Social support by a partner or other relative prevents adverse pregnancy outcomes also among women who suffer low level of stress [Hoffman, Hatch 1996]. This psychosocial support contributes to more favourable birth outcomes of children born to couples with satisfactory relationships. On the other hand, absence of a supportive partner or an abusive partner makes mothers and their children disadvantaged in terms of psychosocial stress and health-related behaviour, which impacts on the health of their children negatively. The beneficial effect of marriage on birth outcomes stems from a higher quality and supportiveness (on average) of marital unions compared to other family arrangements.

9.1.3 Social acceptance and stigmatization of non-marital childbearing

Unmarried motherhood is (or was) usually associated with a more or less severe social stigma (see e.g. [Hyde 2000]). Deviation from social norms imposes psychosocial stress to unmarried mothers and may prevent social support. For instance, a study of U.S. pregnant teenagers found than almost 40% them felt stigmatized by the pregnancy,

[27] Psychosocial stress in pregnancy is defined as "an internal psychological state of an individual who perceives threats to wellbeing" [Ruiz, Fullerton 1999: 20]. The experience of stress rises from feelings of imbalance a pregnant woman has when she cannot cope with demands of her life situation [*ibid.*]. Researchers have studied the impact of specific stressful events, but the perception of these events as stressful showed to be more important than the experience as such [Sable, Wilkinson 2000].

which was associated with an increased risk of social isolation and verbal attacks from family or peers [Wiemann et al. 2005]. Another study, with a vignette design, showed that relatives are less willing to provide support for unmarried parents if they perceive the extramarital birth as embarrassing [Mollborn 2009]. Having a non-marital birth in a context where non-marital childbearing is not socially accepted and causes social stigma has more adverse consequences than unmarried birth in the context of highly prevalent and approved non-marital childbearing. This is supported by Zeitlin et al. [2002] who compared the effect of marital status on preterm birth across 16 European countries with various prevalence of non-marital childbearing. Both unmarried cohabitation and single status were stronger predictors of preterm birth in countries where having children outside marriage was less common [*ibid*.]. Also analyses from single countries report less diminishing effect of marital status when nonmarital childbearing becomes more common. A Finnish study [Rantakallio, Oja 1990], for instance found that the health gap between marital and nonmarital newborns declined between 1966 and 1986, when the non-marital childbearing rate rose from 4% to 20%.

9.2 Previous research on social differences in birth outcomes in the Czech Republic

There is a substantial body of research on social influences on birth outcomes in the Czech Republic. Most of them [Carlson et al. 1999; Dzúrová 2001; Gerylovová, Holčík 1997; Koupilová et al. 1998a, 1998b; Kreidl Hrešanová 2007; Rychtaříková 1999, 2001; Rychtaříková, Demko 2001; Štípková, Kreidl 2011] work with data from the population registers of abortions, births, congenital malformations, and infant deaths. There are also several hospital-based studies of post-partum women [Bobak et al. 2005; Dejmek et al. 2002; Králíková et al. 2005; Rambousková et al. 2009; Rossnerová 2011] and a cohort study which recruited pregnant women [Hrubá et al. 1999; Kukla et al. 2002]. The latter surveys measure a wider range of variables, including behavioural characteristics that help understanding the mechanisms of the social disparities. Results of these studies are consistent with the general patterns of social disparities in the health of infants described in above. Below I summarize what has been found about these influences and widen the discussion also to other factors.

9.2.1 Socioeconomic status of parents

Socioeconomic status of the family is an important predictor of birth outcomes. High maternal education positively influences birth weight [Koupilová et al. 1998a; Rychtaříková 1999; Štípková, Kreidl 2011] and length of pregnancy [Koupilová et al. 1998a; Štípková, Kreidl 2011]. Maternal education also reduces the risk of foetal death [Carlson et al. 1999] and infant mortality [Koupilová et al. 1998a; Rychtaříková 1999; Rychtaříková, Demko 2001]. The positive effect of maternal education on infant survival persists even after controlling for birth weight and gestational age [Koupilová et al. 1998a; Rychtaříková, Demko 2001]. Paternal educational attainment has been found to positively influence birth outcomes, as well, although it is less important than maternal education [Kukla et al. 2002; Rychtaříková 2001].

Previous section explained that the effect maternal socioeconomic status is to a large extent mediated through working conditions and health-related behaviour. Shift-work and occupational exposure to permanent noise, which are typical for poorly qualified women, impair intrauterine growth [Hrubá et al. 1999]. Moreover, occupational exposure to chemicals causes a higher incidence of congenital malformations [*ibid.*]. Smoking, a major risk factor directly influencing foetal development, is also more prevalent among women with lower levels of education [Králíková et al. 2005]. The birth weight disparity between children born to smokers and non-smokers reaches hundreds of grams [Dejmek et al. 2002; Králíková et al. 2005; Kukla et al. 2001]. For instance, Dejmek and his colleagues [2002] found a disadvantage of 239 g for children born to women who smoke more than 10 cigarettes a day in the third trimester of pregnancy.[28] Heavy exposure to tobacco smoke during pregnancy also significantly limits intrauterine growth, although the effect is weaker [Dejmek et al. 2002; Kukla et al. 2001].

The importance of maternal education has been changing during the post-socialist transformations of the Czech society. The educational gap increased during 1990s [Koupilová et al. 1998a; Kreidl, Hrešanová 2007; Štípková, Kreidl 2011]. For instance, Koupilová et al. [1998a] report that the odds of post-neonatal death was 1.47 time higher among children of mothers with elementary education relative to children of university graduates in 1989-1991. The odds ratio then increased to 1.91 till 1994-

[28] This effect is controlled for a wide range of maternal characteristics. The crude effect is substantially higher: 408g [Dejmek et al. 2002]

1995.[29] Similar trend of widening educational gradient during 1990s was observed for several indicators of birth weight, length of pregnancy and stillbirth [Štípková, Kreidl 2011]. The disparity then stabilized or started to decline during 2000s [*ibid*.].

9.2.2 Family arrangements

The effect of family arrangement is less understood. The universally found favourable effect of parental marriage on birth outcomes is confirmed also with Czech data, but the influence of various non-marital partnership situations is not described. Children born to married mothers have, on average lower risk of low birth weight [Koupilová et al. 1998a; Kreidl, Hrešanová 2007; Rychtaříková 1999; Štípková, Kreidl 2011], prenatal death [Carlson et al. 1999; Štípková, Kreidl 2011], and infant mortality [Koupilová et al. 1998a; Rychtaříková 1999; Rychtaříková, Demko 2001]. However, the effect on infant survival is fully explained by less favourable birth weight composition of non-marital children [Rychtaříková 1999; Rychtaříková, Demko 2001].

As far as I know, there is only one paper that used other measurement of family arrangement than legal marital status. Kukla et al. [2002] studied the impact of whether the mother has a coresident partner/husband or not. Children born to single women were, on average, 95 g lighter. The mothers were also asked whether the partner is their husband or not. Mothers who were not married to their partners had 89 g lighter infants than married mothers and single mothers had 39 g lighter infants [Kukla et al. 2002]. This does not conform the gradient of family arrangements with single status being the least protective described above. However, the study has severe limits. It included only women who gave birth in Brno in 1991-1992 and the sample was highly selective, because of high failure rate of collecting the data about conditions during pregnancy (only 3327 out of the total of 5370 filled the questionnaire).[30] Moreover, the share of women who reported other family arrangement than living with a husband was very low (6%, which is in line with the results of Chapter 7), so the birth outcomes may be easily biased in such a small group of respondents.

[29] This result is controlled for birth weight, maternal marital status, age, parity, and sex of the infant. The crude odds ratios are much higher (2.69 in 1989-1991 and 3.68 in 1994-1995) [Koupilová et al. 1998a].

[30] The limited coverage of the population did not result from a high non-response rate, but from a failure of reaching the women in hospitals during pregnancy because of the newly introduced option of prenatal care by private gynaecologists [Kukla et al. 2002].

There is limited evidence about the trends in the effect of marital status in time. Koupilová et al. [1998a] found that the marital status gap increased immediately the fall of the socialist regime. The disadvantage of children born to single mothers (compared to marital children) was 169 g in 1989. The figure then rose to 191 g in 1990. The disparity then returned to around 165 g in mid-1990s [Koupilová et al. 1998a].[31] Kreidl and Hrešanová [2007] analysed data on birth weight between 1994 and 2002 and found that the birth weight of children born to both married and never married mothers increased. The increase was steeper among children of never married mothers which reduced the gap from 172 g to 145 g [*ibid*.].

9.2.3 Maternal age and parity

The stage of maternal life course, defined by her age and number of previous births, is important, as well. Firstborns have, on average, lower birth weight, which makes them more susceptible to infant death [Rychtaříková 1999]. However, the risk of infant death rises gradually with increasing parity when the birth weight composition is controlled for [Rychtaříková 1999; Rychtaříková, Demko 2001]. The negative impact of higher order is especially pronounced at very young ages, e.g. having the second child before reaching 20 years [Rychtaříková, Demko 2001]. The authors interpret this finding as a result of social characteristics of women who have this childbearing behaviour [Rychtaříková, Demko 2001: 331].

Maternal age seems to be of less importance. It has a U-shaped effect on birth weight and survival (children born to very young or older women are at higher risk of negative outcomes) [Rychtaříková 1999]. However, maternal age is strongly correlated with parity, education, and (especially at low ages) with marital status. When these factors are taken into account, the net effect of age attenuates of even turns to be unimportant. The net effect of maternal age on survival chances even showed to be moderately positive in Rychtaříková's [1999] analysis. The authors suggest that the explanation could be housing conditions and income, which tend to improve with age [Rychtaříková

[31] These results are controlled for maternal age, parity, education, and sex of the infant [Koupilová et al. 1998a].

1999: 99].[32] I am not aware of any study that would assess whether the effect of parity or maternal age changed in time.

9.2.4 Region-specific factors

There are also significant regional disparities in birth outcomes [Dzúrová 2001; Gerylovová, Holčík 1997; Rychtaříková, Demko 2001]. Less favourable outcomes are typically found in areas with worse socioeconomic situation, like regions Karlovarský, Ústecký, Liberecký and Ostravský. For instance, Gerylovová and Holčík [1997] report elevated infant mortality rates in these regions. Incidence of congenital malformations was found to be clearly the highest in the region Karlovarský [Dzúrová 2001]. However there are also exceptions to this pattern, for instance Rychtaříková and Demko [2001] document higher infant mortality rate in Prague and the rural Southern-Bohemian (Jihočeský) region. But Prague, on the other hand, recorded a faster progress in reduction of neonatal mortality than the remaining regions, probably due to more rapid improvements in medical care [Koupilová 1998b]. The quoted papers do not analyse regional patterns of birth weight, but Chapter 11 will show that there are regional disparities in this outcome, as well.

Beside socioeconomic differences, there are more explanations for the regional disparities. One of them is air pollution, which contributes to adverse birth outcomes [Bobak, Leon 1999; Bobak 2000; Rossnerová 2011]. This applies especially to the area along the North-Western border with opencast coal mines and a history of intensive industrialization. Another source of health disadvantage of regions may be their ethnic composition. The area along the German border was originally settled by Germans. They were re-settled shortly after the end of WWII and the vacated area was inhabited by newcomers from different parts of the re-established Czechoslovakia, including migrants of Roma ethnicity. Several studies of Roma mothers show that the birth outcomes of their children are impaired, in comparison to majority population. Data on maternal ethnicity are not available from the birth register. Hospital-based studies revealed a large disadvantage of Roma newborns in terms of their birth weight,

[32] Rychtaříková also provides an alternative explanation which relates to the limits of the data. Birth at very low or very high maternal ages are less frequent and so any effect could be less significant due to the limited number of cases [Rychtaříková 1999: 99].

gestational duration [Bobak et al. 2005; Rambousková et al. 2009] and birth length [Rambousková et al. 2009]. For instance, Bobak et al. [2005] found that Roma newborns weighed on average more than 370 g less than those of non-Roma origin. A substantial part of the ethnicity gap can be explained by maternal socioeconomic characteristics [Bobak et al. 2005; Rambousková et al. 2009], smoking [Bobak et al. 2005; Rambousková et al. 2009], and nutrition [Rambousková et al. 2009]. An explanation of the persisting health disadvantage of the Roma is ethnic/racial discrimination and marginalization they face. Their labour market disadvantages have risen since 1989 [Pulkrábková 2009]. They are also limited in access to education. Roma children are often placed in sub-standard track of elementary education which prevents them from continuing higher-level education [Nekorjak et al. 2011].

9.2.5 Explanations of the trends

The research undertaken so far provides an extensive evidence about social inequality in the health of newborns. It also suggests that the pattern of these disparities changed during the eventful and change-bringing post-social period. Authors provide several explanations.

First, the role of changing composition of the population of mothers is acknowledged. There were profound changes in the socio-demographic characteristics of women who bear children which contributed significantly to shaping the trends in birth outcomes. The improvement of birth outcomes was fuelled by rising educational attainment and age of mothers and mitigated by rising share of unmarried mothers [Kreidl, Hrešanová 2007; Kreidl, Štípková 2009]. Kreidl and Hrešanová [2007] further suggest that the rising educational disparity can be explained by interaction of educational attainment and marital status: education stratifies birth outcomes more strongly among unmarried mothers and, consequently, the increasing share of unmarried mothers resulted in wider average disparity in 1990s (they studied period 1994-2002).

Second, the strengthening educational disparity can be related to social and economic changes that were concentrated to the first decade after the collapse of the state socialism [Koupilová et al. 1998a; Štípková, Kreidl 2011]. These changes included especially rising inequality in socioeconomic opportunities and risks, which became

more tied to educational attainment (see also Chapter 3.1). Health inequalities could be also influenced by the transformation of the Czech health care system in the first half of the 1990s. The reform assumed (and encouraged) a more active role for patients in utilising health care and lead to commercialisation of the health-care system's approach to its clients [c.f. Hasmanová Marhánková, Hrešanová 2008]. The growing emphasis on individual agency and responsibility may have made socioeconomic status a more salient factor influencing how and when (potential) patients seek out and use health-care services. Štípková and Kreidl [2011] suggest that the growing advantage of children born to highly educated women in 1990s may result either from their faster and more successful adjustment to the new social and economic situation or from their more deliberate assessment of whether and when bear children.

9.2.6 Limitations of previous research

There is a solid base of knowledge about social determinants of birth outcomes but our understanding of the time trends in these effects is still limited. The research on the trends in social disparities in birth outcomes has paid more attention to the diverging outcomes of educational groups. Although the importance of family arrangements and its close association with education has been acknowledged [Kreidl, Hrešanová 2007; Rychtaříková 1999], a deliberate analysis of this association is lacking. Non-marital childbearing rose considerably in the past two decades, but there is no assessment of how the effect of marital status on birth outcomes changed during this period in general or within individual educational groups.

Furthermore, the effect of marital status may have changed due to the growing tendency of postponement of marriage after first birth. Nothing is known about whether marriage represents the same advantage for firstborns and higher-order children.

9.3 Research goals and hypotheses

Below, I formulate research goals which focus in the trend in marital status gap in birth outcomes. I then offer four hypotheses of how and why the marital status gap changed.

9.3.1 Research goals

The goal of the present analysis is to describe and explain the trend in the marital status gap in two birth weight measures: the continuous measure of birth weight given in grams and the binary indicator of low birth weight. The analysis of continually measured birth weight provides a sensitive assessment of the disadvantage at any point of the birth weight distribution. Low birth weight represents a serious health issue therefore any disparity in this outcome is a stronger evidence of a health disadvantage.

I have four partial goals for the analysis.

1. The first goal is to describe the general trends in birth weight and inspect whether both marital and non-marital children participated equally in these trends.

2. The second goal is to identify sources of the trends. Four hypotheses stemming from the theoretical explanations, reviewed above, are formulated and tested in the subsequent analysis. Two of the explanations relate the trend to the composition of mother by education, parity and age. The other two explanations assume a change in the direct effect of marital status itself.

3. The third goal is to inquire in the heterogeneity of family arrangements of unmarried mothers and quantify the effect of partnered and single motherhood on birth weight.

4. Finally the last goal is to assess whether the effect of single and partnered status on birth weight changed as the prevalence of these family arrangements changed. I will use the partially observed and partially imputed data on partnership status of unmarried mothers for this purpose.

9.3.2 Hypotheses

The theoretical explanations of the positive effect of marriage on birth outcomes propose three arguments: the self-selection of unmarried mothers from women with unfavourable (in terms of birth outcomes) characteristics, supportiveness of marriage, and social acceptance of non-marital childbearing. I outline five hypotheses which relate the three explanations to the Czech context of rapid social change during the past two

decades. The former two explanations (the hypothesis of socioeconomic selection and the hypothesis of marriage postponement) are related to the selection argument. Beside the two "selection" hypotheses it is also possible that the marital status gap changed because of the changing relative supportiveness of marriage compared to unmarried status. The latter three explanations (the social acceptance hypothesis, the economic protection hypothesis, and the cohabitation hypothesis) are therefore related to the supportiveness of unmarried motherhood.

9.3.2.1 Hypothesis of socioeconomic selection

The effect of marital status can be partly explained by its correlation with maternal education (socioeconomic status). The strength of the association between maternal education and unmarried status changed during the study period. This should, everything else being constant, shape also the effect of marital status. The association of unmarried motherhood with lower educational groups of mothers strengthened during 1990s and stabilised or even weakened afterwards, when also highly educated women started to increasingly have children outside marriage. The effect of marriage should mirror this trend: the stronger the educational gradient in unmarried motherhood, the larger the advantage of marriage.

The effect of marriage can also be shaped by the changing effect of maternal education which took place during the study period (see above). Even if the association between marital status and education was constant, the advantage of marriage would grow, assuming that the effect of socioeconomic status on birth weight increased. The same would hold vice versa: if the effect of socioeconomic status on birth weight declined, even constant relationship between maternal education and marital status would lead to a decline in the crude effect of marital status on birth weight.

In either of these cases, any trend in the effect of marriage should disappear once maternal education (and its interaction with time) is controlled for.

9.3.2.2 Hypothesis of marriage postponement

The hypothesis of marriage postponement relates the marital status gap to parity and age composition of married and unmarried mothers. As unmarried motherhood spreads

especially among first-time mothers, the gap should increase, because firstborns tend to weigh less. The more is unmarried motherhood associated with first transition to motherhood (or in other words, the more is marriage reserved for higher-order births), the larger should be the marital status gap.

Childbearing has also shifted to higher ages. Maternal age should work in a more complex way, because the effect of age is not linear. The less is unmarried motherhood associated with young age, the less risk should it represent. On the other hand, the more is childbearing in marriage shifted to older ages, the worse for these children, and the narrower the marital status gap. This refers to the biological effect of age. However, in social terms, the increasing age could have positive impact on birth weight. The longer the woman/parental couple wait before having children, the more resources they accumulate and the better living conditions they have. So the rising maternal age could also contribute to rising disadvantage of non-marital children.

Once maternal age and parity are controlled for, any trend in the marital status gap should diminish if the marriage postponement is its main explanation.

9.3.2.3 Hypothesis of social acceptance of non-marital parenthood

When more people have children outside marriage, such behaviour stops being deviant and stigmatizing to its holders. Having children outside marriage, both with and without a partner, has become much more accepted in the Czech society [Kozlová, Tomanová 2005; Rabušic 2001; Thornton, Philipov 2009; see also Chapter 4]. As the number of people who have children outside marriage grows, norms of behaviour as unmarried parent(s) and role models are becoming more visible and provide unmarried mothers/parents with directions in how to perform their roles. This may reinforce the support that unmarried mothers receive from the fathers of their children (whether they live together or not) and other members of their social networks. This should rule out social acceptance as the source of disadvantage of non-marital children.

I will use the region-specific measure of prevalence of non-marital childbearing to approximate the level of social acceptance of the behaviour. Higher non-marital childbearing rate should attenuate the positive effect of marriage.

9.3.2.4 Hypothesis of economic protection

One of the benefits of marriage is that it provides economic security. Spouses share their incomes and living costs, which is especially protective at times of economic insecurity. Considerations of changing socioeconomic conditions rightly dominated the explanations of changing social inequalities in birth outcomes in the Czech Republic 1990s (see above). It is well possible that the economic supportiveness of marriage becomes a larger comparative advantage at uncertain times. Unfavourable macro-economic conditions may prevent unmarried pregnant women from receiving material support from their social networks. This could be especially harmful for those who are unpartnered. Even those who have partners may be less economically protected than wives. Partners in unmarried unions are, on average less willing to share their resources [Chaloupková 2006][33]. The willingness to share may further decline when the insecurity of income and employment rises, which may have harmful effects on maternal wellbeing and healthy course of the pregnancy.

The economic insecurity will be measured with unemployment rate (the average unemployment rate in the given region during the year at which the birth occurred and two preceding years). If the economic protection argument holds, the effect of maternal marital status will positively interact with rising unemployment rate.

9.3.2.5 Hypothesis of rise in cohabitation

Previous analysis showed that the rise of non-marital childbearing was mainly caused by the spread of childbearing in cohabitations. Single motherhood rose as well, but at a slower pace. A larger share of unmarried mothers has a partner now than 20 years ago. The average effect of unmarried status should therefore weaken due to this change in the composition of unmarried mothers by partnership status, because cohabitation, on average, provides a better support for a healthy pregnancy than single status. Moreover, the difference between the supportiveness of unmarried relationships and marriage may diminish as parenthood within cohabitation becomes more common because the rising social acceptance (see above) could apply more strongly to unmarried mothers with

[33] The lower average willingness to share among cohabiting couples was to a large extent attributable to their socio-demographic characteristics, partnership history and current relationship quality [Chaloupková 2006].

partners. This would be consistent with comparative research that found that the more common cohabitation is, the more it is similar to marriage in terms of relationship stability [Liefbroer, Dourleijn 2006] or partner selection [Hamplová 2009].

The spread of the share of partnered women was linear (see Chapter 7), so the birth weight outcomes of children born in and outside marriage should converge gradually.

10 GENERAL TRENDS IN BIRTH WEIGHT AND THEIR RELATION TO SHORTENING DURATION OF PREGNANCIES

This chapter offers a detailed insight into the trends in birth weight before the marital status disparities are studied. Perinatal and infant mortality has been improving gradually since 1989 [e.g. Syrovátka, Šípek 2001]. The same does not hold for birth weight, which is a more sensitive health indicator when infant mortality is very low. The following sections first describe the trend then look for its relation to average gestational age.

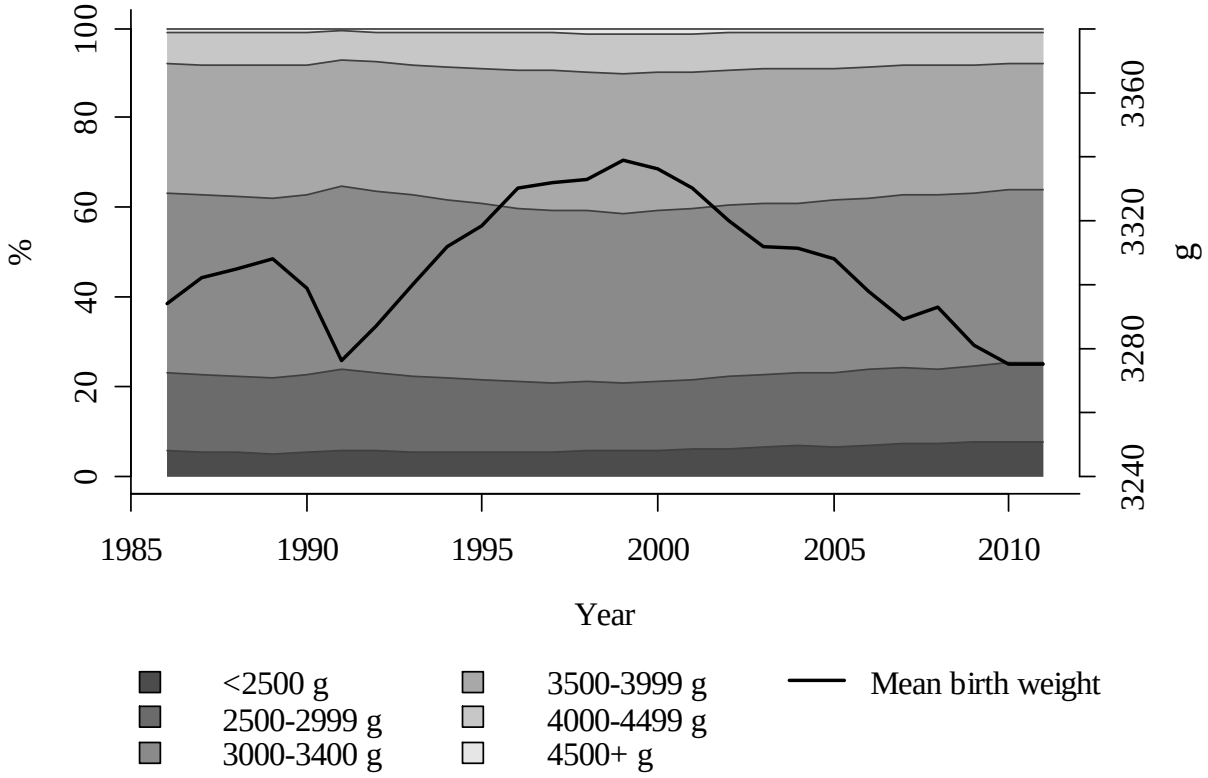
10.1 Birth weight – description of the trend

Birth weight showed an unstable trend over the last twenty years. The birth weight of live born children is reported by the Czech Statistical Office since 1986 [CSO 2012]. It is plotted in Figure 10.1, which shows relative distribution of birth weight categories along with mean birth weight. The trend in mean birth weight was upward in the late 1980s, peaking in 1989 at almost 3310g. A deep fall of the mean birth weight followed afterwards. It dropped by more than 30g (to 3276g) during the socialist regime breakdown and early post-socialist transition. The increasing trend was reconstituted after 1991 and continued until 1999 to reach 3339g. Another decline has occurred since then. In 2010, the mean birth weight dropped to 3275g, i.e. to the 1991 level.

A look at the proportions of birth weight categories in each year shows that the sources of the trend in mean birth weight come from across the whole weight distribution. The majority of all live newborns weigh between 3000 and 3499g. They made up about 40% till mid-1990s and then their incidence then decreased by 1-2 percentage points. Smaller babies became more common between 1986 and 2011, especially in the 2000s. Newborns in the weight category 2500-2999g represented 17% of all births in the late 1980s and became two percentage points less frequent till the end of the 1990s. Their proportion then slightly rose again and approached 18% in 2011. The percentage of newborns weighing less than 2500g has been increasing gradually. The incidence of low birth weight increased by about one third: it grew from 5% to almost 8%. The increase was most pronounced in the 2000s. The other side of the weight distribution showed a

rather declining tendency. The proportion of newborns weighing between 3500 and 3999g was stable around 29% till early 1990s then rose 32% to decline again since 2000s. It dropped to 28% by 2011. The birth weight category 4000-4499g followed a similar patter with start at 7%, peak at 9% around 2000 and return to the value of the late 1980s by 2011.

Figure 10.1. Relative distribution of birth weight categories and mean birth weight 1986-2011. Live births, N=2,843,911.



Source: CSO, Demographic Handbook 2011.

However, these figures are confounded by the increasing proportion of multiple births (twins, triplets etc.). Their proportion more than doubled between 1990 and 2010 (it rose from 0.9% to 2.1% [CSO 2013]).[34] The health outcomes of multiple pregnancies are worse compared to singletons. For instance, Imaizumi [2001] found five times higher infant mortality rate among twins compared to singletons in Japan. The relative

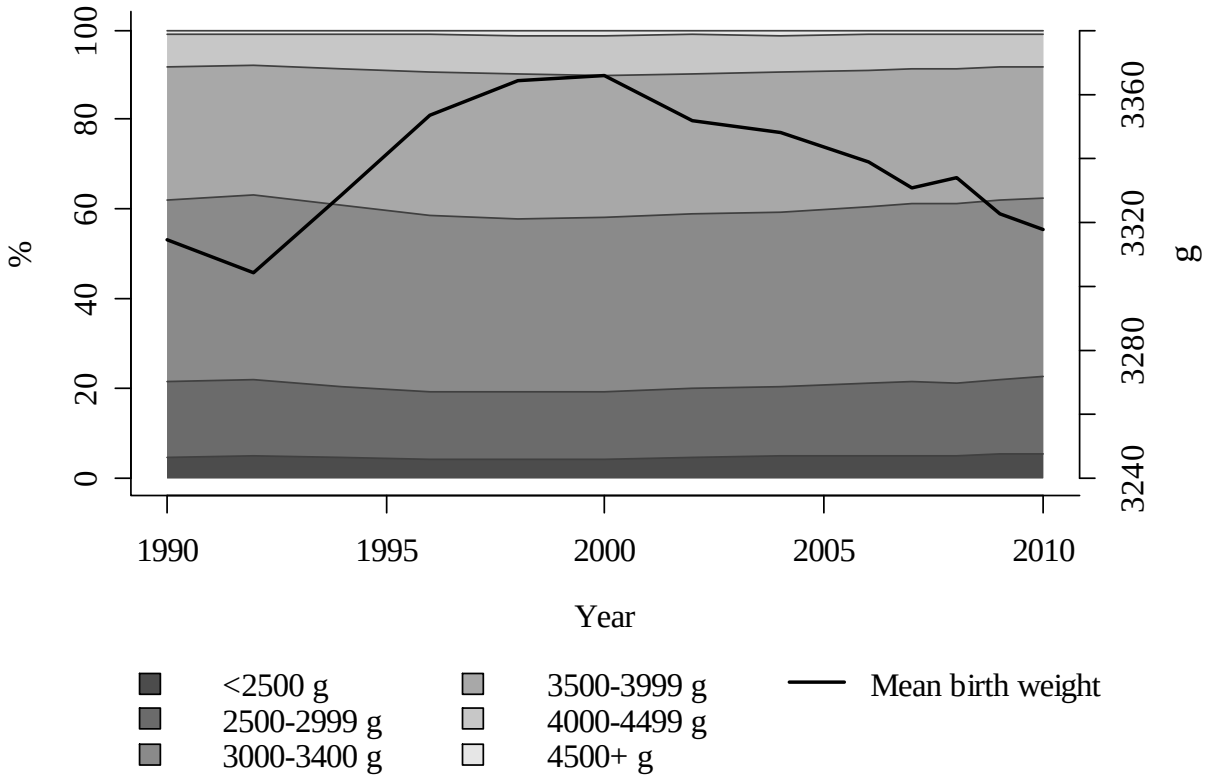
[34] The figure is not presented here. It is published, along with other statistics about multiples by the CSO [2013: Chapter 6-14]. The rise of twinning rate is rather common in modern industrialized countries and can be mostly (but not entirely) explained by shifting age distribution of mothers and spread of assisted reproduction – cf Tandberg et al.[2007].

risk for triplets compared to singletons was 12. The difference in the risk of infant death was almost entirely explained by the difference in birth weight distribution. Similar finding was reached also by Kiely et al. [1992]. Rising twinning rate has thus an important effect on the population measures of low birth weight (see also [Blondel et al. 2002; Joseph 1998]). To avoid the bias caused by the increase in twinning rate, I limit all my analyses to singletons.

Figure 10.2 presents trend in birth weight among singleton births in the period 1990-2010 portrayed with the incomplete series I have access to. The trend in mean birth weight basically copies the values in general population, but it is squeezed and shifted up. The mean birth weight of singletons first dropped from 3315g to 3304g in early 1990s. Then it rose very sharply by 50g between 1992 and 1996. A moderate growth of the mean birth-weight continued until 2000 when it reached its maximum of almost 3366g. This improvement during 1990s was more profound than among all births. The figure then dropped by 48g in the first decade of the 21st century. It shows that the rising twinning rate in 2000s cannot explain substantial part of the worsening of the health of newborns in the last decade. The decline of mean birth weight that took place in 2000s was less pronounced in singletons than among all births, but it still resulted in the current mean birth weight being on a similar level like that of the first half of 1990s.

The proportions of birth weight categories in each year show that percentage of the most common category of 3000-3499g has been rather constant at around 40% during the whole study period. Two categories that border with the modal category are "responsible" for the observed changes in time. Newborns in the weight category 2500-2999g represented 17% of all births in 1990 and then became less frequent by two percentage points. Since around 2004 their proportion has slightly risen again and approached 17% in 2010. Mirroring this trend, the proportion of newborns weighing 3500-3999g rose between 1992 and 1998 from 29% to 32%. This birth-weight category started to decline after 2000 and it proportion decreased by three percent points until 2010. The slightly rising proportion (from 7% to 9%) of birth weight category 4000-4499g contributed to the peak of mean birth-weight around 2000. Then this figure dropped back to 7%. Unlike general population, there was no substantial increase in the percentage of newborns with low birth weight. The percentage of newborns weighing less than 2500g (the low birth weight) is relatively stable at 5%.

Figure 10.2. Relative distribution of birth weight categories and mean birth weight, 1990-2010 (selected years). Live singleton births, N= 1,351,447.



Source: CSO (Birth register), Author's computations.

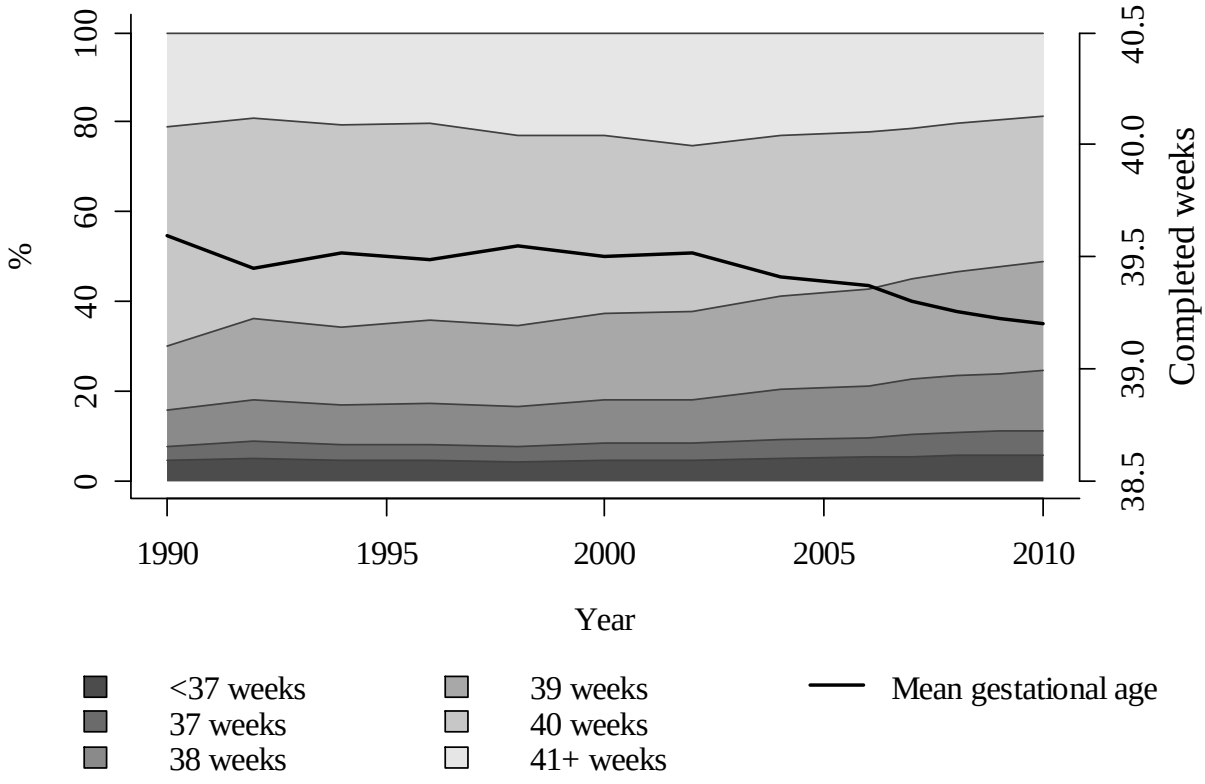
10.1.1 Shortening gestational duration but improving age-specific birth weights

An inspection of the trends in gestational age provides an explanation for the declining birth weight in 1990s. Figure 10.3 shows the distribution of gestational age categories and mean length of pregnancy in 1990-2010. The mean gestational age of live singleton newborns has not dramatically changed during 1990s. It stayed stable around the level of 39.5 completed weeks. However since 2002, there has been a slight but consistently decreasing trend. The recent (in 2010) mean gestational age is 39.2 completed weeks of pregnancy.

The percentage distribution of gestational age categories shows that gestational ages of 40 and more completed weeks became much less prevalent. The most remarkable trend is a profound decline in births at 40 weeks of pregnancy. Half of all singleton newborns

had this gestational age in 1990. This percentage showed a steadily decreasing trend and dropped to less than one third in 2010. Percentage of children born after at least 41 completed weeks rose from 21% to 25% between 1990 and 2002 and then dropped to 19%, i.e. bellow the initial level. On the other hand, shorter pregnancies started to occur more often. The proportion of children born after 39 completed weeks of gestation bumped up from 14% to 18% between 1990 and 1992. After stable rest of 1990s, it continued to increase to 24% by 2010. Proportion of live singletons born in at 38 completed weeks increased from 8% to 13%. The shares of lowest gestational ages did not change remarkably, but also show a slightly rising trend. The share of children born at 37 completed weeks was only 3% in 1990 and rose to more than 5% in 2010. Percentage of children born at less than 37 completed weeks, which is the medical definition of preterm birth, rose from 8% to 11%.

Figure 10.3. Relative distribution of gestational age categories and length of gestation, 1990-2010 (selected years). Live singleton births, N= 1,350,983.



Source: CSO (Birth register), Author's computations.

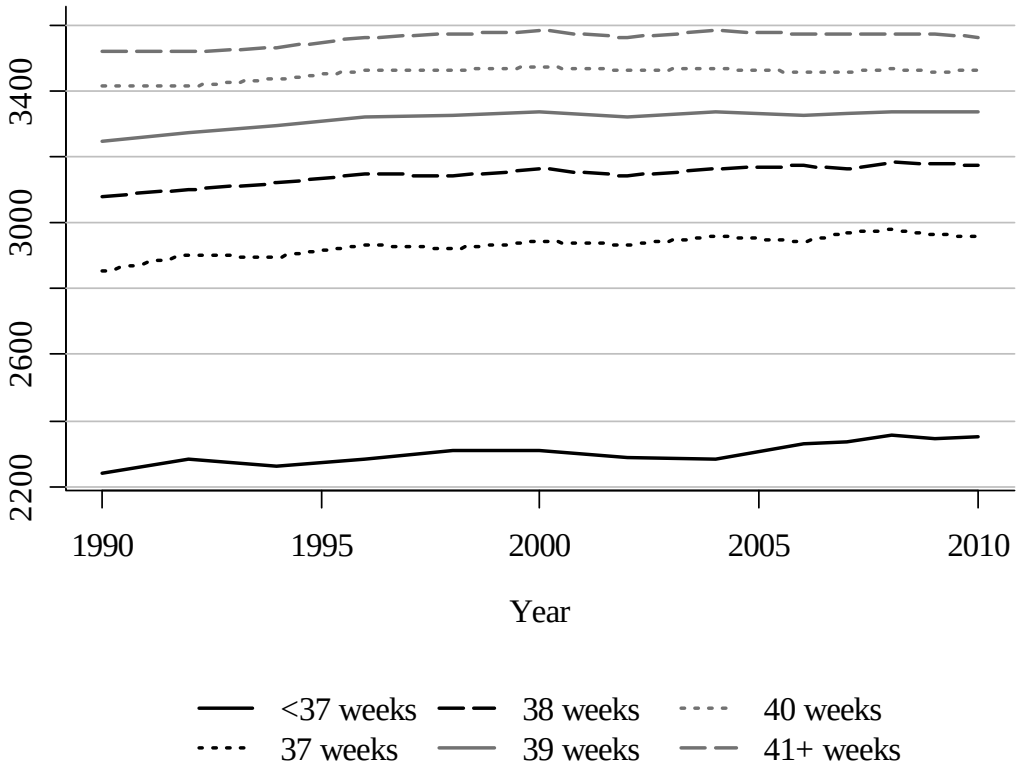
Shortening of the duration of pregnancies seems to be a more general pattern. Similar trend was identifies also on US [Davidoff et al. 2006; Donahue et al. 2010], Australian [Roberts et al. 1999], Spanish [Castello et al. 2011] or Italian [Astolfi et al. 2007] data. The explanations include changes in maternal characteristics [Castello et al. 2011, Donahue et al. 2010], increasingly stressful working and living conditions [Astolfi et al. 2007, Castello et al. 2011], and changes in clinical practice, especially rise in induced births and planned caesarean sections [Astolfi et al. 2007; Castillo et al. 2011; Donahue et al. 2010; Roberts et al. 1999]. The shifts of obstetrical practice towards more interventions has been described also in the Czech Republic [Stephenson et al. 1993; Křepelka 2008; Větr 2009] which could explain the trend of shortening gestational age in 2000s. However, this assumption cannot be tested in my analysis. The influence of maternal characteristics on birth weight will be controlled for in the subsequent analysis.

Figure 10.4 plots the mean birth weight by gestational age categories. Obviously, the longer the pregnancy the higher is the mean birth weight. It is remarkable is that the age-specific birth weights have been improving within all gestational age categories during the whole study period, even at the very beginning of 1990s. The increase was especially pronounced in shorter pregnancies. Children born at less than 39 completed weeks of pregnancy were, in average, by 100g heavier in 2010 than in 1990. The improvement for those born at 40 or 41 weeks was “only” about 45g, which is still a rather large rise. These results explain the trends in the overall mean birth weight. Its improvement after 1992 (see Figure 2) was allowed by the relatively constant average length of pregnancies. Although the gestational-age-specific birth weight continued to increase after 2000, the shortening of average gestational age caused the general trend to decline.

The trends in health outcomes of newborns suggest that there are three distinct phases within the period 1990-2010: early 1990s modest health crisis, positive trend in the rest of 1990, and the worsening during the first decade of 21st century. Immediately after the fall of state socialism, the health outcomes showed moderate but recognizable worsening. Children were born at earlier gestational age and, consequently, with lower birth weight (although the gestational-age-specific average birth weight did not decline). The signs of health crisis lasted very shortly and were replaced with a strong favourable

trend since 1992. Mean birth weight of singleton newborns increased by over 60g between 1992 and 2000. The rise in mean birth weight took place in all gestational age categories. Since the turn of the century, the trend has reversed again. Although the gestational-age specific birth weight continued to improve, the average duration of pregnancy shortened which caused the overall trend in mean birth weight to decline below the level of mid-1990s. The shortening of mean gestational age contributed to less rapid improvements in infant survival.

Figure 10.4. Mean birth weight by gestational age, 1990-2010 (selected years). Live singleton births, N= 1,350,983.



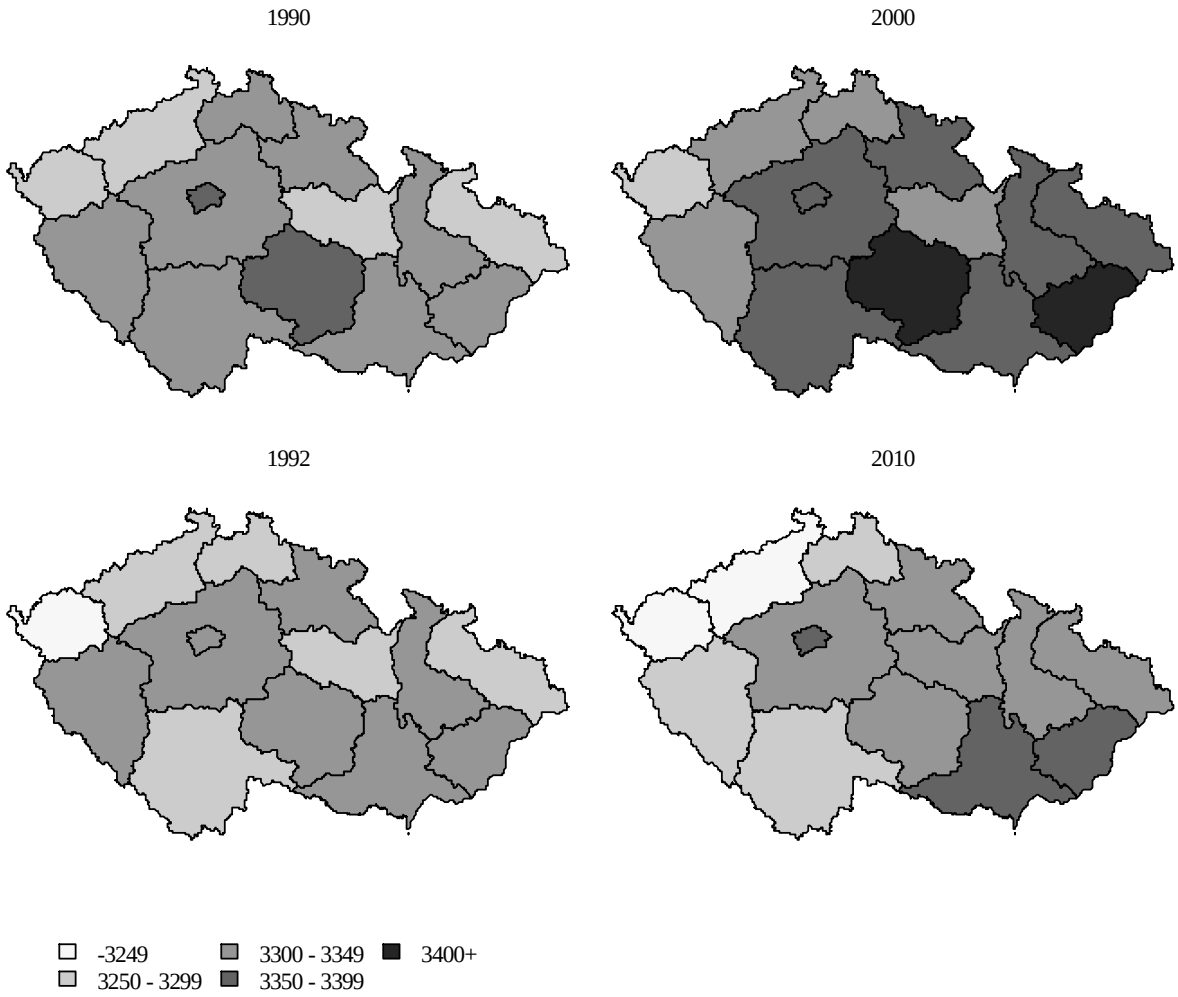
Source: CSO (Birth register), Author's computations.

10.1.2 Regional patterns in birth weight

As social and environmental conditions of regions differ, there are regional differences in birth weight. Figure 10.5 maps the regional trends in mean birth weight. It shows that there are persistently disadvantaged regions along the North-western border. It is the same area that was found to have an elevated non-marital childbearing rate (see Chapter

5). For instance, the mean birth weight in the region Karlovarský was below the national average during the whole study period. In this region, the mean birth weight was 3252g in 1990. It further dropped to 3240g in 1992 and although the trend was improving until 2000, the figure then declined to only 3214g in 2010. Region Ústecký also belongs to the most disadvantaged.

Figure 10.5. Mean birth weight in regions, 1990-2010 (selected years). Live singleton births, N= 1,351,447.

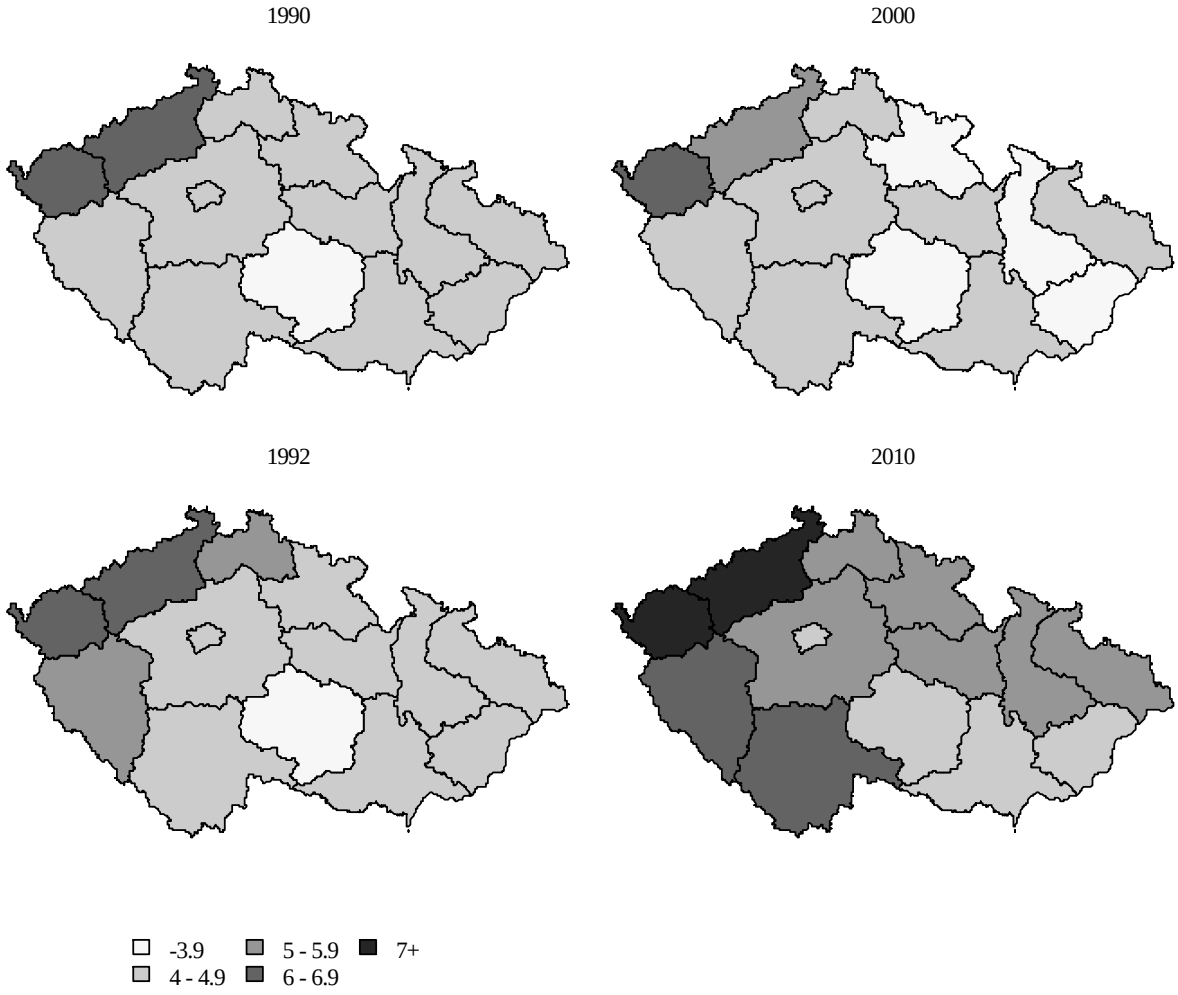


Source: CSO (Birth register), Author's computations.

The incidence of the adverse outcome, the low birth weight, follows a similar pattern of persistent disadvantage of the regions along the North-western border (see Figure 10.6).

The regions Karlovarský and Ústecký have clearly the highest low birth weight rate during the whole study period. It reached the highest values (7-8%) in 2010.

Figure 10.6. Low birth weight rate in regions, 1990-2010 (selected years). Live singleton births, N= 1,351,447.



Source: CSO (Birth register), Author's computations.

There are also other examples of regions that fare badly in some periods, but they rarely remained in that situation for the whole period studied. For example region Pardubický was among the ones with the lowest mean birth weight in 1990 (mean birth weight 3278g) but it improved to the above-average mean birth weight of 3311g in 2010. The low birth weight rate stagnated in this region around 5%. A worsening trend was

experienced in region Plzeňský which belonged to the regions with rather high birth weight in the early 1990s (mean around 3330g, low birth weight rate 4%) but ended with a below-average value of mean birth weight (3283g) and two percentage points higher low birth weight rate in 2010.

Regions with consistently advantageous outcomes are concentrated in the South-eastern part of the Czech Republic. The region Vysočina had the lowest low birth weight rate in 1990 (3%) which remained very low until the late 2000s when it approached 5%. Also the mean birth weight rate was high above average in Vysočina. For instance, it reached 33402g in 2000. Two Southern-Moravian regions (Jihomoravský and Zlínský) also showed good outcomes during the whole study period.

11 TRENDS IN BIRTH WEIGHT BY MARITAL STATUS

This chapter focuses on the effect of maternal marital status and other maternal characteristics on birth weight. It first describes trend in the disadvantage of non-marital children and then evaluates the five explanations offered by the five hypotheses that were introduced in Chapter 9.

11.1 Descriptive analysis

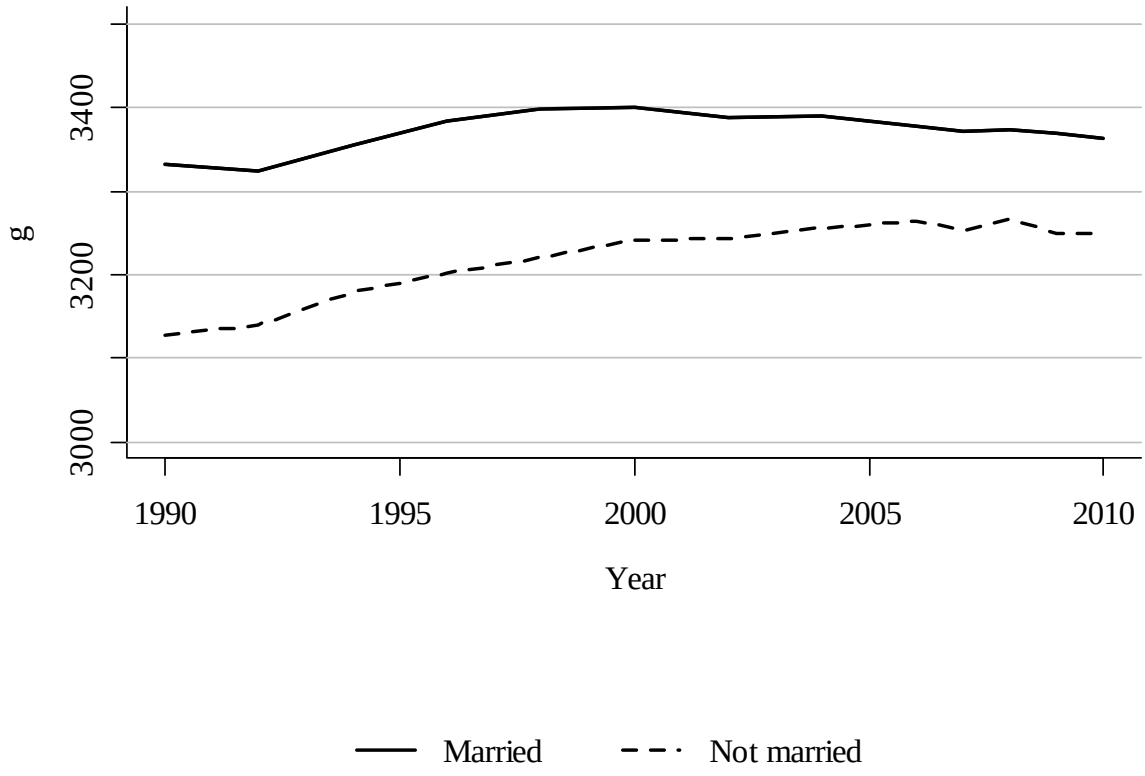
This section shows that the above described trends were not followed equally by marital and non-marital children. The marital status gap in birth weight has shrunken considerably during the study period. Figure 11.1 shows the mean birth weight by maternal marital status. Mean birth weight of marital children first dropped by almost 9 g from its original value of 3332g and then started to improve. It rose to 3400g until 2000, but the trend then reversed and dropped by 40g by 2010. Non-marital children experienced stagnation of the mean birth weight in the early 1990, but the trend was then consistently upward until mid-2010. The mean birth weight stagnated since then on a value around 3250g. As the mean birth weight of marital children was decreasing at that time, the stagnation contributed to convergence of the two groups. The difference between children born to married and unmarried women was 205g in 1990. It then decreased to around 170g and stagnated until late 1990s to finally shrink almost twice to only 113g in 2010.

The shrinking disparity can be found also in low birth weight rate – see Figure 11.2. It shows that the low birth weight rate was almost threefold in unmarried mothers compared to married (11% vs.4 %) in 1990. The incidence of low birth weight has remained rather stable at around 4% among children born within marriage while the trend among non-marital children has improved. The gap between marital and non-marital children gradually decreased and by 2010 the percentage point difference had decline to less than 3% (7% vs. 4%).

Closing of the marital status gap in low birth weight was relatively fast in 1990s and the disparity then stabilized since 2005. The disparity in the mean birth weight was not affected by the converging low birth weight rates during 1990s and only started to

decline around 2000. It is possible that the longer-term trend was more stable before 1990 and the disparity only bumped up during the political regime change and then went back when people adjusted to the new economic and social situation. The clear convergence occurred since late 1990s. The trend of diminishing disparity, however, clearly stopped at the end of the time series. Following sections test the five explanations for this trend.

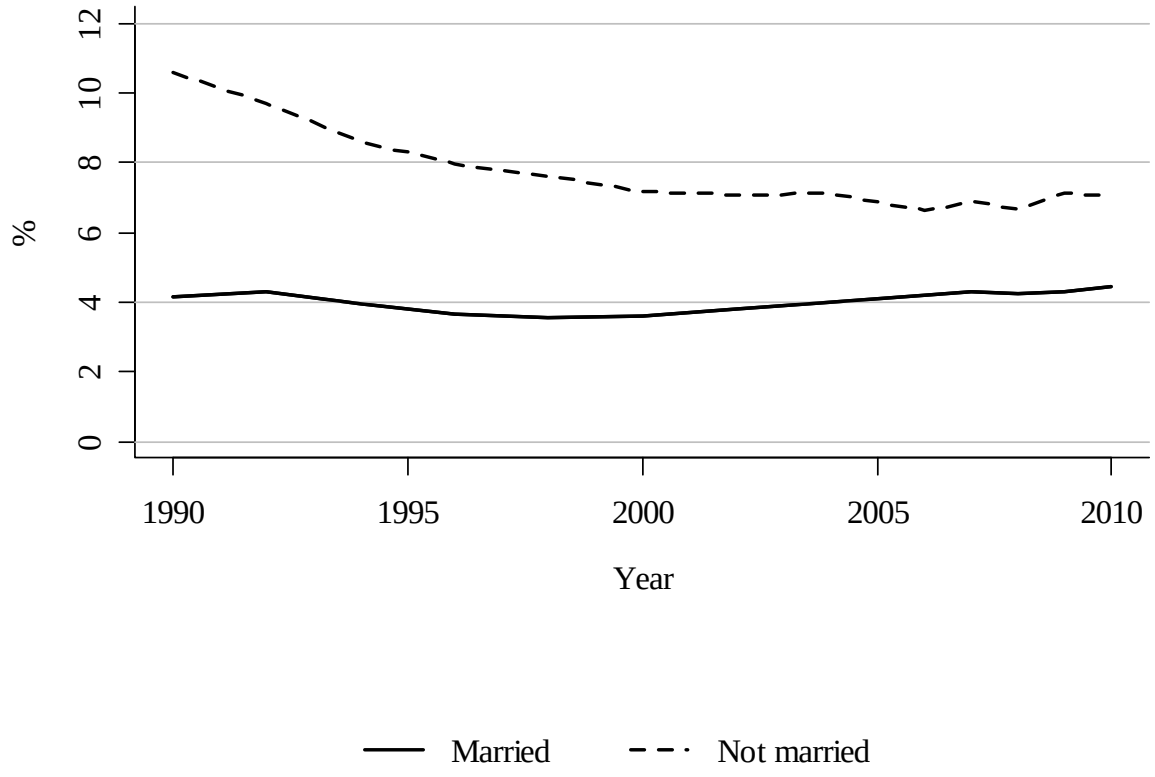
Figure 11.1. Mean birth weight by marital status, 1990-2010 (selected years). Live singleton births, N=1,351,447.



Source: CSO (birth register), author's computations.

Interestingly, the trend in neither of the two outcomes among non-marital children showed any worsening at the beginning of the time series. This suggests that the improving trend may have started already before 1990.

Figure 11.2. Low birth weight rate by marital status, 1990-2010. Live singleton births, N=1,351,447.



Source: CSO (birth register), author's computations.

11.2 Model building

The multivariate analysis follows a similar logic as that of unmarried motherhood. I build random intercepts models with 182 macro-contexts defined as the combination of regions and years. The models assume that each of the contexts influences the course of pregnancies in a different way. The variability of contexts is captured in the random intercepts. This approach is applied to both outcomes, the continuous measure of birth weight and the binary indicator of low birth weight. I denote the models referring to birth weight with M and the models of low birth weight with L. The predictors at the individual level are mother's marital status, education, age, and parity. Marital status is measured as a dichotomy between married and unmarried.[35] Unlike the analysis of

[35] Preliminary analysis showed that never married status has a stronger negative effect on birth weight than divorced/widowed status, but the difference disappeared when control variables were added. So I treat marital status as a dichotomy (married vs. not married).

unmarried motherhood, age is measured absolutely[36], because one of the explanations works with the size of the age categories, which is artificial in the relative measurement of age.

The macro-level predictors include time (year measured in categories or continuously), non-marital childbearing rate as a measure of social acceptance of unmarried motherhood, and unemployment as a measure of economic uncertainty.

I estimate three sets of models. The first set of models (listed in Table 11.1) maps how the individual-level variables influence birth weight. It analyses whether the effect of maternal marital status is similar for children born to different socio-demographic backgrounds. After inspecting the interaction between the individual-level variables, I return back to the main effects and analyse how their sizes change in different contexts. The second set of models (listed in Table 11.4) describes the trend in the marital status gap net of the influence of maternal education, age, and parity. This allows assessment of the two selection hypotheses. The third set of models (listed in Table 11.6) tests the three hypotheses about the change in the direct effect of marital status. These models work with context-level variables to explain the size of the marital status gap.

All models are multilevel random-intercept models. The Residual intra-class correlation is close to zero (see, for instance, Tables 11.2 and 11.3 below). Only less than one percent of the total variability has its source in the regional and time context. The individual-level characteristics of mothers available in the data do not explain much of the total variability, neither. The variability of the outcomes is enormous and the factors which directly determine birth weight are not measured in my data. There is no information about e.g. the height of parents, smoking during pregnancy and other behavioural patterns. Knowing just the few characteristics of a mother (marital status, education, age, parity, and time and region of her birth) would be not very helpful if the goal was predict the weight of her infant. This could be the case, for instance, when researchers seek to formulate recommendations of how to improve birth outcomes. Such research strives to find the factors that explain a big portion of the variability. However,

[36] I simplified the five categories of maternal age to only three, because the three middle categories (20-24, 25-29, 30-34) have almost identical effect on birth weight, once maternal education is controlled for.

this is not the case in my analysis. The few maternal characteristics included in the models shape the exposure to the risks and preventive factors. My goal is to evaluate the size of the inter-group (and inter-contexts) differences. The models can be thus perceived as a more sophisticated version of standardization rather than an attempt to explain the direct causes of birth weight. The multilevel arrangement of the model provides a useful framework for studying the trends in the differences in time.

11.3 General pattern

The first step of the multivariate analysis focuses on the influence of maternal characteristics on birth weight. The models are listed in Table 11.1. Model M1 describes the crude effect of marital status. Model M2 adds the effect of education and Model M3 includes also maternal age and parity. Adding these variables statistically significantly improves the fit of the model (the test criterions and differences in AIC reach tens of thousands). Models M4 to M6 then test whether the effect of marital status on birth weight differs by maternal education, age, and parity. All of these interaction effects are statistically significant, as well. The analogical models of low birth weight (L1 to L6; listed in Table 2) lead to the same conclusion. Likelihood-ratio tests and AIC favour the most complex model L6. These results show that the effect of marital status is differs by maternal education and stage of her life course.

The estimated coefficients of selected models are presented in Table 11.3. Model M1 shows that children born to unmarried mothers are, on average, 125g lighter than children born in marriage. More than a half of the advantage of married status can be explained by maternal education, age and parity. Especially the effect of maternal education explains a substantial portion of the effect. The effect of marital status drops to 88g when maternal education is added in Model M2, and it further declines to only 63 after age and parity are included in Model M3. The control variables work as expected: there is a strong gradient by maternal education and a large disadvantage of children born at first parity. The average disparity between children born to women with the lowest and the highest level of education is 221g according to M3. The average disadvantage of firstborns is 116g. The effect of maternal age is rather small. Children of very young mothers (younger than 20 years) are, one average, 11g lighter, compared

to the reference category 20-34 years. The disadvantage of children born to 35 and more years old mothers is 22g.

Table 11.1. Goodness of fit statistics of the random-intercept models of birth weight. Live singleton births, 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

	Chi2	DF	p-value	AIC
Models of birth weight				
M0: Variance components model	--			20372800
M1: Marital status	13150	1	<0.00001	20359652
M2: M1 + Education	28715	4	<0.00001	20344094
M3: M2 + Age + Parity	43915	8	<0.00001	20328902
M4: M3+ Marital status x Education	44872	11	<0.00001	20327950
M5: M4 + Marital status x Parity	45596.6	13	<0.00001	20327230
M6: M5 + Marital status x Age	45763.4	15	<0.00001	20327068
Models of low birth weight				
L0: Variance components model	--			511034
L1: Marital status	4274	1	<0.00001	506940
L2: L1 + Education	10820	4	<0.00001	501226
L3: L2 + Age + Parity	13130	8	<0.00001	498624
L4: L3 + Marital status x Education	13360	11	<0.00001	498553
L5: L4 + Marital status x Parity	13386	13	<0.00001	498359
L6: L5 + Marital status x Age	13419	15	<0.00001	498281

	Likelihod-ratio tests			Difference
	Chi2	DF	p-value	in AIC
M1 vs. M0	13150	1	<0.00001	-13148
M2 vs. M1	15565	3	<0.00001	-15558
M3 vs. M2	15200	4	<0.00001	-15192
M4 vs. M3	956.7	3	<0.00001	-952
M5 vs. M4	724.7	2	<0.00001	-720
M6 vs. M5	166.8	2	<0.00001	-162
L1 vs. L0	4071.93	1	<0.00001	-4094
L2 vs. L1	5720.01	3	<0.00001	-5714
L3 vs. L2	2610.05	4	<0.00001	-2602
L4 vs. L3	76	3	<0.00001	-71
L5 vs. L4	197.83	2	<0.00001	-194
L6 vs. L5	82	2	<0.00001	-78

Maternal unmarried status clearly has different implications for children of mothers with different socioeconomic background and at different stages of life course. Model M6 describes these interactions. The interaction terms for education are positive. It

means that having an unmarried mother represents a higher health risk for children of uneducated pregnant women. According to Model M6, the marital status gap is 120g among children born to women with elementary education and only 55g (-120+65) among children of university graduates.

Table 11.2. Coefficients estimated in random-intercept models of birth weight. Live singleton births, 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

	M1	M2	M3	M6
Fixed effects				
Unmarried mother	-125.0***	-88.1***	-63.2***	-120.2***
Maternal education (Elementary=ref.)				
Lower secondary		157.5***	169.8***	144.1***
Complete secondary		189.4***	208.6***	177.7***
Teritary		198.8***	221.2***	191.9***
Maternal parity (Second child=ref.)				
First child			-116.7***	-128.3***
Third+ child			-18.9***	-4.2**
Maternal age (20-34= ref.)				
18-19			-11.3***	5.4**
35+			-22.3***	-33.1***
Education x Unmarried status				
Lower secondary x Unmarried				35.4***
Complete secondary x Unmarried				61.4***
Tertiary x Unmarried				65.2***
Maternal parity x Unmarried status				
First parity x Unmarried				40.6***
Third+ parity x Unmarried				-55.5***
Maternal age x Unmarried status				
18-19 x Unmarried				-39.5***
35+ x Unmarried				33.1***
Intercept	3366.6***	3200.4***	3239.9***	3269.9***
Random effect				
SD(Intercept)	34.2***	28.4***	28.6***	29.1***
Rho	0.004***	0.003***	0.003***	0.003***

Note: *** p<0.01, ** p<0.05, * p<0.1

Source: CSO (birth register), author's computations.

The effect of maternal marital status is also weaker among first children and much higher among third and higher-order children. Model M6 shows that the disadvantage of non-marital children is 41g lower among firstborns, compared to second-order children.

On the other hand, the marital status gap widens by 56g when the mother already has two or more children, compared to second parity. The interaction with maternal age is the weakest. Young age deepens the marital status gap by 40g and old age closes it by 33g. Interestingly, the effect of young maternal age turns to be slightly positive for marital children. Infants born to young married mothers have a slight (5g) advantage (compared to their counterparts from the middle age category).

Table 11.4 presents analogical results for models of low birth weight. The relationships between variables conform what has been found in the previous models. The coefficient for unmarried status declined from 0.58 in Model L1 to 0.31 in Model L3. This corresponds to odds ratios 1.79 and 1.36, respectively. Children born outside marriage thus have, on average, 1.36 times (or by 36%) higher odds of low birth weight, net of the effect of the remaining variables. There is strong educational gradient. The total disparity between elementary and tertiary education is 1.0 (or 2.72 expressed as odds ratio). Again, there is a disadvantage for firstborns (beta coefficient 0.44) and for children born at high-parities (beta coefficient 0.30).

The only marked deviation from the patterns found in the analysis of birth weight is in the effect of maternal age. Low maternal age, relative to the 20-34 years category, slightly decreases the mean birth weight (see Model M3 in Table 3), but does not elevate the risk of low birth weight. The coefficient for low maternal age is only -0.03, which is negligible. Model L6 shows that there is a favourable effect of young maternal age for children born to marriage (the coefficient is -013), which is consistent with similar finding on birth weight (see Model M6). On the other hand, the risk of low birth weight rises considerably with higher age. The coefficient estimated in Model L3 is 0.34 (odds ratio 1.40). Children born to mothers aged 35 and more years thus face 40% higher odds of low birth weight. The absence of a similarly strong effect on the average birth weight suggests that the birth weight distribution of children born to older mothers is not systematically shifted downwards. Only the most detrimental outcome is more prevalent in this age category. It is likely to be caused by biological ageing.

Table 11.3. Coefficients estimated in random-intercept models of low birth weight. Live singleton births, 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

	L1	L2	L3	L6
Fixed effects				
Unmarried mother	0.582***	0.380***	0.307***	0.478***
Maternal education (Elementary=ref.)				
Lower secondary		-0.657***	-0.671***	-0.650***
Complete secondary		-0.874***	-0.903***	-0.864***
Tertiary		-0.953***	-1.006***	-0.976***
Maternal parity (Second child=ref.)				
First child			0.443***	0.538***
Third+ child			0.303***	0.262***
Maternal age (20-34= ref.)				
18-19			-0.032**	-0.133***
35+			0.336***	0.411***
Education x Unmarried status				
Lower secondary x Unmarried				0.0136
Complete secondary x Unmarried				-0.0618**
Tertiary x Unmarried				-0.0579
Maternal parity x Unmarried status				
First parity x Unmarried				-0.282***
Third+ parity x Unmarried				0.069**
Maternal age x Unmarried status				
-19 x Unmarried				0.210***
35+ x Unmarried				-0.184***
Intercept	-3.166***	-2.445***	-2.704***	-2.773***
Random effect				
SD(Intercept)	0.123***	0.110***	0.110***	0.110***
Residual intra-class correlation (rho)	0.005***	0.004***	0.004***	0.004***

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: CSO (birth register), author's computations.

In general, the interaction effects estimated by Model L6 are rather weak compared to the models of mean birth weight. Consistently with the results on mean birth weight, first parity reduces the influence of unmarried motherhood on low birth weight (the interaction coefficient -0.28), but there is no effect of third or higher parity. The effect of maternal age on the strength of the unmarried status disadvantage is also consistent with the previous analysis of mean birth weight: the older the mother, the less important

her marital status is. Unmarried status increases the logit of low birth weight by 0.69 (=0.48+0.21) among young mothers and only by 0.30 (=0.48-0.18) in the oldest age category. Surprisingly, higher maternal education does not reduce the disadvantage of unmarried status. The interaction coefficients in Model L6 are negligibly small.

In sum, the health disadvantage of unmarried motherhood can be explained by both compositional effects and by the direct effect of marital status. These two effects are equally strong in both birth weight outcomes. The marital status gap is most pronounced among children of young and uneducated mothers and mothers who already have at least two children. This pattern applies to the more sensitive continuous indicator of birth weight but is much weaker for low birth weight. The width of the marital status gap can be possibly explained by the elevated prevalence of single motherhood among young, uneducated, and high-parity mothers. Whether, and to what extent, the higher benefit of marriage in these groups is attributable to their propensity to be unpartnered will be analysed in Chapter 12. The remaining sections of this chapter analyse the time trend in the general effect of unmarried motherhood on birth weight.

11.4 Trend in the effect of marital status – evaluation of selection versus direct explanations

The individual effects described in previous section represent general patterns, without regard to specific period. The purpose of this section is to assess to what extent is the trend of closing marital status gap, which has been identified in section 11.1., attributable to demographic characteristics of married and unmarried mothers. First, I describe the general trend in the advantage of marriage and assess to what extent it can be explained by educational, age and parity composition of unmarried and married mothers. This provides a first insight in the relevance of the selection hypotheses at one side and the substantive hypotheses at the other.

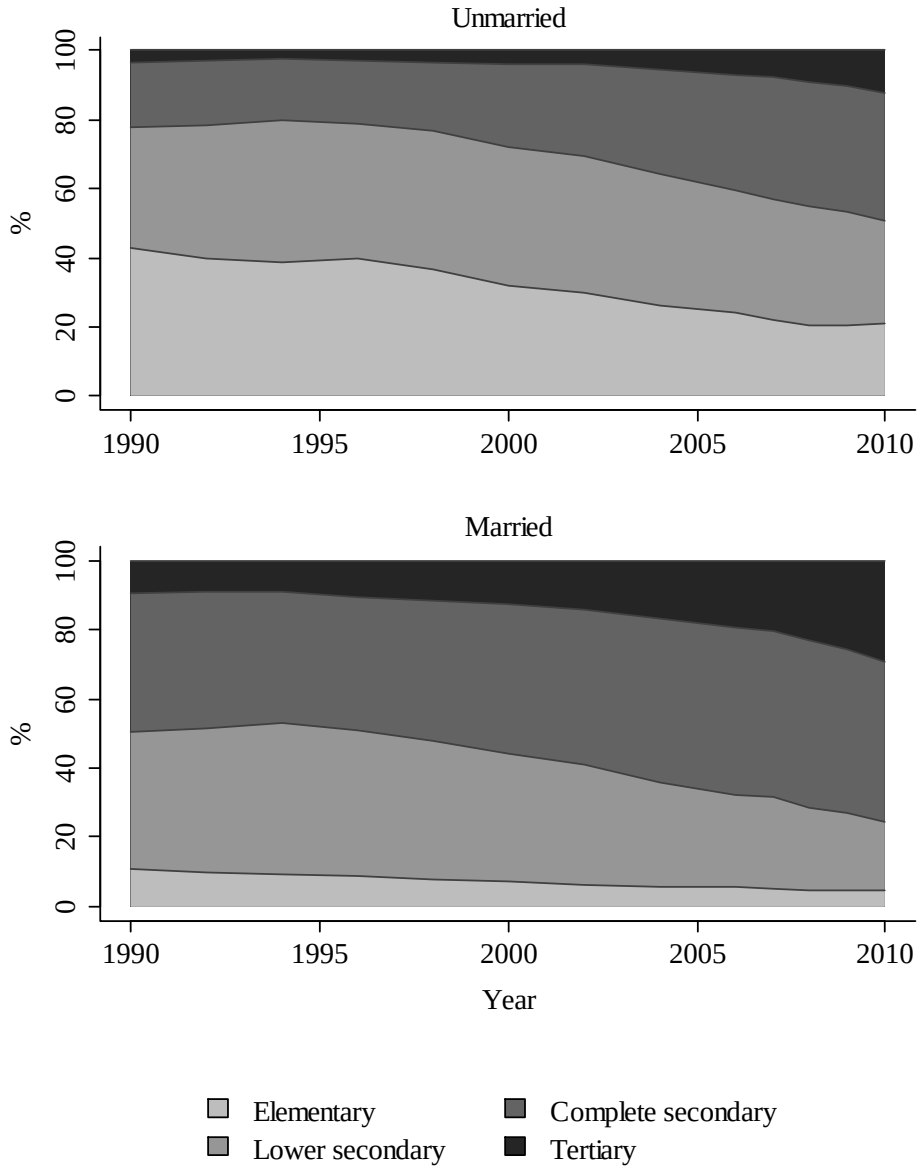
11.4.1 Changing characteristics of mothers

The first two hypotheses assume that the source of the closing marital status gap lies in changing socio-demographic characteristics of mothers. We have seen in previous section that the marital status gap is the widest among poorly educated, very young, and

high-parity women. The number (and share) of mothers with low age and education decreased rapidly between 1990 and 2010, while parity composition showed only slight oscillations (recall Figures 5.2-5.4 from Chapter 5). Figures 11.3 to 11.5 show that the socio-demographic characteristics of both married and unmarried mothers changed in a similar way. Figure 11.3 plots married and unmarried mothers by educational attainment. Educational structure of both married and unmarried mothers follows an upward trend, but disparities persist. Only about 10% of married mothers had the lowest educational level in 1990 and their proportion has halved by 2010. In contrast 40% of unmarried mothers had elementary education in 1990 and proportion halved, as well. The rising proportion of mothers with university education is also parallel in both married and unmarried mothers. The proportion of mothers with tertiary education increased from 4% to 13% in unmarried mothers. The rise was approximately threefold also among married mothers – from 9% to 29%. The onset of the trend of increasing education lagged among unmarried mothers. It started in the second half on 1990s. This is a reflection of the rising association between maternal education and marital status.

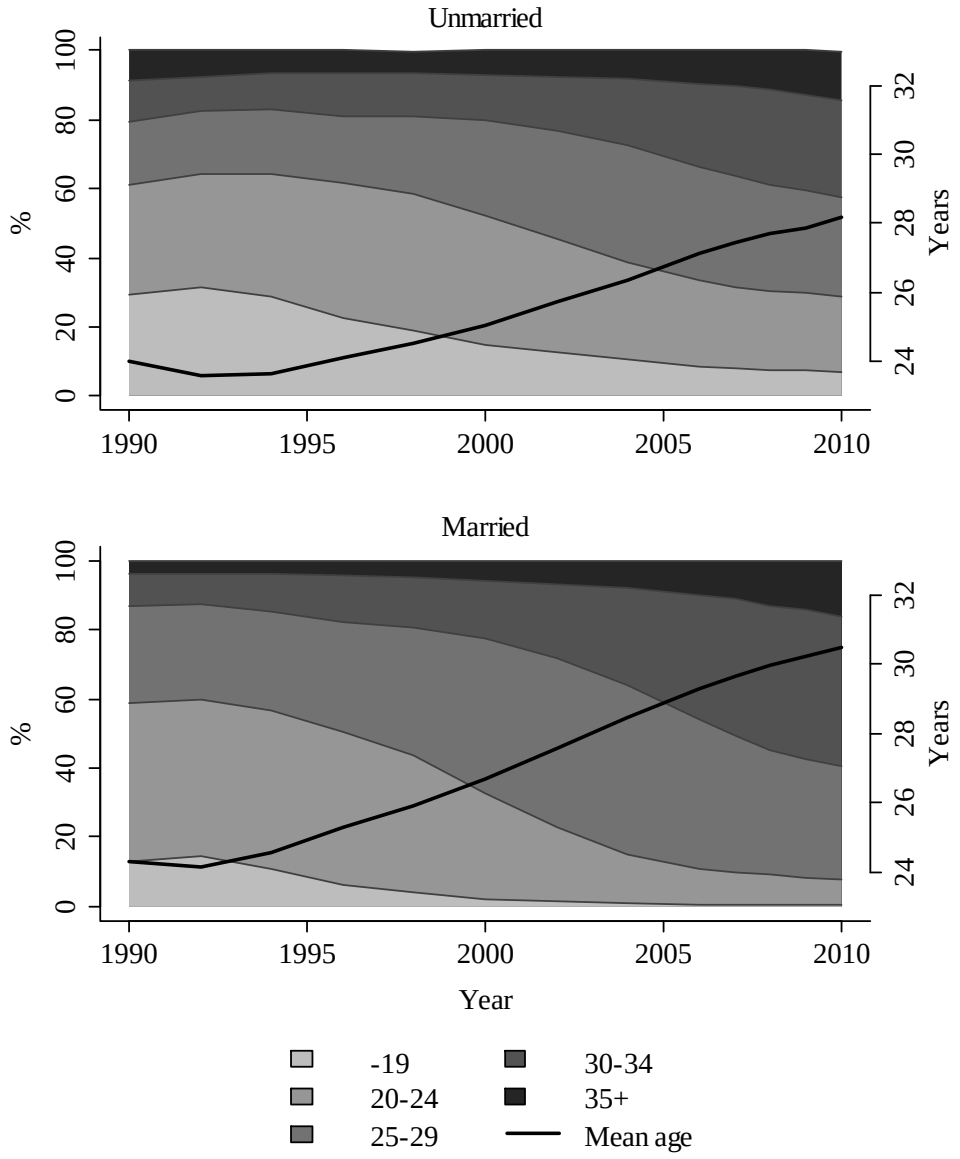
The age composition of both marital status groups shifted upwards, as well. Figure 11.4 shows that both groups had children at rather young age in early 1990s (the mean was about 24), and then started to postpone. The postponement of childbearing was much more pronounced among married mothers. By 2010, the mean age of a married mother had crossed 30. The mean age of unmarried mothers started to rise later (in mid-1990s) and reached only 28 by 2010. There was a very high proportion of, both married and unmarried, young mothers in early 1990. Around 30% of unmarried and almost 15% of married mothers have not reached 20 at that time. Currently, there are almost no married mothers and only 7% of unmarried mothers at such young age. On the other hand, there is an increasing share of older women among both married and unmarried mothers. Mothers older than 34 years made up only 4% of married mothers in 1990. This proportion then rose to 16%, especially in late 2000s. Around 8% of unmarried mothers were aged 35 or more in 1990. This proportion then slightly declined to rise since 2000s to 14%. Although the trends in mean age are diverging between married and unmarried mothers, the share of age groups which represent a health risk for the child got more similar in both marital status groups. This could have contributed to the convergence of health among marital and non-marital children.

Figure 11.3. Married and unmarried mothers by education. Mothers, 1990-2010 (selected years), N=1,370,604.



Source: CSO (birth register), author's computations.

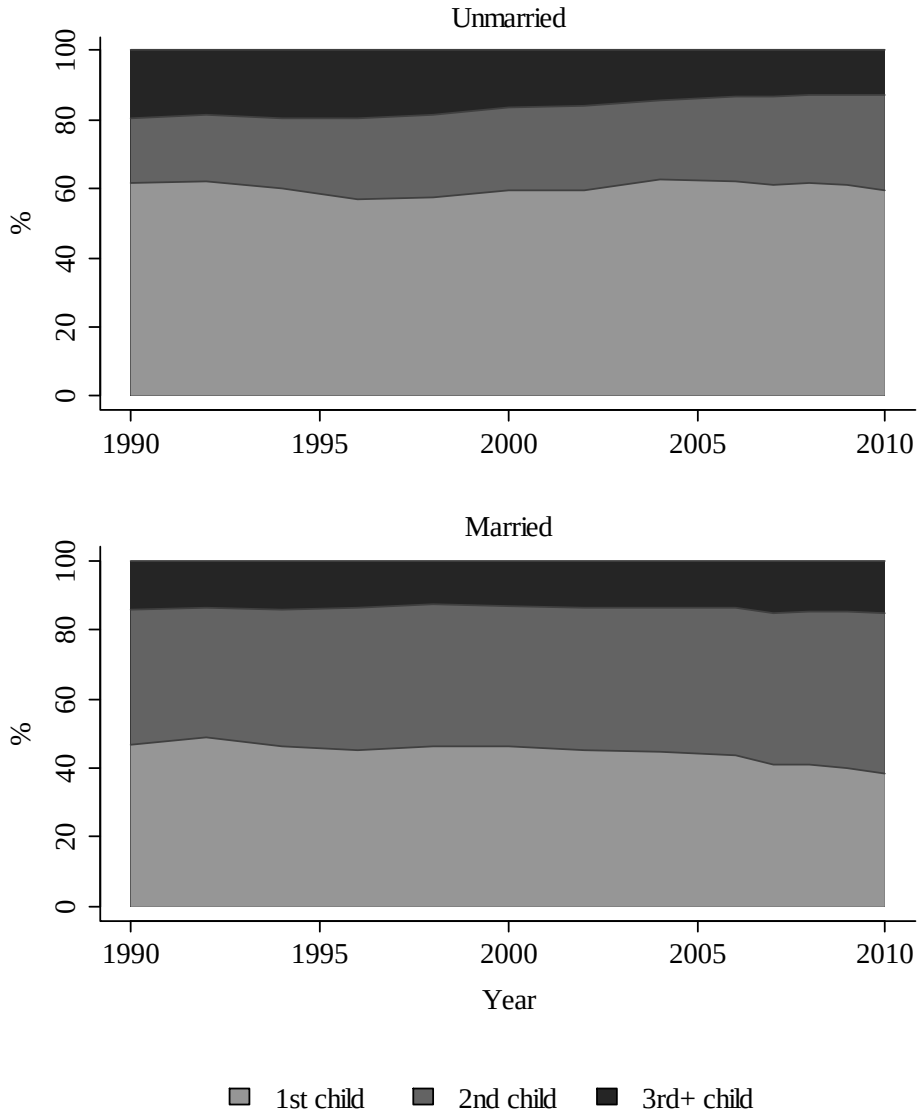
Figure 11.4. Married and unmarried mothers by age. Mothers, 1990-2010 (selected years), N= 1,378,350.



Source: CSO (birth register), author's computations.

Figure 11.5 shows that the parity structure of married and unmarried mothers rather diverged among married and unmarried mothers. Almost half of all children born in a marriage were firstborns in early 1990s. The proportion then declined by 10 percentage points. The proportion of firstborns is higher among unmarried mothers. It first declined from 62% to 57% and the rose again to slightly more than 60% since mid1990s.

Figure 11.5. Married and unmarried mothers by parity. Mothers, 1990-2010 (selected years), N= 1,378,350.



Source: CSO (birth register), author's computations.

11.4.2 Decomposition of the trend in marital status gap

These compositional changes could influence the marital status gap without anything else changing at all. To test for this option, I decompose the reduction of the marital status gap into two parts, the effect of changing composition of married and unmarried mothers by education, age, and parity, and the change in the direct effect of marital status. This is done by standardizing the population composition. Two standards are possible (the composition from 1990 and 2010), so both of them are applied and the

result is averaged. Details on the methods are explained in Chapter 15.2.3. The results are shown in Table 11.4. The mean birth weight of marital children rose only by 31g between 1990 and 2010 while the figure for non-marital children improved by 122g. The observed disparity in the mean birth weight dropped thus dropped by 91g (from 205g to 113g). When the compositions of married and unmarried mothers are fixed, the expected improvements decline to 5g for children born to married mothers and to 46g for non-marital children. The gap would thus decrease only by 41g if the demographic characteristics of married and unmarried mothers did not change since 1990. It means that 46% (=41/91) of the trend in marital status gap in mean birth weight can be explained by a change in the direct effect of marital status. The remaining 50g (56%) result from rising age and education of mothers.

Table 11.4. Decomposition of the trend in the marital status gap in mean birth weight and low birth weight rate. Live singleton births, 1990 and 2010, N=236110.

	Observed values			Standardized values		
	1990	2010	Trend	2010 with 1990 standard	1990 with 2010 standard	Trend
Mean birth weight (g)						
Married	3332	3363	31	3332	3353	5
Unmarried	3127	3249	122	3170	3200	46
Marital status gap	205	114	-91	162	154	-41
Low birth weight rate						
Married	4.2	4.4	0.3	4.8	4.2	0.4
Unmarried	10.6	7.1	-3.5	9.1	8.6	-1.5
Marital status gap	6.4	2.6	-3.8			-2.0

Note: The populations of married and unmarried mothers are standardized on maternal education, age, and parity.
Source: CSO (birth register), author's computations.

Similar results hold also for low birth weight, as shown in the bottom panel of Table 11.4. The advantage of marital children in low birth weight rate declined by 3.8 percentage points (from 6.4% to 2.6%). The standardized trend worsens by 0.4 percentage points among marital children and improves by 1.5 percentage points among non-marital children. The gap is thus reduced by 2.0 percentage points (i.e. 2.0/3.8=52% of the total trend) due to the diminishing direct effect of marital status. The

remaining 48% of the reduction of the marital status gap in low birth weight rate can be explained by socio-demographic composition of married and unmarried mothers.

Shifting characteristics of mothers contributed substantially to the trend of closing gap between birth outcomes of marital and non-marital children. However, approximately half of the trend still remains unexplained. The standardized effect of marital status declines less sharply, but still clearly in both outcomes. These results suggest that any of the five hypotheses may be valid.

11.5 Trend in the effect of marital status – tests of selection explanations

Previous section found that the selection explanations and the direct (substantive) explanations of the closing marital status gap are approximately equally relevant. This section inspects the selection explanations. It evaluates the first two hypotheses, the hypothesis of socioeconomic selection and the hypothesis of marriage postponement. I estimate a series of models that are aimed at explaining the trend in the effect of marital status by individual characteristics of mothers. They are listed in Table 11.5. The first model (S0) includes only marital status interacted with time. The time variable is categorical. It indicates all contexts that correspond to each particular year. It is not parsimonious, but allows a precise description of the trend and serves as a baseline.

Model S1 adds the effect of maternal education to test the socioeconomic selection hypothesis which assumes that the changing size of the marital status gap can be explained by the composition of unmarried mothers by education. Maternal education significantly improves the goodness of fit of the model (likelihood-ratio test statistics is 15308 with 3 d.f. which gives p-value<0.0001, AIC decreases by 15252). Model S1 assumes that the effect of maternal education on birth weight did not change in time. In other words, it expects that having a mother with tertiary education was the same advantage in 1990 as in 2010. This might not be the case (cf. [Koupilová 1998a, Štípková, Kreidl 2011]). So Model S2 allows the effect of education to change in time. This interaction is indicated to be statistically significant, as well.

Analogical models for low birth weight are denoted T0 to T2 and are also listed in Table 11.5. The effect of maternal education, added in T1, improved the model fit. However,

it does not significantly change in time. Likelihood-ratio test (Chi^2=36 with 36 degrees of freedom yields p-value=0.46) and the comparison of AIC values (it rises by 36 from T1 to T2) both favour T1 over T2. The significant improvement of models after education is controlled for supports the hypothesis of socioeconomic selection. Before the results of the models are shown, material for testing the other selection hypothesis is provided.

Table 11.5. Goodness of fit statistics of the random-intercept models of birth weight and low birth weight. Live singleton births, 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

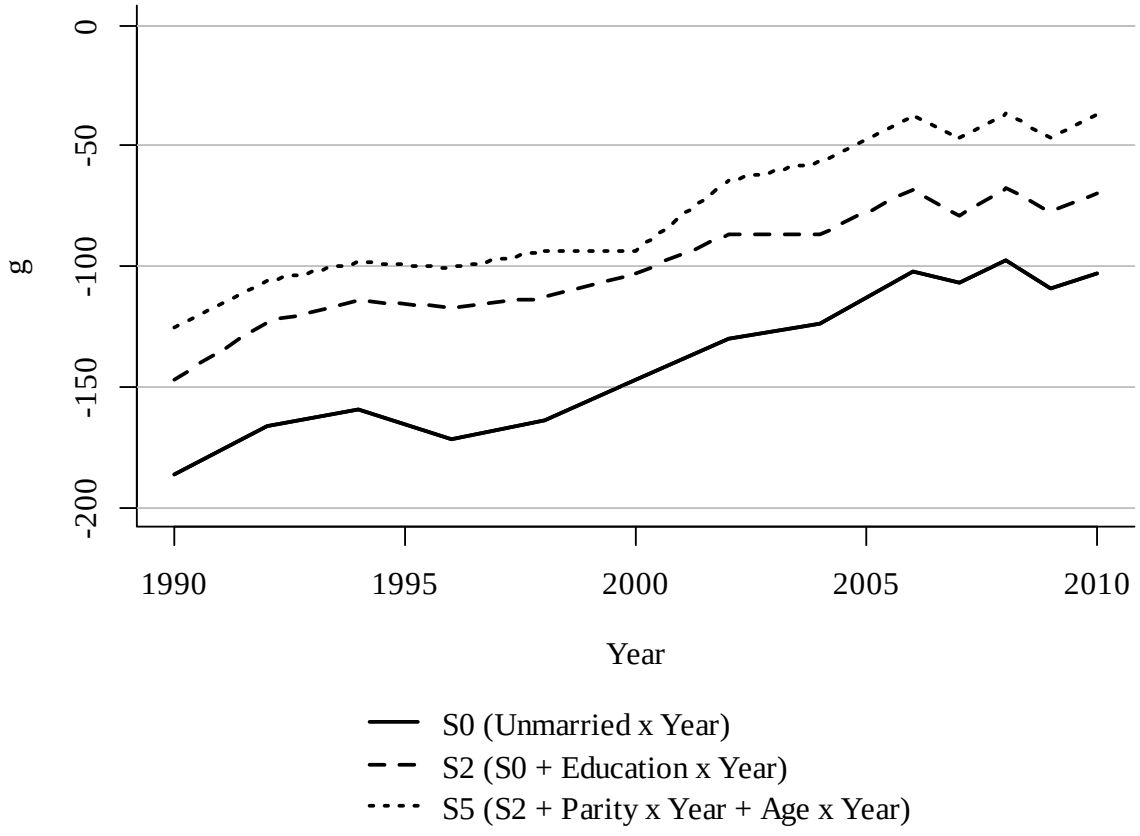
Models of birth weight	Chi2	DF	p-value	AIC
S0: Unmarried x Year	13881	25	<0.00001	20358970
S1: S1+Education	29189	28	<0.00001	20343668
S2: S1 + Education x Year	29422	64	<0.00001	20343506
S3: S2 + Parity + Age	44671	68	<0.00001	20328266
S4: S3 + Parity x Year	44890	92	<0.00001	20328094
S5: S4 + Age x Year	44979	116	<0.00001	20328054
Models of low birth weight				
T0: Unmarried x Year	4791	25	<0.00001	506653
T1: T1+Education	11336	28	<0.00001	500978
T2: T1 + Education x Year	11361	64	<0.00001	501013
T3: T1 + Parity + Age	13618	32	<0.00001	498377
T4: T3 + Parity x Year	13801	56	<0.00001	498253
T5: T4 + Age x Year			<0.00001	498213

	Likelihod-ratio tests			Difference
	Chi2	DF	p-value	in AIC
S1 vs. S0	15308	3	<0.00001	-15302
S2 vs. S1	234	36	<0.00001	-162
S3 vs. S2	15249	4	<0.00001	-15240
S4 vs. S3	219	24	<0.00001	-172
S5 vs. S4	89	24	<0.00001	-40
T1 vs. T0	5681	3	<0.00001	-5675
T2 vs. T1	36	36	0.463	36
T3 vs. T1	2608	4	<0.00001	-2600
T4 vs. T3	172	24	<0.00001	-124
T5 vs. T4	88	24	<0.00001	-40

Note: Year is measured as categorical in these models (unlike models presented in Table 11.6).
Source: CSO (birth register), author's computations.

The hypothesis of marriage postponement assumes that the trend in the marital status gap is driven by parity and age composition of married and unmarried mothers. Model of birth weight S3 follows S2 and adds maternal age and parity. These effects are, as expected, highly significant (see Table 11.5). The next two models allow the effect of maternal parity and age to change in time. Both of these interactions showed to be important, as well. The models of low birth weight lead to the same conclusion. Model T3 develops T1 (the effect of maternal education does not change with time) by adding maternal age and parity. Models T4 and T5 then allow, respectively, parity and age to vary by time. The most complex model T5 is preferred by both likelihood-ratio test and AIC. How the socioeconomic selection and marriage postponement influenced the marital status gap in birth weight and low birth weight is shown in Figures 11.6 and 11.8.

Figure 11.6. Trend in the marital status gap in birth weight estimated by models S0, S2, and S5. Live singleton births, 1990-2010 (selected years) N=1,327,484.



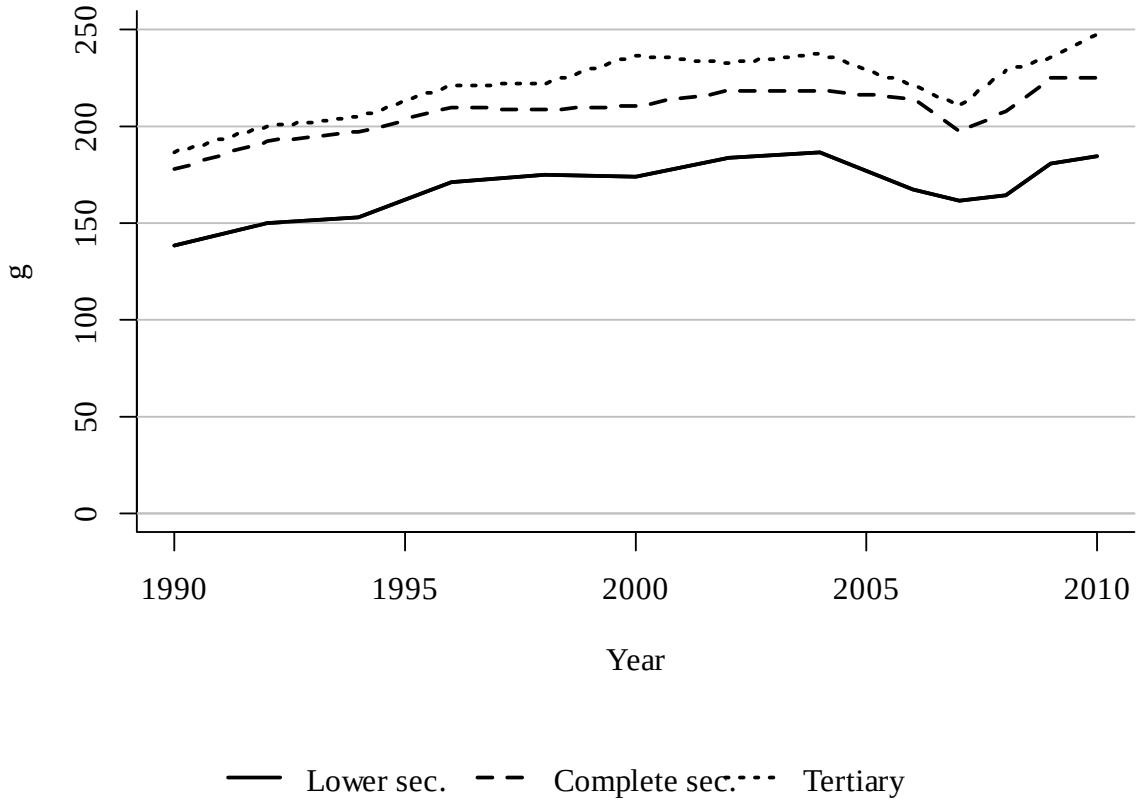
Source: CSO (birth register), author's computations.

Figure 11.6 plots the results for birth weight. The solid line represents the crude marital status disparity.[37] When education is controlled for in Model S2 (the dashed line), the gap declines, because part of it is explained by the association of unmarried motherhood with low education, as expected by the socioeconomic selection hypothesis. Maternal education reduces the effect of education by tens of grams. The socioeconomic selection effect is not equal at every time point. It explains about 39g of the 186g disparity in 1990. The selection effect then gains in strength. It explains the largest part of the marital status gap during mid- and late 1990s. For instance, in 1996, 54g out of the total 171g gap in birth weight was due to maternal education. The selection effect then weakened and it explained only about 30g of the 100g gap by the late 2000s.

Chapter 6 showed that the association of unmarried status with low education grew stronger in the 1990s (but attenuated later). This elevated socioeconomic selection of unmarried mothers prevented the marital status gap in mean birth weight from declining more rapidly in the 1990s. Furthermore, Figure 11.7 shows that the effect of maternal education on birth weight grew in this time. It plots the time trend in the coefficients of maternal education from Model S5. The advantage of any level of maternal education which is higher than the lowest grade has been large during the whole study period and rose gradually between 1990 and 2004. For instance, the advantage of infants born to university graduates, compared to the reference category of elementary education, rose from 187g to 238 g between 1990 and 2004. The size of the advantage then oscillated somewhat and seems to have stabilized at the high level or even continues to grow. This, however, does not outweigh the effect of narrowing educational gradient in unmarried motherhood. Declining socioeconomic selection in the latter half of the study period promotes the convergence of mean birth weights of marital and non-marital children.

[37] The size of the marital status gap is somewhat lower than in the descriptive Figure 11.1. This is due to the fact that the models are estimated a slightly different population (children born to mothers younger than 18 years were excluded from the multivariate analysis because they cannot be married).

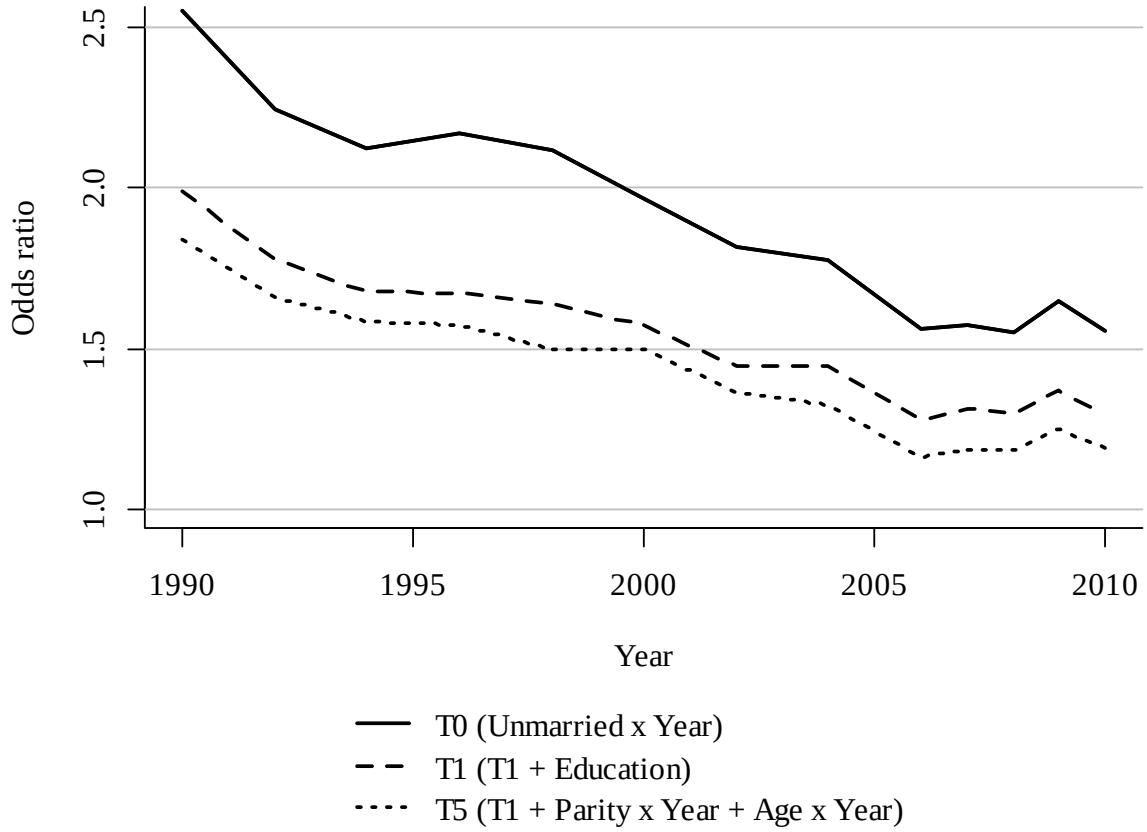
Figure 11.7. Trend in the educational gradient in birth weight estimated by model M5. Live singleton births, 1990-2010 (selected years), N=1,327,484.



Source: CSO (birth register), author's computations.

The trend in the effect of socioeconomic selection was similar in the case of low birth weight. Figure 11.8 shows the effects of unmarried status on the odds of low birth weight estimated by models T0, T1 and T5. The solid line describes the odds ratio of low birth weight for non-marital versus marital children. The crude odds ratio declined from 2.55 to 1.56 between 1990 and 2010. It decreases less steeply when maternal the educational selection is taken into account: from 1.99 to 1.29 (see the dashed line which plots the odds ratios estimated by Model T1). The socioeconomic selection thus attenuated the marital status gap. This took place after 2000. Before that, effect of socioeconomic selection strengthened in the 1990s (especially the late 1990s when the association of unmarried status with low education rose). The decline of the socioeconomic selection then promoted closing the marital status gap in low birth weight and its effect seems to have stabilized in late 2000s.

Figure 11.8. Trend in the marital status gap in low birth weight (odds ratios) estimated by models T0, T1, and T5. Live singleton births, 1990-2010 (selected years), N=1,327,484.



Source: CSO (birth register), author's computations.

The hypothesis of marriage postponement argues that the trend in the marital status gap is shaped by the postponement of marriage to higher age and after first birth. As marriage tends to be delayed after first birth, the gap should increase, because firstborns tend to weigh less. Marital childbearing has also shifted to higher ages. The longer the woman/parental couple wait before having children, the more resources they accumulate and the better living conditions they have. This should increase the marital status gap. On the other hand, higher pace of the rising age of married mothers may reduce the advantage of marital children due to biological ageing and its negative impact on birth outcomes.

The effect of marital status, net of the influence of maternal age and parity, on birth weight (estimated by Model S5) is weaker than the effect of socioeconomic selection. It

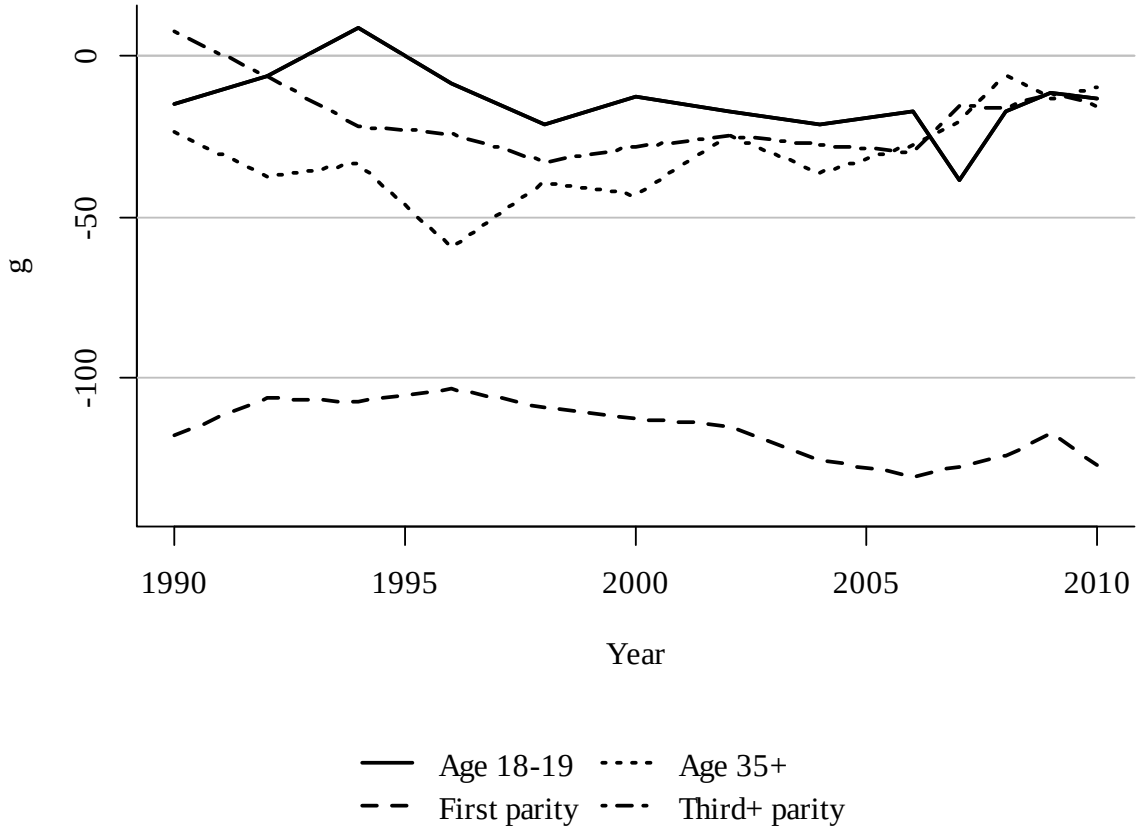
is depicted with the dotted line in Figure 11.6. The part of the gap which is explained by maternal age and parity is small (around 20g) and constant until 2000. The effect of marriage postponement then strengthens. The portion of the marital status gap which is explained by the age and parity composition of mothers increased in the first half of 2000s and then stabilized at around 30g. If the parity and age selection of unmarried mothers did not change, the marital status gap in birth weight would decline even faster (see the dotted line - model S5). The trend of postponement of marriage to higher age and higher parities was prominent in the 2000s (see Figures 11.4 and 11.5), which explains why the effect is stronger in this period.

The effect of marriage postponement was also fuelled by rising disadvantage of firstborns after 2000. It is depicted in Figure 11.9 This figure shows the trend in the coefficients for maternal age and parity estimated in Model S5. The disadvantage of firstborns ranged between 103g and 117g until and then approached 130g. On the other hand, the effect of marriage postponement was hindered in 1990s due to relatively high disadvantage of children born to older mothers (35+ years). It was around 40g until 2000 and then gradually declined to about 10g. This contributed to the preservation of the marital status gap because unmarried mothers were more often older than 35 years than married mothers in1990s (see Figure 11.4).

Figure 11.8 shows that marriage postponement did not shape the declining gap in low birth weight. The size of the gap attributable to maternal age and parity is low and relatively stable (see the difference between the dashed and dotted line in Figure 11.8). The odds of low birth weight for non-marital children estimated by model T5 is 1.84 in 1990 and 1.19 in 2010. The respective figures for Model T1 are 1.99 and 1.29. Figure 11.10 shows why the marriage postponement did not modify the marital status gap. It plots the trends in the effects of maternal age and parity on the odds of low birth weight. Unlike the previous results for birth weight, the effect of first parity is not substantially larger than the remaining effects. It is increasing: the odds ratio rose about 1.4-1.5 in the 1990s to about 1.6-1.8 in the late 2000s. The rising effect of first parity was also compensated by the effect of young age, which was not harmful (odds ratio around 1) until 2005 and then even became a favourable factor. The effects of higher age and parity ranged between 1.3 and 1.5 and did not change much during the study period. Persistently positive effect of high maternal age on low birth weight (which was not

observed for birth weight – see Figure 11.9) prevented the low birth weight rate of children born to marriage from declining (and thus prevented possible hindering of the convergence of the low birth weight rates of the marital status groups). The marriage postponement did not contribute to preserving the marital status gap in low birth weight.

Figure 11.9. Trend in the effect of maternal parity and age on birth weight estimated by model S5, 1990-2010. Live singleton births, 1990-2010 (selected years), N=1,327,484.

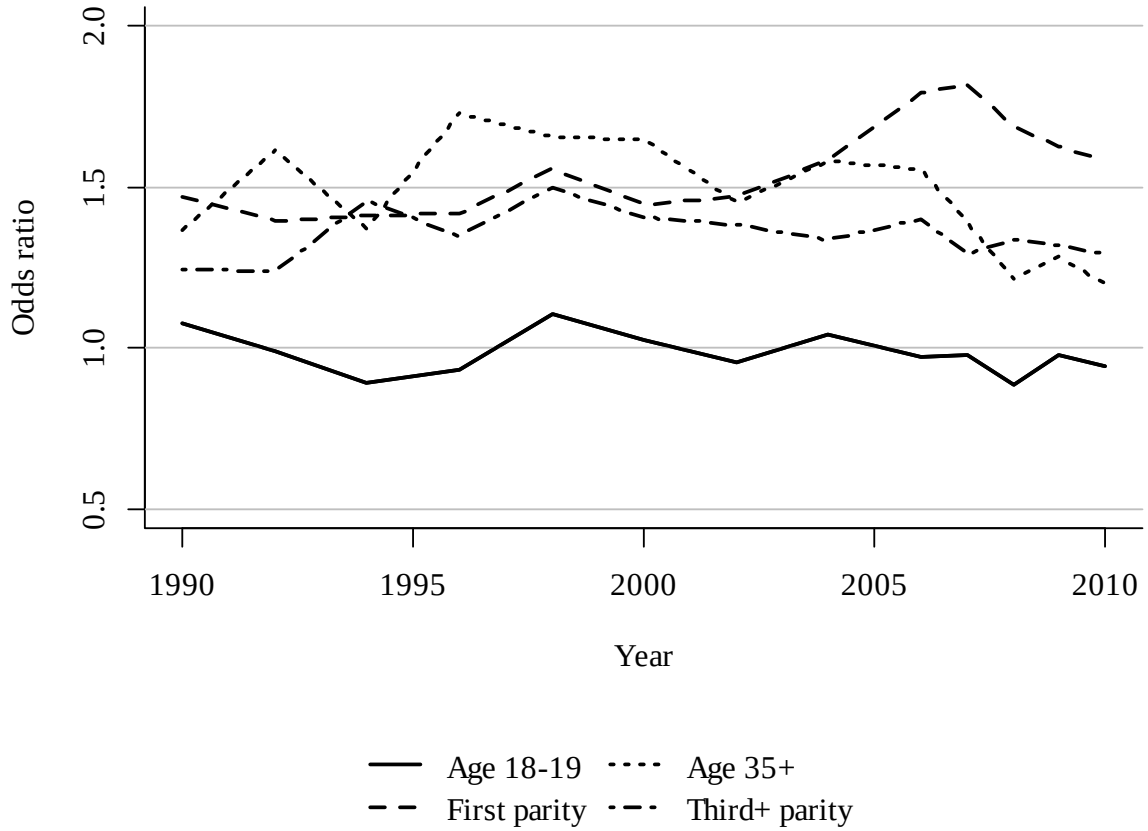


Source: CSO (birth register), author's computations.

In sum, socioeconomic selection of unmarried mothers contributed significantly to the convergence of birth outcomes of married and unmarried mothers. The rising socioeconomic selection of unmarried mothers (and rising importance of SES for birth weight) hindered the decline in marital status gap in 1990s. Although the educational gradient in mean birth weight (but not low birth weight) rose well into the 2000s, the compositional (selection) effect of education weakened since the late 1990s. Declining socioeconomic selection of unmarried mothers contributed to closing the marital status

gap in both birth weight outcomes in the 2000s. Especially the decline of the share of women with elementary education among unmarried mothers, which started in the second half of the 1990s, contributed to this trend.

Figure 11.10. Trend in the effect of maternal parity and age on low birth weight (odds ratios) estimated by model T5. Live singleton births, 1990-2010 (selected years), N=1,327,484.



Source: CSO (birth register), author's computations.

The effect of marriage postponement was weaker and only influenced the marital status gap in mean birth weight. The effect took place in the latter part of the period and inhibited the decline of the marital status gap. The growing association of unmarried motherhood with early stages of family formation hindered further convergence of the birth weight of marital and non-marital children. The marriage postponement effect was further supported by the increasing disadvantage of firstborns and a declining disadvantage of children born to older mothers. The effect of marriage postponement on

the marital status gap in low birth weight involved two processes that cancelled each other: the disadvantage of first-borns did not rise substantially and the disadvantage of older maternal age did not decrease. As a result, the marriage postponement did not change the marital status gap in low birth weight.

11.6 Trend in the direct effect of marital status

Previous analysis showed that the trend of declining marital status gap in birth weight cannot be fully explained by changing composition of mothers and changing effects of maternal education, parity and age. The direct effect of marital status weakened in the two decades under study. Three hypotheses related to the direct effect of marital status are tested in this section. The hypothesis of economic protection assumes that marriage is more protective at times of economic uncertainty (net of the effect of maternal education). The hypothesis of increasing social acceptance of unmarried motherhood relates the weakening of the marriage advantage to how common non-marital childbearing is in the given local and time context. Finally, the hypothesis of rise in cohabitation expects a linearly declining disadvantage of unmarried status, because the linearly rising share of cohabiting unmarried mothers is assumed to explain narrowing of the gap.

Table 11.6 presents the estimated models. The reference models are M3 (for birth weight) and L3 (for low birth weight) presented already in Table 11.1. Three macro-level explanatory variables are added to this baseline model in Models M7 and L7. The unemployment rate models the effect of economic uncertainty, the non-marital childbearing rate measures how much accepted it is in the give context to give birth as unmarried. A continuous measure of year expresses the increasing share unmarried mothers with partners. These context-level predictors improve the fit of the models and reduce unexplained variance at the contextual level. The standard deviation of the random intercepts was 28.6 (see Table 11.3) which was reduced to 23.4 in M7 (see Table 11.7 below). Similarly the residual context-level variability decreased from 0.110 to 0.074 between models L3 and L7 (see Tables 11.4 and 11.9).

Table 11.6. Goodness of fit statistics of the random-intercept models of birth weight and low birth weight. Live singleton births, 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

	Chi2	DF	p-value	AIC
Models of birth weight				
M3: Unmarried + Education + Age + Parity	43915	8	<0.00001	20328902
M7: M3 + Nonmarital childbearing rate + Unemployment rate + Year	43985	11	<0.00001	20328838
M8: M7 + Unmarried x Unemployment	44025	12	<0.00001	20328800
M9: M8 + Unmarried x Unemp. x Policy	44323	24	<0.00001	20328526
M10: M7 + Unmarried x Nonmarital CB	44124	12	<0.00001	20328700
M11: M7 + Unmarried x Nonmarital CB_splined	44299	16	<0.00001	20328534
M12: M7 + Unmarried x Year	44415	12	<0.00001	20328410
Models of low birth weight				
L3: Unmarried + Education + Age + Parity	13130	8	<0.00001	498624
L7: L3 + Nonmarital childbearing rate + Unemployment rate + Year	13475	11	<0.00001	498533
L8: L7 + Unmarried x Unemployment	13522	12	<0.00001	498496
L9: L8 + Unmarried x Unemp. x Policy	13861	24	<0.00001	498382
L10: L7 + Unmarried x Nonmarital CBR	13580	12	<0.00001	498448
L11: L7 + Unmarried x Nonmarital CBR_splined	13683	16	<0.00001	498397
L12: L7 + Unmarried x Year	13658	12	<0.00001	498362

	Likelihod-ratio tests			Difference
	Chi2	DF	p-value	in AIC
M7 vs. M3	70	3	<0.00001	-64
M8 vs. M7	40	1	<0.00001	-38
M9 vs. M8	298	12	<0.00001	-274
M10 vs. M7	139	1	<0.00001	-138
M11 vs. M10	175	4	<0.00001	-166
M12 vs. M7	430	1	<0.00001	-428
L7 vs. L3	96.51	3	<0.00001	-91
L8 vs. L7	39.16	1	<0.00001	-37
L9 vs. L8	138	12	<0.00001	-114
L10 vs. L7	87	1	<0.00001	-86
L11 vs. L10	58	4	<0.00001	-50
L12 vs. L7	173	1	<0.00001	-171

Source: CSO (birth register), author's computations.

The effect of unemployment rate is, surprisingly, positive. An increase of 10 percentage points elevates the mean birth weight by 24 g (coefficient 2.4 in M7). The effect is

rather small considering that the unemployment rate rarely oscillates by more than few percentage points (except the unique situation of the 1990s). The influence on low birth weight seems to be even weaker. The coefficient estimated by model L7 (see Table 11.8) has value -0.01 (odd ratio 0.90 when for a 10% increase in unemployment rate). The positive influence of unemployment rate on birth outcomes will be discussed below.

Table 11.7. Coefficients estimated in models of birth weight. Live singleton births, 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

	M7	M8	M10	M12
Fixed effects				
Unmarried mother	-63.0***	-64.8***	-68.0***	-114.0***
Maternal education (Elementary=ref.)				
Lower secondary	169.6***	169.5***	169.1***	167.8***
Complete secondary	208.3***	208.4***	208.0***	206.9***
Tertiary	220.9***	221.0***	221.0***	220.7***
Maternal parity (Second child=ref.)				
First child	-116.7***	-116.8***	-116.9***	-117.3***
Third+ child	-19.0***	-18.9***	-18.7***	-18.3***
Maternal age (20-34= ref.)				
18-19	-11.3***	-11.3***	-10.8***	-9.7***
35+	-22.3***	-22.1***	-21.7***	-21.7***
Unemployment rate (Mean=6.4=ref.)	2.4***	1.9***	2.4***	2.6***
Non-mar. childbearing rate (Mean=25.6=ref.)	-2.4***	-2.4***	-2.7***	-2.4***
Year (1990=ref.)	3.3***	3.4***	3.5***	2.5***
Unemployment x Unmarried		1.7***		
Non-marital CBR x Unmarried			1.1***	
Year x Unmarried status				3.8***
Intercept	3,204.3***	3,203.6***	3,201.4***	3,214.6***
Random effect				
SD(Intercept)	23.4***	23.6***	24.1***	24.9***
Rho	0.002***	0.002***	0.002***	0.002***

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: CSO (birth register), author's computations.

The effect of non-marital childbearing rate is negative. Non-marital childbearing rate rose roughly by 30 percentage points during the study period. According to model M7, a 30% rise in the prevalence of non-marital childbearing implies a 72g (-2.4 * 30) decline in mean birth weight. This can be expected because more unmarried mothers, who

usually have smaller infants, clearly reduce the mean birth weight. The effect of non-marital childbearing rate is positive: a 30% rise of non-marital childbearing implies a 1.35 (=exp(30*0.01) times higher odds of low birth weight. Year influences birth weight positively. We have seen in Chapter 10 that the time trend in mean birth weight was not linear and that the value in 2010 was similar to that of 1990. But with all the variables controlled for, the upward tendency prevails and the mean birth weight tends to rise by 3.3g per year. Analogical trend for low birth weight is much less clear. The coefficient is lower than -0.01. The general effects of the context-level variables variables are, however, not the main interest here.

Table 11.8. Coefficients estimated in models of low birth weight. Live singleton births, 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

	L7	L8	L10	L12
Fixed effects				
Unmarried mother	0.297***	0.309***	0.325***	0.538***
Maternal education (Elementary=ref.)				
Lower secondary	-0.667***	-0.666***	-0.664***	-0.660***
Complete secondary	-0.902***	-0.902***	-0.900***	-0.898***
Tertiary	-1.007***	-1.008***	-1.010***	-1.012***
Maternal parity (Second child=ref.)				
First child	0.443***	0.444***	0.445***	0.447***
Third+ child	0.304***	0.304***	0.303***	0.301***
Maternal age (20-34= ref.)				
18-19	-0.026	-0.026	-0.028*	-0.032**
35+	0.333***	0.330***	0.328***	0.327***
Unemployment rate (Mean=6.4=ref.)	-0.011***	-0.006**	-0.011***	-0.013***
Non-mar. childbearing rate (Mean=25.6=ref.)	0.010***	0.011***	0.013***	0.010***
Year (1990=ref.)	-0.006***	-0.007***	-0.008***	-0.001
Unemployment x Unmarried		-0.014***		
Non-marital CBR x Unmarried			-0.007***	
Year x Unmarried status				-0.019***
Intercept	-2.635***	-5.205***	-2.620***	-5.138***
Random effect				
SD(Intercept)	0.074***	0.077***	0.078***	0.081***
Rho	0.002***	0.002***	0.002***	0.002***

Note: *** p<0.01, ** p<0.05, * p<0.1.

Source: CSO (birth register), author's computations.

The interaction of the macro-variables with maternal marital status is important for evaluation of the hypotheses. Models M8 and M9 (L8 and L9, respectively) focus on the hypothesis of economic protection and include interaction between marital status and unemployment rate. This interaction (added in models M8 and L8) is highly statistically significant for both outcomes (birth weight and low birth weight). It assumes that the effect of unemployment is linear. However, we have seen in Chapter 6 that rising unemployment influenced marital behaviour of mothers differently under different policy regime. The protective effect of marriage may have changed as well under these changing conditions. Models M9 and L9 thus allow the interaction between marital status and unemployment to vary by policy regime. This three-way interaction adds 12 more parameters but improves the fir of the models. I first build this model step-wise and tested if a simpler model with the policy variable represents the data more parsimoniously. The three-way interaction model is the best for birth weight, but not for low birth weight [38]. So I prefer model M9 for birth weight and M8 for low birth weight.

Selected coefficients estimated by model M9 are shown in Table 11.9. The protective effect of marriage is clear in the first half of the 1990s (before the social security system was fully reformed). Unemployment rate had a negative effect on mean birth weight of children born to both married and unmarried mothers and the impact on non-marital children was about 4g stronger. The effect of unemployment on birth weight then turned to be slightly positive between 1996 and 2008. There is no substantial difference between marital and non-marital children. A likely explanation is that (unlike the previous period) women of prime childbearing age started to intensively delay childbearing and probably started to be more deliberate about timing of the birth and the consequences of economic insecurity were not that harmful as when the first experiences with market economy were learned in the early 1990s. Rising unemployment showed to impact negatively on non-marital children after the 2009 cuts on the social benefits for single mothers. The effect of economic protection of marriage was thus revived at the end of the study period. On the other hand, the effect of marriage protection is not present for low birth weight. The coefficient for unemployment rate estimated by mode L8 is almost zero for marital children and -0.02 for non-marital children.

[38] The three-way interaction in L9 was only significant due to the policy variable than interacted with marital status among captured the L9

Table 11.9. Selected coefficients estimated by models M9 and M11. 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

	Marital status		
	Married	Unmarried (interaction terms)	**Main effect of policy**
M9			
The effect of unemployment rate			
Policy			
Universal benefits	-4.7	-3.8	-88.6
First income-testing	-1.0	-4.2*	-52.3***
Advanced income-testing	1.1*	0.1	ref.
Equal length of maternity allowance	0.3	-3.1***	-14.4**
Main effect of unmarried status	Ref.	-61.1***	
M11			
The effect of non-marital childbering rate			
Non-marital childbearing rate			
<35%	-1.6***	2.5***	
>35%	-2.6***	-1.3***	
Main effect of unmarried status	Ref.	-62.8***	

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: CSO (birth register), author's computations.

Models M10 and M11 (L10 and L11, respectively) test the hypothesis of social acceptance of non-marital childbearing. The harmful effect of unmarried status should diminish when the absence of marriage becomes more common and socially accepted. The interaction between non-marital childbearing rate, added in models M10 and L10 is highly statistically significant. The effect of the spread of non-marital childbearing is assumed to be linear in these models. To test for the possibility that the effect is not linear, models M11 and L11 add (and interact with marital status) a spline variable that allows the effect of non-marital childbearing rate to change the slope in context where its value exceeds 35%.[39] This improves the model fit. The likelihood-ratio test criterion comparing M10 to M10 is 175 with 4 degrees of freedom (p-value<0.001) and AIC decreases by 166. The test statistics is lower but still highly significant (58) and AIC drops by 50 for L11 vs. L10.

[39] I first included more knots for the spline variable and the threshold of 35% showed to change the sing of the coefficient.

The resulting coefficients for birth weight (M11) are shown in Table 11.9 and for low birth weight (L11) are presented in Table 11.10. Unmarried status interacts negatively with non-marital childbearing in the context where it is lower than 35%. The marital status gap was estimated to 61g by model M11 and it closes by 2.5g with every percentage point rise of non-marital childbearing rate. The increase of the non-marital childbearing rate from 10% to 35% implies disappearance of the gap (25*2.5=62.5). Table 11.10 shows that the also the marital status gap in low birth weight becomes smaller as the non-marital childbearing rate rises. The difference in the logit of low birth weight (whose reference value is 0.30) declines by 0.01 with every percentage point increase of non-marital childbearing rate (0.01*25=0.25 i.e. the gap in the logit of low birth weight drops to only 0.05). This supports the social acceptance hypothesis. However, the effect reverses once having children outside marriage becomes too common. Rising share of mothers who are not married is not beneficial for their children once more than approximately one third of children are born outside marriage. The interaction coefficient that term is rather low for both outcomes so the reversal of the trend did not influence the marital status gap substantially but it could contribute to widening of the disparity between marital and non-marital newborns in the future if the non-marital childbearing rate continues to grow.

Table 11.10. Selected coefficients estimated by models M9 and M11. 1990-2010 (selected years), N(individuals)=1,327,484, N(contexts)=182.

	Marital status	
	Married	Unmarried (interaction terms)
The effect of non-marital childbering rate		
Non-marital childbearing rate		
<35%	0.011***	-0.013***
>35%	0.010***	0.004
Main effect of unmarried status	Ref.	0.296***

Note: *** p<0.01, ** p<0.05, * p<0.1.

Source: CSO (birth register), author's computations.

Finally, models M12 and L12 extend model M7 and L7 by interacting maternal marital status with year which measured the spread of cohabitations within unmarried family arrangements. The models assume that the effect of marital status declined linearly in time, as the childbearing in cohabitation spread. This assumption is strongly supported.

The criterion of the likelihood-ratio test is the highest for one degree of freedom (430 for M12 and 173 for L1; also the decline of AIC is the most pronounced).

The value of the interaction effect is positive and rather large. Model M12 predicts the marital status gap to be 114g (referring to the year 1990) and declining by almost 4g every year (i.e. by 84g within two decades). The unmarried status disadvantage in the logit of low birth weight was estimated to 0.54 in 1990 by model L12 which then declined by 0.02 every year (it results in decline by 0.40 in 20 years). This strongly supports the hypothesis of rise in cohabitation.

In sum, this chapter showed marriage has had a beneficial effect on birth weight of newborns during the whole study period and in all socio-demographic groups. The strength of the effect of marital status varies by maternal characteristics. Unmarried status is most harmful for children born to young and poorly educated women. Higher education and age partially protect against the negative consequences of unmarried status (this holds especially for mean birth weight and less for low birth weight) but do not override it. Having children outside marriage is more common for first-time mothers and the disparity between marital and non-marital children is less pronounced at first parity. The risk of adverse outcomes of maternal unmarried status rises gradually with progressing parity.

The birth weight of children born to married and unmarried mothers converged significantly during the past two decades. Several explanations for this trend were evaluated. One kind of the explanations relates to the self-selection of unmarried mothers from women with characteristics which are not favourable for the health of infants (low maternal education, first parity). About half of the convergence can be attributed to these socio-demographic characteristics of mothers. Rising educational attainment of mothers (especially diminishing of the lowest educational category) fuelled the convergence of birth outcomes by marital status, except for a period around the mid- and late 1990s, when strengthening educational selection of unmarried mothers hindered narrowing of the gap. This was a time of rising economic uncertainty. The effect of maternal education on birth outcomes increased and, moreover, maternal

education became also more tightly associated with her marital status. But the strong educational stratification of unmarried motherhood started to weaken after 2000 and contributed thus to the convergence of birth weights of marital and non-marital children. Postponement of marriage after first birth (and thus growing association of unmarried motherhood with first parities) prevented further decline of the marital status gap in mean birth weight (but not low birth weight), especially in the 2000s, when the disadvantage related to first parity deepened. But the contribution of the marriage postponement to the trend in the marital status gap in birth outcomes was rather low.

Three substantive explanations of the trend in marital status gap in birth weight and low birth weight are valid, as well. The declining gap in both birth weight outcomes can be attributed especially to the rising share of unmarried mothers who have partners and thus benefit from more social support. The increasing share of cohabiters among unmarried mothers makes the average disadvantage of unmarried status decline. The next chapter further inspects this finding.

The explanation of the diminishing marital status gap by rising social acceptance of unmarried motherhood was supported, as well. The disparity between marital and non-marital children was lower in contexts with higher prevalence of non-marital childbearing. However, this holds only under certain threshold. When the non-marital childbearing rate exceeds 35%, its rise is not beneficial for non-marital children anymore. This suggests that once the social stigma of unmarried motherhood is blunted, the negative implications of the spread of non-marital childbearing prevail.

The hypothesis of economic protection assumes that the positive effect of marriage on birth weight gets stronger at times of economic insecurity. This protective effect of marriage was found in the first half of the 1990s when childbearing at early age was common and social policy universally supported families. The negative impact of unemployment rate on birth weight vanished among both marital and non-marital children after 1995. This can be tentatively explained by the postponement of childbearing that took place at that time. Women who felt endangered by the economic situation and by the diminishing support for families from the social security system may have decided to postpone childbearing and thus left the study population. The protective effect of marriage against economic uncertainty was revived at the end of the

2000s when cuts on the social benefits for single mothers were introduced. An economic crisis took place at the same time which could be another source of this effect.

12 THE EFFECT OF PARTNERED AND SINGLE MOTHERHOOD

This chapter assesses the heterogeneity of unmarried mothers and inspects whether partnered unmarried motherhood has the same negative impact on birth outcomes as single motherhood. The data have serious limits for fulfilling this task. They do not allow a multivariate analysis of the trend across the whole study period. I therefore divide the analysis into two parts. The first part describes the crude trend in the birth weight disparity by family arrangement which is modelled with multiple imputation of the missing data on family arrangement in the period 1990-2006. The second part analyses the period with fully observed data (2007-2010) and analyzes the net effect of family arrangements on birth weight outcomes. It also assesses to what extent the results from previous chapter might be biased by ignoring the heterogeneity of unmarried mothers.

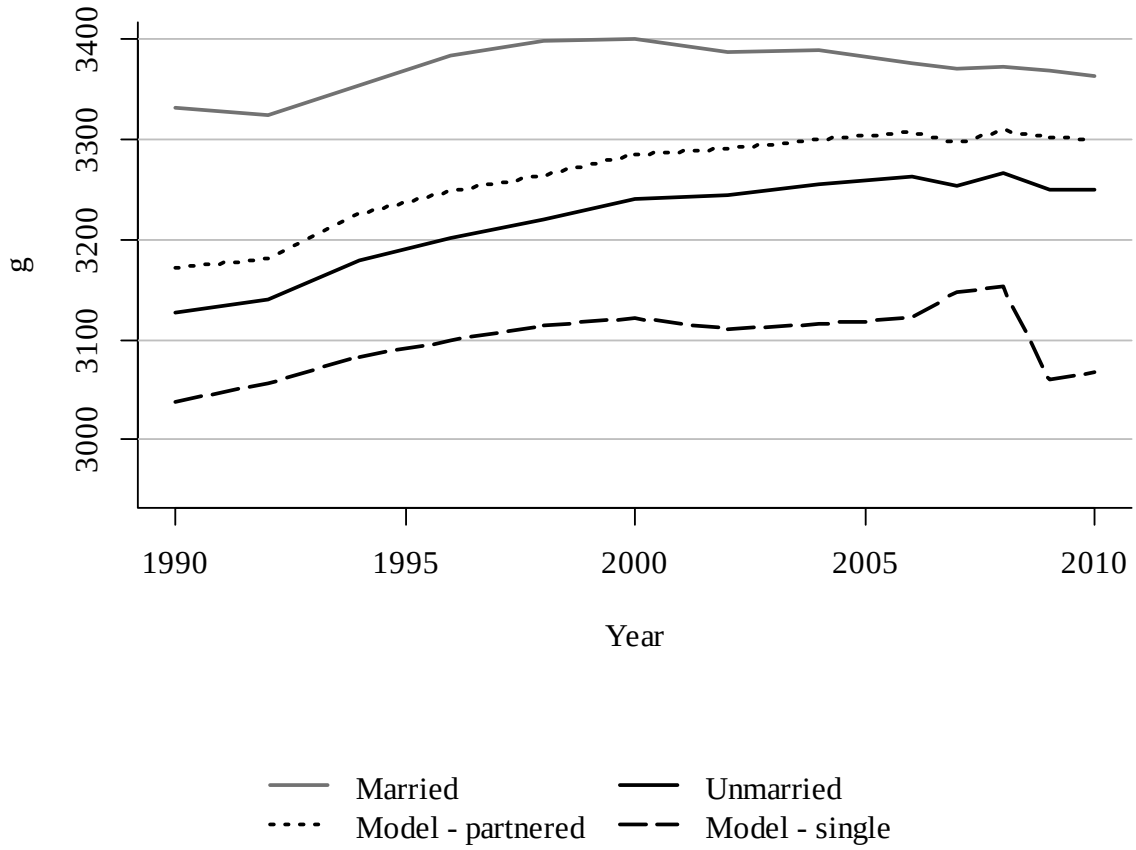
12.1 Description of the trend

The data from the birth register allow distinguishing partnered and single unmarried mothers only since 2007. This section models the past trends in the low birth weight rate among children born to partnered and single unmarried mothers. The analysis is done on the aggregated data coming from the multiple imputation. The technique of multiple imputation was already introduced in Chapter 7 where I used it to reconstruct the trend in family arrangements of unmarried mothers. This section analyses the birth weight of children born to these reconstructed categories of family arrangement.

Figures 12.1 and 12.2 plot the trends in mean birth weight and low birth weight rate (respectively) by the imputed categories of maternal family arrangement. Figure 12.1 shows that the rising trend of mean birth weight of non-marital children was present among both children of partnered and single women in 1990s. The trend then continued for children of partnered mothers, but stopped for infants without fathers. Improvement for children born to unmarried partners was from 3170g to 3300g. The mean birth weight of children born to single mothers first rose from 3040g to 3120g and then dropped to 3070g. The estimated trend in the low birth weight rate follows a similar pattern. Figure 11.2 shows that the favourable trends of decreasing incidence of low birth weight in all family arrangements stopped in late 1990s for children born to single

mothers (and also for marital children), while the trend for children of partnered mothers continued to be improving till 2005 and then stabilized. The proportion of children born to partnered mothers (mothers who reported fathers) who had low birth weight drop from 9% to 5% between 1990 and 2010. The estimated low birth weight for children without reported fathers first declined from 15% to 12%, but then rose again, even above the original level.

Figure 11.1. Trend in mean birth weight by family arrangement (categories of single and partnered mothers from multiple imputation in 1990-2006). Live singleton births, 1990-2010 (selected years), N= 1,344,508.

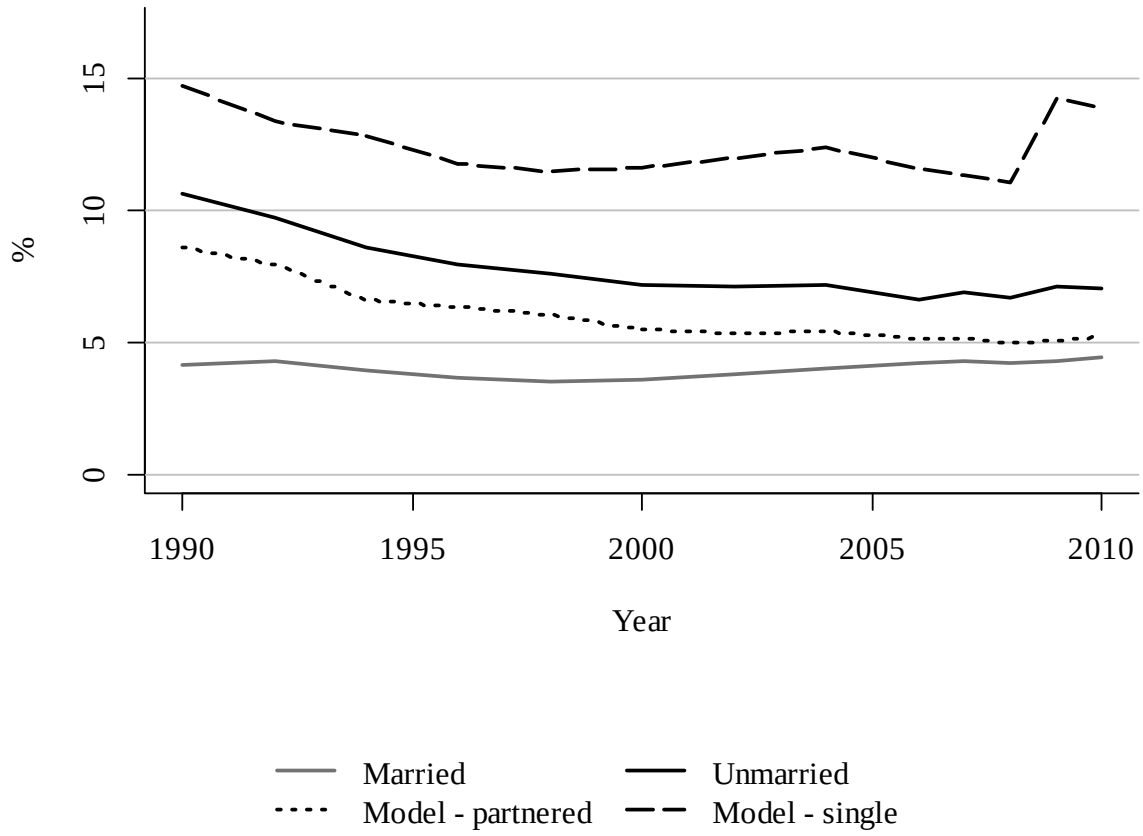


Source: CSO (birth register), author's computations.

Both figures show an oscillation of the trend in 2007-2008, especially among the children of single mothers. Their outcomes are significantly better in these two years. This is clearly a consequence of the misreporting of single status due the maternity allowance policy. Mothers who lived in unmarried unions pretended to be single and

thus elevated the birth weight in the single group. The bias is filtered in the imputed time series, because I included a variable indicating the 2007-2008 period as special.

Figure 11.2. Trend in low birth weight rate by family arrangement (categories of single and partnered mothers from multiple imputation in 1990-2006). Live singleton births, 1990-2010 (selected years), N= 1,344,508.

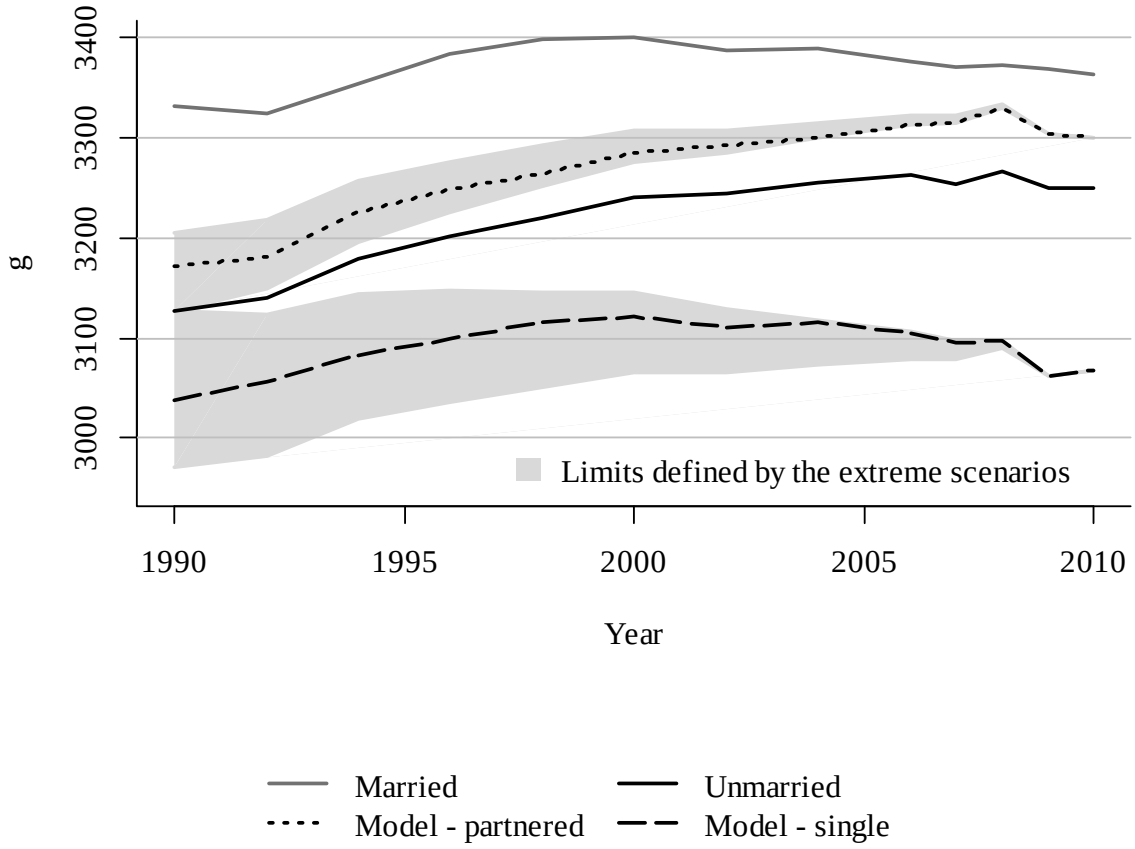


Source: CSO (birth register), author's computations.

I compare the imputed data with hypothetical scenarios of the birth weight disparities to evaluate their plausibility. The observed data in 2007-2010 show that the disadvantage of maternal single status is much larger than the disadvantage of partnered status. This does not necessarily hold also for the past trend. The imputed dataset suggests that the discrepancy between the two unmarried family arrangements was widening during the study period. Theoretically, two extreme alternative scenarios can be imagined. The first scenario is a constantly high disparity between children born to single and partnered mothers. It assumes that disparity was the same during the whole study period. The second extreme assumes that, as both single motherhood and parenthood within an

unmarried relationship were rare and rather deviant forms of parenthood in 1990, there was no difference between the birth weights of children born to all unmarried mothers, without regard to the parental partnership status. The disparity between the two unmarried family arrangements then rose gradually to the observed level in 2007-2010. Hypothetical results of these scenarios, together with the trends estimated by multiple imputation are shown in Figures 12.3 and 12.4. Details on how the hypothetical trends were computed are described in Chapter 15.2.4.

Figure 12.3. Adjusted trend in mean birth weight by family arrangement, (categories of single and partnered mothers from multiple imputation in 1990-2006). Live singleton births, 1990-2010 (selected years), N= 1,344,508.

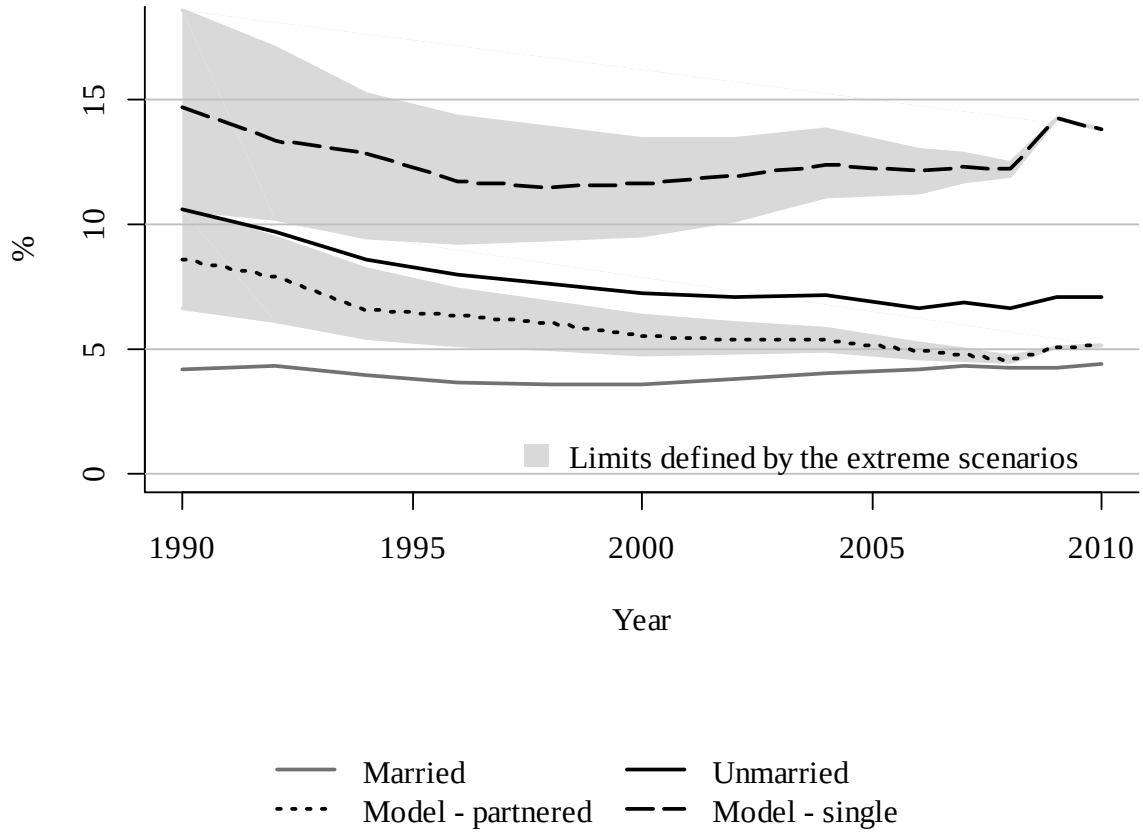


Source: CSO (birth register), author's computations.

Although they are unlikely, the two extreme scenarios define the limits of what might have happened with the birth weight disparity by family status and allow an assessment of how realistic the results of multiple imputation are. I also adjusted the oscillation of the trend in 2007-2008, which was caused by misreporting single status, by linear

interpolation between 2006 and 2009. The imputed trend for children of partnered mothers and also both of the extreme scenarios suggest that children of partnered mothers are being born with increasing weight and they are thus getting more similar to children born in marriage. The convergence was supported also by slightly worsening outcomes of marital children in 2000s. The trend is less clear for children of single mothers. Their mean birth weight was improving in 1990s, similarly as we saw in all family arrangements. After 2000, the trend has reversed. This pattern is, more or less pronounced, present in all three models.

Figure 12.4. Adjusted trend in low birth weight rate by family arrangement (categories of single and partnered mothers from multiple imputation in 1990-2006). Live singleton births, 1990-2010 (selected years), N= 1,344,508.



Source: CSO (birth register), author's computations.

The models however differ in whether there is a convergence towards marital children. The assumption of constant disparity between marital and non-marital children suggests slightly narrowing difference between marital children and children of single mothers.

The scenario of equality of nonmarital arrangements in 1990, on the other hand, suggests widening gap. The imputed model indicates a slight divergence in mean birth weight and rather stable gap in low birth weight between children born to married and single mothers. In any case, the disparity between birth weight of children born in these two family arrangement persists to be large.

When the oscillation in the outcomes in 2007-2008 is smoothened, the disparity between children born to different family arrangements seems to be stabilizing at the end of the study period with possible worsening trend for infants born to single mothers at the very end of the time series.

12.2 Multivariate analysis of recent data

The recent part of the data series (2007-2010) with complete information about fathers acknowledgement allows a multivariate analysis which will shed light on whether the findings on unmarried status and its interaction with other variables in influencing birth weight applies to both single and partnered unmarried mothers. Although I do not expect to find any substantial changes in the size of the effects within such a short period of time, the models are built in the same manner as in previous chapter to allow direct comparison of the size of the effects. This will also help to understand the policy-induced misreporting of fathers.

I first focus on the relationships between individual-level variables and test, whether the effect of family arrangement interacts with context-level variables to see whether the expectations about the marital status gap hold for both single and partnered status.

12.2.1 General pattern

This section focuses on the individual characteristics of mothers and their interactions in influencing birth weight and low birth weight. The models are analogical to those of Chapter 11 and are listed in Table 12.1. Models M1 and L1 include only family arrangement of the newborn's mother. Maternal education is added in Model M2 and L2. Finally, Models M3 and L3 include also maternal age and parity. As expected, goodness of fit statistics prove all these variables as important. Likelihood-ratio tests

favour the more complex models (p-values<0.0001) and AIC is the lowest in Models M3 and L3.

Table 12.1. Goodness of fit statistics of the random-intercept models of birth weight. Live singleton births, 2007-2010, N(individuals)=439494, N(contexts)=56.

	Chi2	DF	p-value	AIC
Models of birth weight				
M0: Variance components model	--			6750268
M1: Family arrangement	7950	2	<0.00001	6742321
M2: M1 + Education	11562	5	<0.00001	6738716
M3: M2 + Age + Parity	17090	9	<0.00001	6733196
M4: M3+ Family arrang. x Education	17161	15	<0.00001	6733136
M5: M4 + Family arrang. x Parity	17473	19	<0.00001	6732833
M6: M5 + Family arrang. x Age	17515	23	<0.00001	6732798
Models of low birth weight				
L0: Variance components model	--			180479
L1: Family arrangement	3972	2	<0.00001	177112
L2: L1 + Education	5293	5	<0.00001	175943
L3: L2 + Age + Parity	6244	9	<0.00001	174851
L4: L3 + Family arrang. x Education	6217	15	<0.00001	174807
L5: L4 + Family arrang. x Parity	6226	19	<0.00001	174696
L6: L5 + Family arrang. x Age	6247	23	<0.00001	174684

	Likelihod-ratio tests			Difference
	Chi2	DF	p-value	in AIC
M1 vs. M0		2	<0.00001	-7947
M2 vs. M1	3612	3	<0.00001	-3605
M3 vs. M2	5528	4	<0.00001	-5520
M4 vs. M3	71	6	<0.00001	-60
M5 vs. M4	312	4	<0.00001	-303
M6 vs. M5	43	4	<0.00001	-35
L1 vs. L0	3371	2	<0.00001	-3367
L2 vs. L1	1175	3	<0.00001	-1169
L3 vs. L2	1099	4	<0.00001	-1091
L4 vs. L3	57	6	<0.00001	-45
L5 vs. L4	119	4	<0.00001	-111
L6 vs. L5	21	4	<0.001	-13

Source: CSO (birth register), author's computations.

The effect of family arrangement is allowed to differ for educational groups of mothers in Models M4 and L4. This interaction is statistically significant, but the evidence in

favour of the more complex models is weaker than in the previous steps of the model building (the likelihood ratio test criterions are much lower; AIC decreases by only 60 between M3 and M4 and even by 45 between L3 and L4). The interaction between family arrangement and, respectively, maternal parity (added in Model M5 and L6) and age (see Model M6 and L6) are also significant at a similar level of statistical significance.

Table 12.2 shows coefficients of the step-wise built models of birth weight. There is a large gap in birth weight between children born to married and unpartnered mothers. Outcomes of children born to partnered mothers are more similar to marital children than to children of single mothers. The crude disadvantage of partnered status estimated in Model M1 is only 60g while it reaches more than 250g for single status. For comparison, the total disadvantage of unmarried status was about 100g in late 2000s (see the solid line Figure 11.6 in the previous chapter). These gaps are, to a large extent, attributable to socioeconomic status (education) and demographic characteristics of mothers (age and parity). Model M2 controls for the effect of education. This reduces the disadvantage to 40g and 198g, respectively. Maternal age and parity further decrease the effects to only -8g for partnered status and persistently high -166g for unpartnered status. The effect of unmarried status in general, net of maternal education, and parity, was about 40-50g in late 2000s (see the dotted line Figure 11.6).

Distinguishing unmarried mothers by their family arrangement attenuated the effects of the other variables, which suggests that they were biased by the overrepresentation of single mothers within the unmarried category in certain socio-demographic groups. This applies to the effect of maternal education and age, but not to the effect of birth order. Higher maternal education represents a large advantage for the birth weight. The gap between the highest and the lowest educational group was estimated to 210-250g in late 2000s (see Figure 11.7). The size of the coefficient is slightly overestimated due to the association of low education with single status. The educational gap estimated by Model M3 is 206g, which is still very high, but lower than the effect uncontrolled for partnership status of unmarried mothers.

Table 12.2. Coefficients estimated in random-intercept models of birth weight. Live singleton births, 2007-2010 , N(individuals)=439494, N(contexts)=56.

	M1	M2	M3	M6

Fixed effects				
Family arrangement (Married=ref.)				
Unmarried, reported father	-57.6***	-39.7***	-8.0***	-22.4***
Unmarried, unreported father	-251.6***	-197.5***	-166.3***	-174.7***
Maternal education (Elementary=ref.)				
Lower secondary		140.8***	150.8***	147.4***
Complete secondary		165.9***	188.8***	182.0***
Tertiary		175.1***	206.2***	199.7***
Maternal parity (Second child=ref.)				
First child			-124.1***	-137.2***
Third+ child			-11.9***	9.8***
Maternal age (20-34= ref.)				
18-19			-7.0	9.1
35+			-11.9***	-22.6***
Education x Partnership status				
Lower secondary x With father				-0.8
Complete sec. x With father				4.3
Tertiary x With father				4.3
Lower secondary x No father				-18.9**
Complete sec. x No father				-3.1
Tertiary x No father				35.7***
Maternal parity x Partnership status				
First parity x With father				29.0***
Third+ parity x With father				-55.8***
First parity x No father				45.9***
Third+ parity x No father				-70.7***
Maternal age x Partnership status				
18-19 x With father				-34.4**
35+ x With father				34.3***
18-19 x No father				-25.7
35+ x No father				0.3
Intercept	3361.1***	3208.8***	3240.0***	3248.9***
Random effect				
SD(Intercept)	32.7***	26.3***	27.9***	27.4***
Rho	0.004***	0.003***	0.003***	0.003***

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: CSO (birth register), author's computations.

The bias in the effect of maternal age is much more serious. Low maternal age (below 20 years) was associated with a 15-40g disadvantage in the late 2000s (see Figure 11.9). However, it is completely explained by the fact that young mothers tend to be single much more than other age groups. The value of the coefficient for young maternal age

in Model M3 is only 7g. The effect of older maternal age (35+ years), which also reduces birth weight in comparison to the middle age category, does not change as dramatically. It was around 15g without control for partnership status of unmarried mothers (see Figure 11.9) and declined to 12g when the partnership status is controlled for in Model M3 (see Table 12.2).

The interactions of maternal family arrangement with, respectively, her education, parity and age (estimated by Model M6) suggest that the disadvantage of single motherhood is not equally strong for all socio-demographic groups of mothers. The negative effect of single status is 36g weaker among mothers with tertiary education. The disparity between partnered and married status does not differ by maternal education. Both partnered and single motherhood are the more harmful the more children the mother already has. The interaction of single status with parity is stronger. The disadvantage of single status is 46g lower for firstborns, compared to second children, and 71g higher for third and higher parity. Partnered status represents no disadvantage for firstborns (the interaction effect of 29g fully compensated the -22g main effect of partnered status – see Model M6). The disadvantage at second parity persists and becomes some 56g higher at higher than second parity. Unmarried status (both single and partnered) is more harmful when it is combined with young maternal age. Young age deepens the disadvantage related to partnered status by 34g. The same coefficient for single status is -26g, but it is not significant in statistical terms. Also its size is substantively negligible when we consider the almost 180g main effect of single status. Older maternal age outbalances the difference between married and partnered status. Among mothers aged at least 35 years, partnered status turns to be a slight advantage of 12 g (-22+34). Advanced age, however, does not alter the detrimental effect of single status.

Table 12.3 presents analogical results for low birth weight. Model L1 describes the elevated risk of low birth weight among children born to partnered and especially single mothers that was already shown in Figure 12.2. Expressed in logit, the gap is 0.14 for partnered status and 1.14 for single status. Model L2 controls for maternal education and model L3 adds also maternal age and parity. Interestingly, partnered motherhood (compared to marriage) does not elevate the logit of low birth weight at all. The coefficient has even a negative sign (-0.07), indicating a slight (although negligible)

advantage of children born to partnered mothers. Compared to the models which did not distinguish partnership status of unmarried mothers, the gradient in maternal education is somewhat lower. When compared to elementary education, university education decreases the logit of low birth weight by 0.92 in Model L3 and by 1.01 in Model L3 from the previous chapter where all unmarried mothers were treated together. The difference between the two effects is very small, so only a small part of the effect of maternal education can be explained by the higher prevalence of single motherhood among women with low education.

The interaction terms added in Model L6 reveal substantive difference in the interaction between family arrangements and maternal education in comparison to the previous results on birth weight. The effect of single status shows an educational pattern, but it is inverse compared to the findings from the analysis of birth weight above and the analysis of low birth weight on unmarried status in general. Giving birth as unpartnered elevates the risk of low birth weight much more among higher educational categories. Model L6 shows that the disadvantage of single status is 0.73 among children of mothers with elementary education and 1.09 (=0.73+0.36) among children of university graduates. It corresponds to odds ratios 2.08 and 2.97, respectively. Children born to single mothers with complete secondary education have even 3.06 (=exp(0.73+0.39)) times higher odds of having low birth weight than their counterpart from married families. The effect of partnered status does not vary by maternal education. The interaction terms are very close to zero and statistically insignificant.

The disadvantage of partnered or single status in parity and age categories varies in the same manner as in the analysis of birth weight above. Both partnered and single status are the least harmful for firstborns and most risky for children born at high parities or to young mothers. The effect of single status does not vary with maternal age, except for the lowest age category. The detrimental effect of partnered status declines and even inverts with progressing maternal age. Logit of low birth weight does not differ between children of married and partnered mothers at the middle age category. When the mother is at least 35 years old, being partnered rather than married represents a modest advantage of 0.18 (-0.01-0.17). This corresponds to odds ratio 0.84, i.e. almost 20% lower odds of low birth weight.

Table 12.3. Coefficients estimated in random-interacept models of low birth weight. Live singleton births, 2007-2010, N(individuals)=439494, N(contexts)=56.

	L1	L2	L3	L6
Fixed effects				
Family arrangement (Married=ref.)				
Unmarried, reported father	0.135***	0.033**	-0.071***	-0.012
Unmarried, unreported father	1.147***	0.886***	0.785***	0.731***
Maternal education (Elementary=ref.)				
Lower secondary		-0.482***	-0.533***	-0.631***
Complete secondary		-0.659***	-0.746***	-0.853***
Tertiary		-0.796***	-0.918***	-1.037***
Maternal parity (Second child=ref.)				
First child			0.522***	0.639***
Third+ child			0.245***	0.162***
Maternal age (20-34= ref.)				
18-19			-0.131***	-0.375***
35+			0.239***	0.286***
Education x Partnership status				
Lower secondary x With father				0.059
Complete sec. x With father				0.043
Tertiary x With father				0.100
Lower secondary x No father				0.268***
Complete sec. x No father				0.392***
Tertiary x No father				0.358***
Maternal parity x Partnership status				
First parity x With father				-0.240***
Third+ parity x With father				0.188***
First parity x No father				-0.334***
Third+ parity x No father				0.079
Maternal age x Partnership status				
18-19 x With father				0.396***
35+ x With father				-0.168***
18-19 x No father				0.309**
35+ x No father				-0.002
Intercept	-3.077***	-2.481***	-2.700***	-2.652***
Random effect				
SD(Intercept)	0.156***	0.123***	0.129***	0.129***
Rho	0.007***	0.005***	0.005***	0.005***

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: CSO (birth register), author's computations.

In sum, splitting unmarried status mostly confirmed the findings from the analysis of unmarried status in general, but also revealed special patterns which were obscured by

merging children born to partnered and single mothers. The most stable result is the effect of maternal parity. Unmarried status in general, as well as split to partnered and single, is increasingly harmful with progressing parity. This probably has to do with mother's work and stress load when caring for and maintaining more children. Unmarried status, either partnered or unpartnered, is also consistently more detrimental when combined with early motherhood. On the other hand, advanced maternal age does not influence the strength of the effect of single status and, surprisingly, inverts the effect of partnered status. Children born to partnered older mothers thus, on average, fare better than their counterparts from married families. This weakening importance of family arrangement can be related to the resources and personal maturity (which may be positively related to stress coping) that older mothers have accumulated.

The effect of unmarried status was found to be stronger among the least educated in the previous chapter. This was, however, not confirmed when the two categories of unmarried mothers are distinguished. The effect of partnered status does not vary with maternal education at all. The detrimental effect of single status differs for different categories of maternal education, but not in the same way for the two outcomes. The harmful effect of single status on low birth weight rises with maternal education. This pattern is not present when the continuous measure of birth weight is considered. In this case, the unpartnered status disadvantage is the lowest among children born to university graduates and the lowest for children of women with secondary education (especially lower secondary). The educational gradient in the marital status gap described in the previous analysis is then fully explained by the higher prevalence of single mothers in lower educational categories. Having a highly educated mother thus does not protect infants against harmful effects of single motherhood. Some results even suggest the contrary. This will be further discussed later.

12.2.2 Context-level explanations

Models M7 to M12 (for birth weight) and L7 to L12 (for low birth weight rate) add the context-level variables to test if they interact equally with both non-marital family arrangements. They are listed in Table 12.4. The macro variables include unemployment rate (a measure of economic uncertainty), non-marital childbearing rate (a measure of social acceptance of unmarried motherhood), and a binary indicator of the

policy change of 2009. The cancellation of the prolonged maternity allowance was found to influence maternal reporting about fathers (see Chapter 7) which approximates the family arrangement of unmarried mothers so its effect is controlled for in the present analysis. Obviously, I do not use the variable measuring the linear effect of time, which served as approximation of the spread of partnered motherhood, because the measure of maternal partnership status is already included at the individual level. Table 12.5 shows coefficients of the models of birth weight and Table 12.6 the same results for low birth weight.

Models M8 and L8 interact the effect of family arrangement with the policy change. This interaction is highly statistically significant for birth weight (see Table 12.4) and less convincingly significant for low birth weight. The likelihood-ratio test statistics comparing L8 to L7 is 13 with 2 degrees of freedom which yields p-value=0.002. This is significant at the common 0.95 confidence level. Also the decrease of AIC is very small (the difference is only -4). The overall effect of policy change estimated in models M7 and L7 is virtually non-existent for both outcomes. Model M8 shows that the policy change did not influence birth weight of children whose mothers reported fathers but has a rather large negative effect no children without established paternity (-54g). This can be explained by the fact that the negative effect of single status was underestimated in 2007-2008 by the mothers who only pretended to be single but in fact lived with a partner. Similarly, the policy change deepened the low birth weight disparity between married and single mothers (it increases the disparity in the logit of low birth weight from 0.72 to 0.85).

Models M9 and L9 interact the effect of unemployment rate with family arrangement and models M10 and L10 test if this interaction is the same in both periods. The most complex models M10 and L10 are favoured by the likelihood ratio tests and AIC (see Table 12.4), but the estimated interaction coefficients are very low and their interpretation is thus meaningless. I thus prefer models M9 and L9. The protective effect of marriage in economically insecure contexts seems to be working according to models M9 and L9. Rising unemployment rate has a moderately positive effect on birth weight of marital children. The birth weight rises by 3g (see M9) and the logit of low birth weight decreases by 0.02 (see L9) with every percentage point increase of

unemployment rate. But the effect is virtually zero effect on both groups of non-marital children (the size of the interaction coefficients is almost equal but with the other sign).

Table 12.4. Goodness of fit statistics of the random-intercept models of birth weight. Live singleton births, 2007-2010, N(individuals)=439494, N(contexts)=56.

	Chi2	DF	p-value	AIC
Models of birth weight				
M3: Family arrangement + Education + Age + Parity	17090	9	<0.001	6733196
M7: M3 + Policy + Unemployment rate + Nonmarital childbearing rate	17153	12	<0.001	6733139
M8: M7 + Fam. arrang. x Policy	17246	14	<0.001	6733050
M9: M7 + Fam. arrang. x Unemployment	17182	14	<0.001	6733113
M10: M9 + Fam. arr. x Unemployment x Policy	17289	19	<0.001	6733016
M11: M7 + Fam. arrang. x Nonmarital CBR	17289	14	<0.001	6733006
M12: M11+ Fam. arr. x Nonmar. CBR x Policy	17466	19	<0.001	6732840
Models of low birth weight				
L3: Family arrangement + Education + Age + Parity	6244	9	<0.001	174851
L7: L3 + Policy + Unemployment rate + Nonmarital childbearing rate	6341	12	<0.001	174813
L8: L7 + Family arrang. x Policy	6341	14	<0.001	174805
L9: L7 + Family arrang. x Unemployment	6351	14	<0.001	174804
L10: L9 + Fam. arr. x Unemployment x Policy	6399	19	<0.001	174792
L11 L7 + Family arrang. x Nonmarital CBR	6353	14	<0.001	174789
L12: L7 + Fam. arr. x Nonmar. CBR x Policy	6473	19	<0.001	174742

	Likelihod-ratio tests			Difference
	Chi2	DF	p-value	in AIC
M7 vs. M3	70	3	<0.001	-57
M8 vs. M7	93	2	<0.001	-89
M9 vs. M7	30	2	<0.001	-26
M10 vs. M9	107	5	<0.001	-97
M11 vs. M7	137	2	<0.001	-133
M12 vs. M11	176	5	<0.001	-166
L7 vs. L3	44	3	<0.001	-38
L8 vs. L7	13	2	0.002	-9
L9 vs. L7	14	2	0.001	-10
L10 vs. L9	22	5	0.001	-12
L11 vs. L7	29	2	<0.001	-25
L12 vs. L11	57	5	<0.001	-47

Source: CSO (birth register), author's computations.

Table 12.5. Coefficients estimated in models of birth weight. Live singleton births, 2007-2010, N(individuals)=439494, N(contexts)=56.

	M7	M8	M9	M11

Fixed effects				
Family arrangement (married=ref.)				
Unmarried, reported father	-7.727***	-7.876***	-7.586***	-7.096***
Unmarried, unreported father	-166.0***	-141.4***	-165.7***	-166.6***
Maternal education (elementary=ref.)				
Lower secondary	150.4***	149.4***	149.9***	148.7***
Complete secondary	188.4***	187.3***	187.8***	186.6***
Tertiary	206.0***	204.7***	205.5***	204.5***
Maternal parity (Second child=ref.)				
First child	-124.1***	-124.1***	-124.2***	-124.4***
Third+ child	-12.0***	-11.9***	-12.0***	-11.7***
Maternal age (20-34= ref.)				
18-19	-7.1	-6.8	-6.3	-5.2
35+	-11.7***	-11.8***	-11.9***	-12.4***
Policy (Longer maternity alowance for single mothers=ref.)	-4.5	0.2	-4.8	-4.9
Unemployment rate (Mean=8.1=ref.)	2.1**	1.9*	3.2***	2.1**
Non-mar. childbearing rate (Mean=38.8=ref.)	-3.3***	-3.2***	-3.3***	-2.3***
Policy x partnership status				
Equal allowance x With father		-1.0		
Equal allowance x No father		-54.0***		
Unemp. rate x partnership status				
Unemployment rate x With father			-3.1***	
Unemployment rate x No father			-2.9***	
Nonmarital CBR x partnership status				
Nonmarital CBR x With father				-2.1***
Nonmarital CBR x No father				-3.6***
Intercept	3,244.7***	3,243.5***	3,245.6***	3,247.5***
Random effect				
SD(Intercept)	15.2***	15.0***	15.3***	15.4***
Rho	0.001***	0.001***	0.001***	0.001***

Note: *** p<0.01, ** p<0.05, * p<0.1.

Source: CSO (birth register), author's computations.

Models M11 and L11 interact family arrangements with the non-marital childbearing rate as a measure of social stigma related to non-marital birth. Models M12 and L12 add a three-way interaction with policy. Goodness of fit statistics indicate that both of these steps help to understand the data. AIC is the lowest in models M12 and L12 and also likelihood-ratio tests favour them (see Table 12.4).

Table 12.6. Coefficients estimated in models of low birth weight. Live singleton births, 2007-2010, N(individuals)=439494, N(contexts)=56.

	M7	M8	M9	M11
Fixed effects				
Family arrangement (married=ref.)				
Unmarried, reported father	-0.075***	-0.085***	-0.081***	-0.088***
Unmarried, unreported father	0.781***	0.717***	0.786***	0.780***
Maternal education (elementary=ref.)				
Lower secondary	-0.528***	-0.526***	-0.527***	-0.525***
Complete secondary	-0.742***	-0.739***	-0.739***	-0.738***
Tertiary	-0.914***	-0.911***	-0.912***	-0.912***
Maternal parity (Second child=ref.)				
First child	0.522***	0.522***	0.522***	0.523***
Third+ child	0.246***	0.245***	0.247***	0.245***
Maternal age (20-34= ref.)				
18-19	-0.131***	-0.131***	-0.132***	-0.136***
35+	0.237***	0.238***	0.238***	0.241***
Policy	0.022	-0.008	0.0238	0.026
Unemployment rate (Mean=8.1=ref.)	-0.009	-0.009	-0.015**	-0.010
Non-mar. childbearing rate (Mean=38.8=ref.)	0.015***	0.015***	0.015***	0.009***
Policy x partnership status				
Equal allowance x With father		0.025		
Equal allowance x No father		0.131***		
Unemp. rate x partnership status				
Unemployment rate x With father			0.019***	
Unemployment rate x No father			0.0001	
Nonmarital CBR x partnership status				
Nonmarital CBR x With father				0.011***
Nonmarital CBR x No father				0.009***
Intercept	-2.723***	-2.710***	-2.726***	-2.730***
Random effect				
SD(Intercept)	0.076***	0.075***	0.077***	0.079***
Rho	0.002***	0.002***	0.002***	0.002***

Note: *** p<0.01, ** p<0.05, * p<0.1.

Source: CSO (birth register), author's computations.

The analysis from previous chapter showed that the influence of non-marital childbearing rate on birth weight is positive when childbearing outside marriage is less common (the share of non-marital births below 35%) but the direction of the effect then reverses as it continues to spread. Almost two thirds of the contexts had non-marital

childbearing rate higher than 35% in the period 2007-2010, so the effect should be negative. Models M11 and L11 confirm this expectation: the higher the prevalence of non-marital childbearing, the worse for the newborns in any of the two non-marital family arrangements.

The coefficients estimated by Models M12 and L12 separately for each period (see Table 12.7) show that the effect on single status is absent in the 2009-2010 period. A 10% increase in non-marital childbearing rate would imply a 28g (10*(-2.8)) decline in the birth weight among married mothers, a 48g decline among partnered mothers, but only marginally significant (and substantively rather irrelevant) 12g reduction of birth weight among children of unpartnered mothers. Analogically a 10% rise of the non-marital childbearing rate would increase the logit of low birth weight rate by 0.13 (10*0.013) among marital children and even stronger, by 0.23, among children of partnered unmarried mothers. The effect for children of single mothers is not significantly different from zero.

In sum, the analysis that distinguished partnered and unpartnered unmarried mothers showed that these groups are rather heterogeneous and followed different trends. The outcomes of children born to partnered mothers seem to have improved and approached the outcomes of marital children during the study period. Children born to unmarried partnerships continue to face a modest disadvantage when compared to marital children but it can be fully explained by their socio-demographic characteristics. The recent data suggest that there is no disadvantage for firstborns of partnered mothers (first children born to partnered mothers have the same mean birth weight as newborns born to marriage and even a lower risk of low birth weight). Unmarried arrangement with a partner thus seems to be more beneficial than marriage for the birth weight. However, partnered arrangement elevates the risk of adverse outcomes for children born to very young mothers (below 20 years) and for children of third and higher birth order. The size of the disparity between married and partnered status is sensitive to social conditions. Marriage shows to be more protective when uncertainty at the labour market grows. The disparity also grows when having children without marriage becomes more and more common.

Table 12.7. Selected coefficients estimated by models M12 and L12. Live singleton births, 2007-2010, N(individuals)=439494, N(contexts)=56.

	Family arrangement			
	Married	Unmarried, with father (interaction term)	Unmarried, without father (interaction term)	**Main effect of policy**
M12				
The effect of non-marital childbearing rate				
Policy				
Higher allowance for single mothers	-1.8	-2.0***	-6.7***	Ref.
Equal allowance	-2.8***	-2.0***	1.6***	-4.1
Main effect of family arrangements	Ref.	-12.0***	-160.4***	
L12				
The effect of non-marital childbearing rate				
Policy				
Higher allowance for single mothers	0.007**	0.011**	0.022***	Ref.
Equal allowance	0.013***	0.010**	-0.010**	0.012
Main effect of family arrangements	Ref.	-0.068***	-0.759***	

Note: *** p<0.01, ** p<0.05, * p<0.1.
Source: CSO (birth register), author's computations.

Children born to unpartnered mothers, on the other hand, face a large disadvantage in both birth weight outcomes followed in this analysis. The disparity between children of married and single mothers was estimated to be rather stable in time or even increasing. Only a minor part of the gap can be explained by maternal socio-demographic characteristics. The disadvantage of children whose mothers do not declare any father is persistently large in any socio-demographic group. The size of the disadvantage differs by maternal education, age, and parity but it is large in any of these groups. A surprising finding is that the disparity in the risk of low birth weight for children born to married and single mothers rises with maternal education. The size of the disadvantage related to unpartnered status is much less sensitive to social conditions (economic uncertainty and acceptance of non-marital childbearing) than the disadvantage of partnered status. Children born to unpartnered mothers are strongly disadvantaged by the absence of fathers and a change in the unemployment rate or a shift in how common and socially accepted non-marital childbearing is probably does not make a big difference for them.

13 CONCLUSION OF EMPIRICAL PART II

Birth weight of Czech newborns showed an ambiguous trend in the first two decades after the fall of state socialism. The level of low birth weight rate was stable at around 5%. Low birth weight is harmful to health and a life-endangering condition. Absence of the trend in this indicator suggests that the health of newborns in general did not suffer seriously neither during the period of radical societal transformation in the 1990s nor later. However, a more sensitive indicator of infant health status, the birth weight showed an ambiguous trend. It first deteriorated in the very beginning of 1990s, but then improved rapidly. The beneficial trend then inverted and a gradual decline followed during the first decade of the 21st century.

These general trends did not apply equally to children born to married and unmarried mothers. The described pattern reflects mainly the situation of children born to marriage. The outcomes of non-marital children were, on average, worse during the whole study period, but showed a continually improving trend until the mid-2000s and then stabilisation. The gap between birth weight of marital and non-marital children thus declined significantly. Multiple sources of trend in the effect of marital status were theorized about and tested in the analysis. The results show that marital status gap in birth weight was influenced with multiple processes. All of the hypothesised factors contributed somehow (more or less) to the trend. Some of them helped to reduce the disparity while other contributed to its persistence.

Two kinds of explanations for the effect of marital status were proposed: the changing selection of unmarried mothers from socio-demographic groups that are less favourable for birth weight and the substantive change in the meaning of unmarried motherhood. Both of these processes contribute approximately equally to the trend.

There were three main driving forces of the convergence of birth outcomes between marital and non-marital children is the changed meaning of unmarried motherhood: a gradually rising share of unmarried mothers with partners, increasing social acceptance of unmarried motherhood which lead to improvement of birth weight of children of partnered mothers, and declining selection of unmarried mothers from low-status women (during the 2000s but not before).

The spread of childbearing in consensual unions contributed to the improving birth weight of non-marital children in two ways. First, the mere fact that partnered women make up a larger share of unmarried mothers increases the average birth weight and reduces the low birth weight rate of the whole non-marital group because the outcomes of children born to partnered women are better, in comparison to children without fathers. Second, the birth weight of children born to partnered mothers improved considerably during the study period. I estimated several scenarios of the past trend and all of them suggest a clear convergence towards the outcomes of marital children. The recent data with detailed measurement of family arrangement, for instance, show that there is no difference between marriage and unmarried partnership among first-borns (but the disparity persists among larger families). The improvement of the birth outcomes of the children of partnered mothers was fuelled by increasing social acceptance related to nonmarital childbearing. As bearing a child without being married was becoming more usual, the health disadvantage of non-marital children was declining. This result applies to the effect of unmarried status in general. The recent data which allow splitting the unmarried mothers by partnership arrangement suggest that the effect of unpartnered status is much less sensitive to the prevalence of non-marital childbearing. So the supportive effect of declining stigmatisation probably favoured especially the children born to nonmarital unions.

The virtual disappearance of the negative effect of partnered status is rather surprising in comparison to the finding from other countries. A meta-analysis of multiple studies found significant difference in how cohabitation and marriage influence birth outcomes (net of socio-demographic characteristics) [Shah et al. 2011], but the authors did not relate the effect to the prevalence of nonmarital childbearing. Studies from countries where nonmarital childbearing is common yield contradictory results. Castro-Martín [2010] described significant narrowing of marital status gap in low birth weight Spain between 1975 and 2007 (nonmarital childbearing rate rose from 2% to 30% in this period) but cohabiting status remained to be almost equally detrimental as single status (the odd ratio of low birth weight was 1.2, net of socio-demographic characteristics). Similarly Luo et al. documented a persisting disadvantage of cohabitation on multiple birth outcomes (including low birth weight) in Quebec in the period 1990-1997 when nonmarital childbearing rate increased from 20% to 44%.

On the other hand, Young and Declerq [2010] used American dataset from 2005 and found no difference in the effect of marriage and unmarried partnership on low birth weight while unpartnered status represented a disadvantage (the net odds ratio relative to married status was 1.29). However the significance of the results is questionable due to a small sample size. Also Zeitlin and colleagues [2002] found no disadvantage of cohabitation in for preterm birth in countries where more than 20% of births were outside marriage. These inconclusive results about the effect of unmarried unions suggest that the prevalence of nonmarital childbearing necessary for sufficient acceptance of this family might be country-specific. Alternatively, the effect of social acceptance on reduction of the disadvantage might interact with other country-specific factors (such as religiosity or welfare system).

Declining socioeconomic selection of unmarried motherhood contributed to the reduction of the marital status gap in birth weight after 2000. There is an educational gradient in unmarried motherhood that contributes to explaining why birth weight of non-marital children is lower. The educational differences in non-marital childbearing attenuated during the 2000s (see Chapter 6). Spreading of the unmarried motherhood among the more educated women reduced the share of unmarried mothers who have attained only the lowest level of education and whose children tend to have considerably lower birth weight. It contributed to closing of the marital status gap in birth weight in the 2000s. This result is stronger for the continuous measure of birth weight than for the risk of low birth weight. Low birth weight seems to be less sensitive to socioeconomic influences and more tied to biological factors.

On the other hand, there are also factors that hindered the convergence of the birth weights of marital and non-marital children. They include socioeconomic selection of non-marital childbearing (in the 1990s), economic protection of marriage (in the first half of the 1990s and the late 2000s), reversal of the beneficial effect of the non-marital childbearing rate (at the end of 2000s), and postponement of marriage to higher age and parity (during the 2000s).

Socioeconomic selection of unmarried motherhood hindered the decline of the marital status gap in the 1990s. The educational differences in non-marital childbearing rose at that time because women with lower levels of education inclined rapidly to unmarried

motherhood and a similar trend among higher educational groups came with a delay. Furthermore, the importance of maternal socioeconomic status for birth weight (but not for low birth weight) increased, as well. This prevented a more rapid reduction of the marital status gap in birth weight in the 1990s. The effect on both outcomes was the strongest around the mid-1990s.

Marriage was hypothesised to provide protection when economic situation becomes less certain. This effect was not fully confirmed. Marriage showed to be protective in the first half of the 1990s when it was almost universal among mothers and the state's family policy was rather generous to all parents. This influenced the marital status gap in the birth weight outcomes at that time. The protective effect of marriage, however, disappeared later and only appeared again in the late 2000s when it contributed to the stabilisation of the disadvantage of non-marital children. The effect of unemployment on birth weight of marital children born to married mothers was positive but there was no such effect on non-marital children. It was a time of cuts of the social benefits for single mothers. The advantageous conditions of maternity allowance were cancelled for single mothers in 2009. At the same time, the economy was hit by a crisis.

The positive effect of economic uncertainty on the outcomes of marital children cannot be interpreted in the sense that precarious economic conditions promote a healthy course of pregnancies of married women. It is more likely that women who perceive their economic situation uncertain delay pregnancy (cf. [Sobotka et al. 2011]) and thus are not present in the population of mothers. Alternatively they might avoid marriage (as is suggested by the results of Chapter 6) and thus leave women in a better economic situation in the population of married mothers.

The stabilisation of the birth weight disparity by marital status results also from a change in the effect of non-marital childbearing rate. Spreading non-marital childbearing helped to reduce the negative impact of unmarried status, but this favourable effect has limits. It turns to be the opposite when non-marital childbearing rate crosses 35%. This happened in 2008 in the general population. The negative effect of the non-marital childbearing rate is rather surprising (a mere diminishment of the positive effect could be more expectable) and it impacts even on children of married mothers. I am not aware of any study that would describe such effect. There are studies

[Huijts, Kraaykamp 2011; Kravdal 2007] which relate marital status composition of the population to health of adult individuals. Their results are mixed but Huijts, Kraaykamp [2011] found that a high prevalence of unmarried people could influence adult health negatively in some countries. Whether some of the explanation provided by the authors can be applied on the health Czech newborns will be discussed in the final conclusion (Chapter 14).

A faster convergence of birth weight of marital and nonmarital children was also prevented by rising tendency to postpone marriage to later age and higher parity. First-time mothers tend to have smaller newborns due to physiological reasons. The growing share of firstborns among non-marital children thus compromises the outcomes of this group and the convergence towards marital children is restricted. This holds for mean birth weight. A similar effect on low birth weight rate is balanced by a negative effect of maternal age on the risk of low birth weight. Marital children, whose mothers are older, are thus less advantaged in this outcome.

In general, the processes that promote convergence of the birth outcomes of marital and nonmarital children prevail. However, the increasing predominance of cohabitation among the unmarried mothers obscures a large and persistent disadvantage of children born to single mothers. The pregnancy outcomes of unpartnered mothers did not follow the overall positive trends. The disparity between the pregnancy outcomes of single and married mothers was estimated to be large in the past and seems to be stable or even to have become greater by the end of the 2000s. The recent data, which permit an analysis of the socio-demographic characteristics of single mothers, show that a larger part of the gap is tied to single status itself and cannot be explained by maternal socio-demographic characteristics. Even though single motherhood has become more accepted in Czech society, it has not overcome the reality of the lack of support from a partner.

The disadvantage of single status is not equal for all educational groups. Surprisingly, children of mothers with the lowest educational attainment face the least detrimental consequences of absent fathers. Single status of mothers with elementary education represents the lowest (but still high) risk of low birth weight and single status of mothers with complete secondary and tertiary education is the most risky in this regard. It is surprising because more educated mothers tend to be more deliberate about family

planning while less educated women more often stick to motherhood as a life strategy and care less about the proper conditions [Hašková 2009]. These results could be biased by the imperfect measurement of family arrangement with the mother's willingness to report child's father. Even though some social benefits for single mothers were cancelled (which promoted declaration of fathers among mothers with higher education – see Chapter 6), mothers in the lowest income groups could be still motivated to conceal a partner to ask for anti-poverty benefits. If this bias is present, it would imply that negative effect of single motherhood in the present analysis is underestimated and that the disadvantage of children born to truly unpartnered mothers could be in fact even larger.

The negative impact of unmarried status deepens as mothers have additional children. Obviously, being pregnant as unmarried (i.e. without a partner or in an, on average, less supportive partnership than marriage) gets more demanding and stressful the more children the mother already has to maintain and care for. On the other hand, the interaction of marital status with age is inversed: the older the mother, the less important her marital status is. The positive effect of maternal age on reducing the importance of marital status can be due to the fact that the biological age becomes a more prominent predictor of adverse outcomes after the mother turns age 35. Both married and unmarried older mothers thus face similar risks of having a low birth weight infant, because of their older bodies. The reduction of the marital status gap with advancing maternal age can be also explained by better living conditions of older mothers, who are more likely to have accumulated some resources, arranged a suitable housing etc., whether they are married or not.

The two decades of change in childbearing patterns transformed and pluralised the ways how family arrangement influences health of newborns. In 1990, all of the classical explanations (cf. [Shah et al. 2011]) for the health disadvantage of nonmarital childbearing applied. Children born to unmarried mothers had lower average birth weight and a higher risk of low birth weight because they deviated from the social norms of typical motherhood. Most of them did not share a household with the child's father and if they did, the supportiveness of such partnership could be by undermined by societal disapproval and lack of recognition of such arrangement as legitimate (cf. [Mollborn 2009]). Unmarried mothers had poorer socioeconomic background and were

often young first-time mothers which deepened the disadvantage. The normative (cultural) sources of the marital status gap have diminished since then and the supportiveness of nonmarital family arrangements has increased. The socio-demographic disadvantage has persisted, although it has also declined, and became more salient in determining the size of the gap. However, these trends cannot be applied universally to all nonmarital children. The meaning of unmarried motherhood pluralised and so did their health implications. Single status remained detrimental because of the lacking psycho-social support from the absent partners. On the other hand, consensual unions became more or less equal to marriage in terms of support they provide to pregnant women. The relatively small disadvantage is continues to represent is mainly cause by the association of this family arrangement with lower socioeconomic status and with family starts.

14 CONCLUSION

Czech society went through many changes in the first two decades after the fall of state socialism. Shifts in the patterns of family formation belong to the most profound changes during this period and may have long-lasting consequences because they set life chances and orientations for the next generations. My dissertation focused on health of children who were born in this context and related it to the changing family arrangements to which they were born.

Parental marriage has been internationally found to have a positive influence on the health of their children [Shah et al. 2011]. This empirical finding is confirmed in my analysis. The results also show that the reasons for this advantage changed as a consequence of a spread of families formed outside of marriage and a changing meaning of nonmarital childbearing. Findings about the transformation of the mechanisms that link family formation and the health of newborns are summarized and discussed in this final chapter.

14.1 Summary of the results: Three periods in the family change and their consequences for the health of newborns

Three rather distinct periods can be distinguished in terms of arrangement for childbearing and their health consequences. The first half of the 1990s can be conceptualised as an interlude between the old and new patterns of family formation. Nonmarital family arrangements were marginal and maternal unmarried status represented a health risk for children. The period since the mid-1990s till the late 2000s brought a transformation of the meaning of unmarried motherhood and its health implications. Partnered and single unmarried motherhood became rather distinct family arrangements with different effect on birth weight. The close of the study period (the late 2000s) brought a confirmation of these new patterns but their stabilisation for future is unsure.

14.1.1 Interlude between old and new family and health patterns (1990-1995)

The family patterns of the early 1990s show a high degree of continuity with the demographic regime of the state socialism. Family formation typically took place at a young age (average age of mothers did not exceed 25 years until 1994) and marriage was almost universal among mothers. Nonmarital childbearing was a rare (below 15% of mothers were not married) but rising phenomenon and was associated mainly with unsatisfactory partnership situation: more than half of unmarried mothers did not live with a partner).

The disparity in birth weight between marital and nonmarital children was large and related mainly to the direct effect of the marital status. Nonmarital children had about 200g lower mean birth weight and almost three times higher probability of having low birth weight. This was to a large extent caused by the low social acceptance of unmarried motherhood and lack of social support. There was a strong imperative to marry when expecting a baby (about half of all brides were pregnant in the late 1980s – see [Stloukal 1997]). Paternalistic policy and newly emerged job-market uncertainty motivated parents to marry, as well. Economic uncertainty impacted negatively on the health of newborns but marriage could reduce the negative impact while children of unmarried mothers were more vulnerable to these economic pressures.

Despite the structural pressures and norms that promoted marriage, an influence of new values and search for personal autonomy prevailed and the number of children who were born out of wedlock rose. Women with low education, who had been traditionally more likely to have a child as unmarried, were among the first who adhered to this trend. The strong and rising educational gradient in unmarried motherhood also contributed to the large disadvantage of children born outside marriage. Maternal education performs a strong influence on birth weight. The average difference in mean birth weight between extreme educational levels reaches hundreds of grams and remains strong even when other variables are held constant. Mothers with elementary education also have approximately 2.7 times higher odds of having a low birth weight infant, compared to mothers with university education. The effect of maternal education on mean birth weight (but not on low birth weight) was even increasing sharply in the early

1990s.[40] The association of unmarried motherhood with low maternal education helped to preserve the marital status gap in birth weight during the whole 1990s.

The period of the early 1990s merges old patterns of family formation with the new trends that become fully manifested in the following periods. Unmarried motherhood, despite being on rise, remained a rare phenomenon. It was associated with a large health risk for the foetal development because of its marginality, both in terms of its social acceptance and socioeconomic status of unmarried mothers.

14.1.2 Transformation of unmarried motherhood and its health consequences (1996-2006)

The family behaviour started to change rapidly after the first transitory years. The time between the mid-1990s and the mid-2000s was a period of postponement of childbearing to higher age. Women who reached their twenties since the latter half of the 1990s did not form families as early as their older counterparts. They spent more time in education and career building and postponed childbearing [Kantorová 2004; Sobotka et al. 2008]. However, it did not alter nor hindered the trend of nonmarital childbearing becoming more and more common.

The marital status gap in birth weight narrowed remarkably in this period. General trend in birth weight was mixed. A rising tendency in mean birth weight, which was onset in the early 1990s, reversed after 2000. On the other hand, incidence of low birth weight remained relatively stable. But the disparity between marital and non-marital children showed a consistently declining trend for both outcomes. The main reason for this convergence was a spread and institutionalisation of unmarried cohabitations as an arrangement for childbearing.

Both partnered and unpartnered unmarried mothers became more common but the rise of the two-parent nonmarital arrangement was more intensive and mothers with partners started to prevail among unmarried mothers. As in the previous period, nonmarital

[40] The trend of rising educational disparities in birth outcomes was present also in other formerly socialist countries in the 1990s [Brzezinski, Szamotulska. 1994; Koupilová et al. 2000]. It seems to be a general feature of the post-socialist transition.

childbearing continued to increase gradually, net of the economic conditions. This can be explained by rising acceptance of individualist values. Beside this predominant influence, nonmarital childbearing started to be newly fuelled by economic considerations. Economic uncertainty grew considerably (the general unemployment rate rose to 7-9%), income inequalities increased [Večerník 2001], and welfare support for families declined [Hiršl 2004]. Creating an independent household and earning sufficient income to maintain a family thus became increasingly difficult for many prospective parents. Unlike the previous period, economic uncertainty did not fuel marriage. The rising costs of family life probably elevated the "marriage bar", i.e. the economic security considered appropriate for entering marriage. As a consequence, couples who could not meet this standard started to prefer nonmarital unions over marriage. Furthermore, family policy shifted to income-testing and some women found it rational to remain unmarried and deny having a partner to the authorities in order to reach more benefits.

Childbearing in unmarried cohabitations has become institutionalized and families (and society in general) learned how to handle it. The more common it was to have a child without being married, the less negative consequences it had for the birth weight of newborns, net of the economic uncertainty and rising share of partnered mothers. It can be attributed to increasing social acceptance of nonmarital families. As a result of the spread and acceptance of unmarried parental couples, the disparity between health outcomes of children born to married and partnered parents declined considerably.

Also the protective effect of marriage at hard economic times disappeared. Rising economic uncertainty did not elevate the risk of adverse birth weight outcomes in neither of the marital status groups (this could be an effect of selection to motherhood – see the discussion in Chapter 13). The negative influence of economic uncertainty on birth weight of nonmarital children, however, re-emerged later (see below). So the diminishment of the protective effect of marriage seems to be temporary.

The same processes that improved birth weight of children born to unmarried couples do not seem to work for single mothers and their children. The estimates suggest that birth weight of children born to unpartnered mothers did not improve significantly, although their numbers grew.

Maternal education gained importance in influencing the size of the disadvantage of unmarried status. Educational gradient in birth weight continued to rise and then stabilised at a higher level than in 1990. The association of unmarried motherhood with low education grew in the 1990s and slowed down the convergence of birth weight of marital and nonmarital children. However, nonmarital childbearing started to increasingly spread even among women with higher education. The effect of declining socioeconomic selection of unmarried mothers outbalanced the rising disadvantage of children born to mothers with low education and contributed to the positive trend in birth weight of nonmarital children after 2000. Despite the reduction of the absolute effect of maternal education on the marital status gap in birth weight, its relative contribution became more prominent because the direct effect of marital status declined even more.

In sum, marital status gap closed substantially, between the mid-1990s and the late 2000s. The mechanisms that generate the health disparity between marital and nonmarital children transformed in two ways. First, the composition of unmarried mothers by partnership arrangement shifted in favour of partnered mothers whose outcomes dominated the overall trend. Second, the educational structure of unmarried mothers became a more salient factor that defines the size of the gap because the direct effect of unmarried status diminished.

14.1.3 Fragile stability of the new patterns of nonmarital childbearing and its new implications (2007-2010)

The new meanings and health implications of nonmarital childbearing seem to have stabilised at the end of the study period. More mothers had higher education and also the average age of mothers continued to grow (although the pace of the growth slowed down) because also those who delayed childbearing finally decided to become mothers. This did not alter the trend in nonmarital childbearing set in the previous periods. High and continuously growing (towards 40% and more) nonmarital childbearing rate did not show any signs of levelling off. A still growing proportion of unmarried mothers have partners (more than 60% of them were cohabiting and more than 75% of them reported child's father). The educational gradient in marital status of mothers has stabilised

which supports the interpretation that the new patterns of non-marital childbearing had established and only followed the expected trends.

The differences in birth weight by family arrangement have stabilized as well. Partnered and unpartnered motherhood outside marriage ended as distinct in terms of health outcomes and their sources. The birth weight gap between marriage and unmarried partnership did not continue to decline in the late 2000s. The difference in mean birth weight remained around 60g and the low birth weight rate was only by one percentage point higher among children of partnered mothers. These disparities result from the higher education, age, and parity of married mothers. Marriage is postponed to higher age and is increasingly reserved for second and higher-order births. The disadvantage of children born to partnered mothers results mainly from the fact that firstborns tend to be smaller. Lower education of unmarried partnered mothers also plays an important role for maintaining the modest gap in the health outcomes. Difference in the supportiveness of the two-parent family arrangements disappeared. Unmarried relationship provides pregnant women with equal psychosocial support as marriage. This holds especially for the first births. Firstborns of partnered mothers even have a lower risk of low birth weight than their counterparts born to marriage. But a disadvantage of partnered status persists when three and more children are born to unmarried parents.

On the other hand, the health gap between children born to married and single mothers did not show any signs of significant narrowing (not only in the late 2000s but during the whole study period) and remained to be strongly tied directly to the absence of a father. Children of single mothers had, on average, 250-300g lower mean birth weight and more than three times higher risk of low birth weight than marital newborns. The last two years of the study period indicate even stronger disadvantage but it is not clear whether it is a measurement bias or a real worsening. A large portion of this disparity is related to the overrepresentation of women with low education among single mothers (and, to a lesser extent, to their less favourable age and parity structure). However about two thirds of the effect are directly due to the single status itself.

Although the new patterns of family formation and their health implications seem to have stabilized, some results suggest that they might be fragile. An economic crisis hit (not only) the Czech Republic in 2009. The positive influence of unemployment rate on

nonmarital childbearing among women with lower education strengthened at this time and it also started to influence birth weight of nonmarital children negatively. Pregnancy outcomes of married mothers are protected against the economic turbulences. It cannot be decided whether it is because of the protective effect of marriage or due to a stronger selection of married women from those who are less endangered by economic hardship and related stress. The latter explanation seems to be more plausible. The economic crisis also coincided with cancellation of a special protection of single mothers by higher maternity allowance. This measure directed against misusing the benefit by partnered mothers hit the goal and increased the unmarried mothers' willingness to acknowledge fathers but did not change marital behaviour.

Furthermore, the effect of rising nonmarital childbearing rate, that promoted health of nonmarital children by reducing their social stigma in the previous period, reversed. A continual rise (above 35%) of the share of children who are born outside marriage influences health of children negatively. This applies to marital children and even more to the nonmarital ones. As far as I know, such effect has not been observed in any study of birth outcomes. Research on adult health offers some explanations. Kraaykamp and Huijts [2011] analysed data from 29 European countries and found large variation in whether population composition by marital status influences health of adults. They found that the smaller is the proportion of married people, the worse are the health outcomes of never married individuals (compared to spouses).[41] The authors' explanation is that the never married can benefit from support provided by more dense social networks in societies with large share of married persons. This explanation seems to be plausible also for the influence of nonmarital childbearing on birth weight. The support of wider social networks might be highly important for pregnant women, who could benefit from other women and families who could share experience with childbearing as well as material equipment for childrearing. If more women have children outside marriage (especially without a partner or in unstable partnership) such support might be limited. It then outbalances the positive effect of high social acceptance of unmarried motherhood.

[41] However, the result for widowed persons was the opposite. The findings on never married individuals are more informative for the health of newborns because widowhood is common at much higher age than childbearing.

The intensified economic pressures against marriage among women with lower socioeconomic status and negative implications of continually growing share of children whose mothers are not married represent threats to the stabilisation of the health disparities between children born to various family arrangements. Also the educational disparities in birth weight started to rise in the late 2000s (after it appeared to level off and the decline during the previous decade). These trends might be temporary but if they continue, the health of newborns might deteriorate and the disparities between families might widen in the future.

14.2 Discussion

My analysis provides evidence that the meanings of nonmarital childbearing and its consequences for the health of newborns have pluralised since 1990. The category of unmarried mothers merges women who are very diverse in terms of socioeconomic background, relationship to the child's father and family transitions prospects. These different forms of unmarried motherhood have different consequences for wellbeing of children. The kinds of families that imply a health disadvantage for children are more difficult to recognise. Below I discuss some aspects and implications of this situation and suggest directions for further research.

14.2.1 Social stratification of family trajectories

The results of the present analyses suggest that the family trajectories rather than family arrangement are crucial for determining which children are at higher risks of adverse birth outcomes. I have argued above that childbearing in unmarried unions have become more common for all educational groups and that such partnership is equally supportive as marriage. However, the absence of a negative effect cannot be applied to any unmarried union. Cohabitation has become a normative arrangement at the beginning of family formation. It is currently the most common way how to start a coresidential relationship [Kreidl, Štípková 2012b]. The results of the present analyses show that it has increasingly become an arrangement for first birth. It does not have a negative impact on the health of newborns at this stage of family life course. However, only some of the originally unmarried mothers continue bearing children outside marriage. More educated unmarried mothers are more likely to marry after birth [Chaloupková 2011; Polášek 2006]. The educational stratification of nonmarital childbearing (in

general and in unmarried unions in particular) is stronger at second parity. Besides to the less favourable educational structure of unmarried mothers of higher-order children, unmarried partnership seems to be less supportive. There is a disparity in birth weight between higher-order children born to married and partnered mothers.

In contrast to the heterogeneous meaning of unmarried partnership, the harmful implications of unpartnered status are straightforward. Single motherhood clearly diverged from the partnered arrangement in the influence on birth weight. But the health disparity between children born to these two arrangements can diminish later during childhood because of instability of unmarried cohabitations (cf. [Vohlídalová, Maříková 2011]). Those who do not marry after birth are likely to separate and become single mothers. Heiland and Liu [2006] studied the impact of family transitions on the health of children within one year after a nonmarital birth. They found no effect of parental marriage but a detrimental effect of a separation of originally cohabiting or visiting parents. Further convergence in the effect of partnered and single status on the health of children might also be due to fathers' involvement in childrearing. Unmarried fathers are supportive during pregnancy but they might be less engaging after the child is born. Hamplová [2007b] found that unmarried coresident fathers participated much less in childcare than married fathers.

14.2.2 Causal links between maternal social characteristics and birth outcomes

My research is strong in providing evidence about the trends in the influence of maternal characteristics. But it is very limited in explaining the causal links between the maternal characteristics and birth outcomes. What features of the family relationships really matter for the wellbeing of the pregnant women and their children remains to be investigated by further research. Socioeconomic status of fathers, their willingness to share their resources, and commitment to the relationship may explain both the likelihood of entering marriage after first birth and the supportiveness of such union. Further sources of differential support among family arrangements might be gender equality within the couples and emotional quality of the relationship.

Maternal education (as a proxy for her socioeconomic status) has become a more important source of health inequality between newborns, especially among those who have both parents. Besides influencing family trajectories of mothers, it has a strong direct influence on birth outcomes. More attention should be paid to the class differences in health-related behaviour.

Especially the interaction between the pregnant women and the health care system and its impact on birth outcomes would be an interesting subject to study. The main source of the trends in birth weight was shortening gestational duration. It is closely related to obstetrical practice and interventions during the final stage of pregnancy, including delivery induction and preventive caesarean sections. Further research on this issue is needed to understand the mechanisms of how patients with different socioeconomic characteristics are treated and how the decision making about such interventions looks like. There are already some studies that suggest that the care for pregnant and birthing women may be influenced by their socioeconomic background and serve thus as a channel to reinforcement or attenuation of social inequalities in health at the beginning of life. Hrešanová [2011] studied birth care satisfaction and opinions of post-partum women and identified various approaches to the medicalisation of the birth care and different levels of knowledge about childbirth. Although the study did not focus on the relation of these perspectives to the socio-demographic characteristics of mothers, the author noticed that critical opinions on birth care and a higher level of knowledge and self-study was typical for mothers with university education. Hasmanová Marhánková and Hrešanová [2008] provide a perspective of the providers of health care. They show that perinatal health care professionals perceive different approaches to medicalisation of birth and among their patients and recognise their relation to the patient's socioeconomic status. The authors argue that rising commercionalisation of birth care may strengthen the social disparities in received health care. Further research on how the interactions between patients and care providers work and how the decisions about intervention take place is more than welcome.

14.2.3 The policy relevance of the results

The increasing heterogeneity of unmarried family arrangements and family trajectories poses challenges not only to researchers who study family forms and processes and their

implications but also to policy-makers because the identification of families that face health risks has become more difficult.

The disadvantage of children born to partnered women diminished but they remain to be vulnerable due to the low stability of unmarried unions (see above) and also due to a weak legal protection of unmarried families. The legal norms regarding relationships between parents and children do not distinguish between parents and children, but the rights and obligations between unmarried partners are much weakly defined (cf. [Hrušáková Králíčková 2006]). Unmarried families and children brought in these arrangements are, for instance, much less protected against negative consequences of parental separation than marriages. Divorce of a marriage is always assisted with a judge who has to take into account the needs and benefits of children when deciding about the post-divorce material and other arrangements. Similar protection is lacking in the case of separation of unmarried couples unlike one of the partners asks for judicial decision about custody and maintenance payments.

The large and persisting disadvantage of children born to single mothers suggests that there is a need to use public resources to better protect single mothers who are unable to rely on the support of the child's father. The share of such mothers is small (currently about 10-15%), but it has been growing continuously in the period studied. If this rising trend continues and the pregnancy outcomes of single women do not improve, an increasing share of newborns will face a health disadvantage, with all the negative consequences for their life (and also for the public budgets that would have to cover the increasing expenses for health care).

15 DATA AND METHODS

15.1 Data and variables

15.1.1 Birth register

The main data source analysed in the dissertation is the birth register. The dataset includes anonymous individual records of all children born in years 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006, and 2007-2010. The total number of newborns in these years is 1,400,920 (between 90,763 and 131,094 per year). The birth register includes a number of characteristics of the child and his/her parents. I defined two different subsets of the original data for two parts of the analysis. The first part focuses on mothers. Mothers of both stillborns and liveborns are included. Mothers of multiples are counted only once. It is not possible to identify mothers who had subsequent children in different years. The total number of mothers is 1,378,350. Second part of the analysis focuses on children. Only live singleton births were considered, which leaves 1,352,139 observations. Cases with maternal age lower than 18 years were excluded from the multivariate analyses because these mothers cannot be married (marital status is crucial variable in all analyses). This reduces the number of observations to 1,361,164 for mothers and to 1,335,112 among live singletons. These counts of observations are further slightly reduced by missing information on maternal education and/or birth weight (see below).

15.1.1.1 Information about newborns

The information about the newborn includes following birth outcomes: vitality, birth weight, birth length, and gestational age. I work only with the information on birth weight and gestational age among live singletons. They are almost fully observed. Information about birth weight was missing in 692 cases among the live singletons. Gestational age was missing in 1178 cases. Birth weight and/or gestational age were missing in 1186 observations. All of these cases occur in years 2008 and 2010. The observations with incomplete information were excluded from the analysis of birth weight.

Table 15.1. Distribution of live singleton births by birth weight and mean birth weight, 1990-2010 (selected years).

	Birth weight (g)						Total	N	Mean birth weight (g)
	<2500	2500-2999	3000-3499	3500-3999	4000-4499	4500+			
1990	4.7	16.9	40.4	29.6	7.5	0.9	100%	128,243	3314.6
1992	4.9	17.3	40.9	29.2	6.9	0.9	100%	119,394	3304.0
1994	4.6	16.0	40.3	30.4	7.7	1.0	100%	104,558	3328.7
1996	4.4	15.1	39.1	31.9	8.4	1.1	100%	88,315	3353.3
1998	4.3	14.8	38.8	32.1	8.7	1.2	100%	87,598	3364.2
2000	4.4	14.8	39.0	31.6	8.9	1.2	100%	88,124	3365.6
2002	4.7	15.4	39.1	31.2	8.6	1.1	100%	89,737	3351.7
2004	5.0	15.5	39.0	31.1	8.3	1.2	100%	94,001	3348.0
2006	5.0	16.0	39.6	30.2	8.1	1.1	100%	101,578	3338.7
2007	5.2	16.2	40.0	29.8	7.8	1.0	100%	109,992	3330.5
2008	5.1	16.2	39.9	30.0	7.9	0.9	100%	114,749	3333.9
2009	5.4	16.7	39.8	29.7	7.5	0.9	100%	113,570	3322.7
2010	5.5	17.1	40.0	29.2	7.4	0.9	100%	111,588	3317.6
Total	4.9	16.1	39.7	30.3	7.9	1.0	100%	1,351,447	3334.3

Source: CSO (Birth register), Author’s computations.

Table 15.2. Distribution of live singleton births by length of gestation and mean length of gestation, 1990-2010 (selected years).

	Length of gestation (completed weeks)						Total	N	Mean length of gestation
	<37	37	38	39	40	41+			
1990	4.5	3.2	7.9	14.3	49.1	20.9	100%	128,243	39.6
1992	4.9	3.8	9.5	18.1	44.5	19.1	100%	119,394	39.5
1994	4.6	3.6	8.9	17.5	44.9	20.6	100%	104,558	39.5
1996	4.5	3.7	9.3	18.5	43.9	20.1	100%	88,315	39.5
1998	4.4	3.4	8.8	18.1	42.4	22.8	100%	87,598	39.5
2000	4.7	3.8	9.5	19.2	39.7	23.0	100%	88,124	39.5
2002	4.8	3.9	9.4	19.5	37.3	25.1	100%	89,737	39.5
2004	5.2	4.2	10.9	21.0	35.9	22.7	100%	94,001	39.4
2006	5.3	4.5	11.3	21.6	35.2	22.0	100%	101,578	39.4
2007	5.6	4.9	12.3	22.3	33.7	21.3	100%	109,992	39.3
2008	5.6	5.1	12.9	23.1	33.1	20.1	100%	114,619	39.3
2009	5.9	5.2	13.0	23.6	32.7	19.6	100%	113,570	39.2
2010	5.9	5.3	13.5	24.2	32.5	18.7	100%	111,257	39.2
Total	5.1	4.2	10.6	20.1	38.9	21.1	100%	1,350,986	39.4

Source: CSO (Birth register), Author’s computations.

Vitality states whether the child was liveborn or stillborn. The definitions stem from the WHO guidelines, but apply some weight limits. A live birth is defined as "*the expulsion or extraction of the foetus from the mother's body if the infant shows any sign of life and his/her birth weight is a) equal or higher than 500 g or b) lower than 500 g and the infant survives 24 hours. The signs of life are breath, heartbeat, pulsation of the umbilical cord, or movement of voluntary muscles, regardless of whether or not the umbilical cord has been cut or the placenta is attached*" [Ministry of Health 1988]. A stillbirths is defined as a birth of foetus weighing at least 1000 g without signs of life. A foetus without signs of life and with weight lower than 1000 g or a foetus with less than 500 g who does not survive 24 hours is considered as a miscarriage [Ministry of Health 1988] and is not included in the birth register.

Birth weight is measured in grams. I use it either as such or as a binary indicator of low (<2500 grams) versus other birth weight. Description of the trends in the birth weight distribution and mean birth weight is presented in Table 15.1.

Gestational age is recorded in completed weeks since mother's last menstrual period. Description of the trends in the distribution of gestational age and mean length of pregnancy is shown in Table 15.2. I do not analyse the duration of pregnancy as such, but I only use the information when describing the general trends in the health of newborns. The main outcome of interest is, however birth weight. Table 15.3 presents the gestational age-specific birth weight trends.

15.1.2 Information about mothers and fathers

Following information about mothers is recorded: legal marital status, age, educational attainment, parity (number of previous births). There are no missing values for these variables, except for maternal education. Mothers increasingly refuse to report their educational attainment. There were only 10 such cases before 2007, all of which occurred before among mothers aged less than 18 years. They could have reached only elementary education at this age, so I recoded them accordingly. However since 2007, the number of mothers with unreported education increased from 165 to 4437 per year. The rising number of mothers who did not fill in their educational attainment reflects a change in data collection policy. Provision of the information about maternal (and

paternal) education has been made voluntary since 2005. The cases with missing maternal education still make up a negligibly small proportion (less than 1%) of births at any year and are omitted from the analysis.

Table 15.3. Distribution of live singleton births by length of gestation and mean length of gestation. Live singleton births, 1990-2010 (selected years).

	Length of gestation (completed weeks)					
	<37	37	38	39	40	41+
1990	2498.1	3077.6	3249.0	3414.5	3505.6	3551.4
1992	2551.3	3102.0	3270.7	3416.4	3510.9	3558.3
1994	2540.8	3119.4	3292.4	3434.2	3523.9	3559.5
1996	2570.4	3145.3	3318.8	3462.0	3554.5	3596.7
1998	2574.1	3140.3	3325.0	3463.5	3561.5	3607.1
2000	2592.3	3164.4	3334.0	3470.1	3572.0	3620.7
2002	2573.9	3141.0	3320.1	3459.6	3554.3	3598.6
2004	2585.5	3164.8	3334.6	3464.8	3569.6	3631.1
2006	2610.9	3172.0	3327.7	3456.5	3562.2	3620.4
2007	2631.1	3165.0	3331.8	3457.2	3565.3	3602.1
2008	2651.6	3184.1	3337.0	3466.0	3571.2	3583.3
2009	2631.0	3177.4	3336.3	3456.0	3567.1	3600.7
2010	2637.8	3173.8	3333.9	3459.8	3559.5	3573.5
Total	2308.2	2937.8	3151.7	3317.9	3448.9	3558.5

Source: CSO (Birth register), author's computations.

Data on fathers include age and educational attainment. However, the information about fathers is limited in a large segment of the data. For extra-marital births before 2007, no information about the father was requested from the mothers. Since 2007 all mothers have been asked to provide information about the child's father, but some of them are either not able (when they do not know the information) or not willing to do so. This information is then forwarded to the birth register and used in the child's birth certificate (if the father confirms paternity at the register office). The information whether an unmarried mother identified child's father is lacking before 2007.

Maternal marital status. There are four categories of maternal marital status: never married, married, divorced, widowed. The distribution of these categories across years is shown in Table 15.4. The formal marital status is simplified to binary indicator of unmarried status in most analyses. Some descriptive results are presented also for three categories of marital status: never married, married, divorced/widowed. The two

post/marital categories are merged, because widows are very rare among mothers (there are about 300 widowed mothers per year – see Table 15.4).

Table 15.4. Relative distribution of mothers by marital status, 1990-2010 (selected years).

	Never Married	Married	Divorced	Widowed	Total	N
1990	6.1	91.4	2.2	0.3	100%	129,908
1992	7.8	89.3	2.7	0.3	100%	120,958
1994	10.7	85.4	3.6	0.3	100%	105,888
1996	12.5	83.0	4.2	0.3	100%	89,668
1998	14.3	80.9	4.5	0.4	100%	89,337
2000	16.7	78.1	4.9	0.3	100%	89,754
2002	19.6	74.6	5.5	0.3	100%	91,502
2004	24.2	69.3	6.3	0.3	100%	96,078
2006	26.9	66.5	6.3	0.3	100%	103,985
2007	28.1	65.3	6.3	0.3	100%	112,605
2008	29.9	63.5	6.4	0.3	100%	117,429
2009	32.3	61.0	6.4	0.2	100%	116,261
2010	33.9	59.6	6.3	0.2	100%	114,977
Total	20.3	74.4	5.0	0.3	100%	1,378,350

Source: CSO (Birth register), author's computations.

Maternal partnership situation is a categorical variable with three possible values: married, partnered (i.e. unmarried who acknowledged child's father), and single unmarried (unmarried who did not provide information about child's father). Theoretically, some married mothers may not live with their husbands and be rather partnered or single mothers. This stems also from the law which always identifies mother's husband as newborn's father unlike paternity consent is officially stated by the mother, her husband and her child's real father [Hrušáková, Králíčková 2006]. Such possibility is, however not likely to be frequent. The misreporting cannot be identified in the data. All married mothers are then coded in the same category.

The partnership situation of unmarried mothers is approximated by whether she acknowledged child's father in the birth report. When the mother decides to report about father, she is asked to provide his name, address of permanent residence, personal identification number (so called *birth number* in Czech) and educational attainment. His age can be read from the identification number. From obvious reasons, the dataset provided for research purposes does not contain the name, address, and identification

number of the father, but is does include paternal age. When paternal age is not missing, it means that the mother identified the child's father. All marital children have non-missing information about father (because the husband is established as father by law). Non-marital children with non-missing paternal information are considered as born to partnered mothers. Non-marital children born with missing paternal information are considered as born to single mothers. Before 2007, the partnership status of unmarried mothers is missing and the value of this variable is filled with multiple imputation (see below). The observed proportions of mothers by acknowledgement of child's father are given in Table 15.5.

Table 15.5. Relative distribution of mothers by partnership situation, 2007-2010.

	2007	2008	2009	2010	Total
Maternal partnership situation					
Married	65.3	63.5	61.0	59.6	62.4
Unmarried, reported father	25.0	26.5	30.2	31.8	28.3
Unmarried, not reported father	9.7	10.1	8.8	8.6	9.3
	100%	100%	100%	100%	100%
N	112,605	117,429	116,261	114,977	453,526

Source: CSO (Birth register), author's computations.

Maternal educational attainment is used as an indicator of her socioeconomic status. It has four categories: elementary, lower secondary, complete secondary, tertiary. The elementary level of education denotes an obligatory 8-9 years (depending on mother's birth cohort) long education or less. It corresponds to levels 0-2 of the International Standard Classification of Education (ISCED 97) - see [CSO 2008]. Lower secondary denotes usually 3 years long vocational training. Graduates of this educational program receive a certificate, but it is not equal to General Certificate of Secondary Examination (GSCE; *Maturita* in Czech), so they cannot continue studying at a university. It corresponds to the ISCED 3C. Complete secondary education refers to 4-year secondary education which is terminated with the GSCE. GSCE is a necessary condition for entering university. The complete secondary education refers to ISCED level 3A or 3B. The category also includes post-secondary, but non-tertiary level of education (ISCED level 4). Finally, tertiary level of education denotes university-type post-secondary education (ISCED levels 5 and 6). Distribution of the educational categories is presented in Table 15.6.

Table 15.6. Relative distribution of mothers by educational attainment, 1990-2010 (selected years).

	Elementary	Lower secondary	Complete secondary	Tertiary	Total	N
1990	13.8	38.8	38.5	8.88	100%	129,908
1992	13.1	41.3	37.3	8.21	100%	120,958
1994	13.6	43.1	35.1	8.16	100%	105,888
1996	13.9	41.8	35	9.24	100%	89,668
1998	13.1	40.3	36.8	9.82	100%	89,337
2000	12.4	37.6	39.2	10.7	100%	89,754
2002	12.4	35.7	40.4	11.4	100%	91,502
2004	11.9	32.8	42.1	13.2	100%	96,078
2006	11.7	29.9	43.1	15.3	100%	103,985
2007	11.1	29.5	43.6	15.9	100%	112,440
2008	10.5	27.7	43.9	17.9	100%	116,276
2009	10.9	26.2	43.3	19.7	100%	114,270
2010	11.2	23.9	42.5	22.4	100%	110,540
Total	12.26	34.32	40.17	13.25	100%	1,370,604

Source: CSO (Birth register), author's computations.

Table 15.7. Relative distribution of mothers by age, 1990-2010 (selected years).

	-19	20-24	25-29	30-34	35+	Total	N
1990	14.1	44.9	27	9.96	4.04	100%	129,908
1992	16.3	44.1	26.6	9.15	3.94	100%	120,958
1994	13.5	44.4	26.9	10.8	4.34	100%	105,888
1996	9.06	43.3	29.7	13.1	4.76	100%	89,668
1998	6.75	39.6	34.4	14	5.19	100%	89,337
2000	4.96	32	41.1	15.9	6.07	100%	89,754
2002	4.13	24.5	44.5	19.7	7.2	100%	91,502
2004	3.79	18.5	44.1	25.5	8.14	100%	96,078
2006	3.34	15.2	39.6	32.2	9.7	100%	103,985
2007	3.14	14.3	36.8	34.9	10.9	100%	112,605
2008	3.08	13.8	34.3	36.6	12.2	100%	117,429
2009	3.12	13.7	32.4	37	13.7	100%	116,261
2010	2.96	13.4	31.1	37.1	15.4	100%	114,977
Total	6.96	27.64	34.04	23.09	8.27	100%	1,378,350

Source: CSO (Birth register), author's computations.

Maternal age is recorded exactly in completed years. I use it in categorical form in the analyses, because the outcomes I follow (birth weight, unmarried status) do not vary linearly with age. Five categories are distinguished in descriptive figures: 19 and less, 20-24, 25-29, 30-34, 35 and more. Distribution of mothers by these categories is

presented in Table 15.7. The typical age at childbearing shifted substantially during the study period. Therefore I used also a relative measure of age in some of the analyses. The relative indicator of maternal age distinguishes three categories: maternal ages that are lower or equal to the 20th percentile of the age distribution at the respective year, ages between the 20th and the 80th percentile, and ages equal or higher than the 80th percentile. Mean age within these categories and mean age at childbearing in total is shown in Table 15.8, along with the total mean age at childbearing each year.

Table 15.8. Mean age in the relative categories of maternal age and in total, 1990-2010 (selected years).

	Mean age in the relative categories of maternal age			Total mean age
	Low	Middle	High	
1990	19.0	23.7	31.6	24.3
1992	18.9	23.6	31.4	24.1
1994	19.0	23.6	31.5	24.4
1996	19.7	24.6	32.3	25.1
1998	20.4	25.2	32.3	25.6
2000	21.2	26.2	33.1	26.3
2002	21.1	26.9	33.9	27.1
2004	21.7	27.6	33.8	27.8
2006	22.4	28.6	34.5	28.5
2007	22.4	29.1	35.3	28.9
2008	22.3	29.2	35.3	29.1
2009	22.3	29.2	35.3	29.3
2010	22.3	29.7	36.1	29.5
Total	20.9	26.8	33.6	27.0

Source: CSO (Birth register), author's computations.

Parity (or birth order; these terms are used interchangeably) gives the number of previous births. Both live births and still births are counted. I simplified the counts to three categories: no previous birth, 1 previous birth, and 2 or more previous births. Alternatively, I use terms first, second, and third+ parity. The shares of these categories are provided in Table 15.9.

Table 15.9. Relative distribution of mother by parity, 1990-2010 (selected years).

	First child	Second child	Third+ child	Total	N
1990	48.2	37.1	14.7	100%	129,908
1992	50.3	35.7	14.0	100%	120,958
1994	48.1	36.8	15.0	100%	105,888
1996	47.1	38.3	14.6	100%	89,668
1998	48.4	37.7	13.9	100%	89,337
2000	49.0	37.0	14.0	100%	89,754
2002	49.0	36.8	14.2	100%	91,502
2004	50.1	36.1	13.8	100%	96,078
2006	50.0	36.4	13.6	100%	103,985
2007	48.1	37.4	14.4	100%	112,605
2008	48.5	37.5	13.9	100%	117,429
2009	48.2	37.8	13.9	100%	116,261
2010	47.1	38.6	14.3	100%	114,977
Total	48.7	37.2	14.2	100%	1,378,350

Source: CSO (Birth register), author's computations.

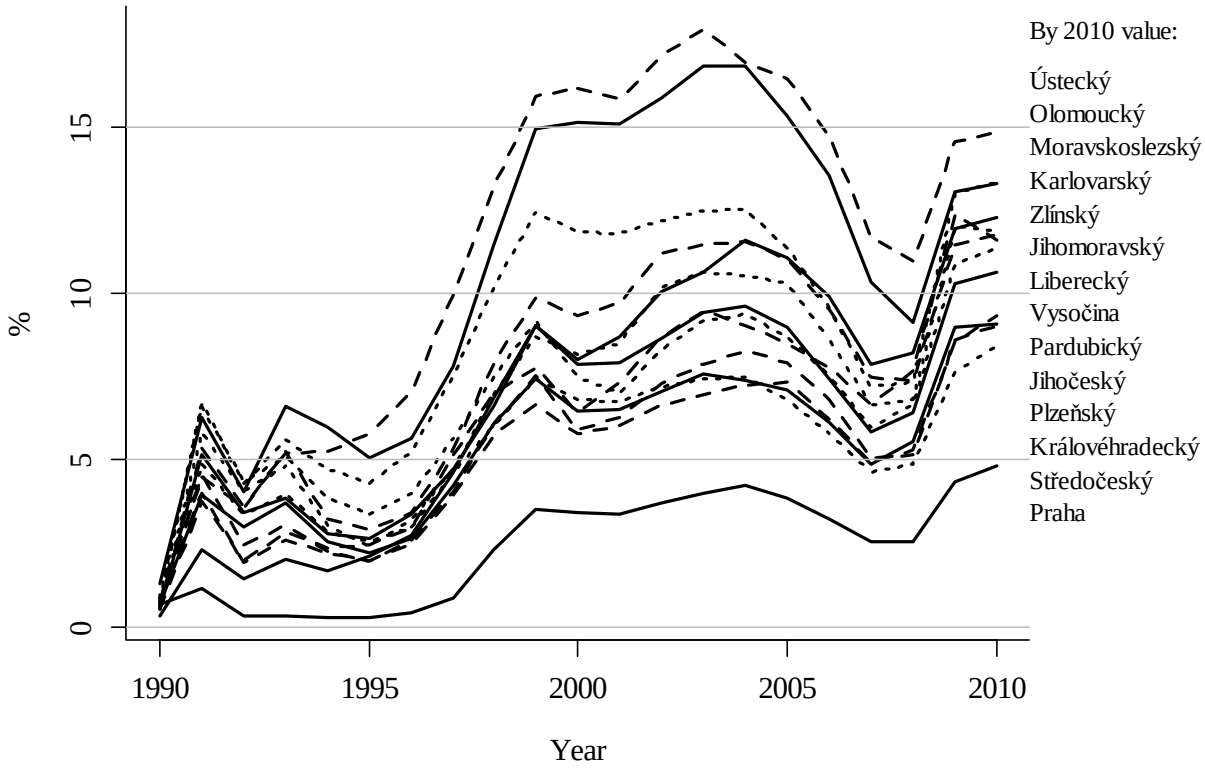
15.1.3 Contextual (macro-level) variables

Birth register includes also information about administrative district (level 4 of the Nomenclature of Units for Territorial Statistics, NUTS) where the birth took place. There are 76 administrative districts and the capital Prague which has a status of region (a higher-level unit). The border of the districts did not change during the study period, with one exception of district Šumperk which was divided into Jeseník and Šumperk in 1996. These districts are organized into 14 regions (NUTS-3 level). The regions were established in 2000, but they follow the borders of districts, so they are easily kept consistent in the whole analysis. The regional borders do not cross the border of the split region.

The analyses of both unmarried motherhood and birth weight which use the birth register work at two levels. The individual observations are clustered in regional and space contexts. These contexts are defined by years and regions. There are 13 years and 14 regions which gives 182 contexts. These contexts are used to cluster the individual observations either as such (each context representing a single values of a random variable – see section method) or are attributed with some characteristics. These contextual variables are year, policy regime, unemployment rate, and non-marital childbearing rate.

The **policy regime** measured the type policy of protection of unpartnered mothers. Four periods are distinguished. Four periods with different policy regimes are then distinguished: universal benefits, longer maternity allowance for single mothers (1990-1991); partially income-tested benefits, longer maternity allowance for single mothers (1992-1995); income-tested benefits, longer maternity allowance for single mothers (1996-2008); income-tested benefits, unified length of maternity allowance (2009-2010).

Figure 15.1. Trends in registered unemployment rate by region, 1990-2010 (selected years).



Source: CSO 2013.

The **unemployment rate** gives the registered unemployment rate for the each context (region and year). The data are taken from the Czech Statistical Office [CSO 2013]. The registered unemployment rate is the ratio of the number of people who registered as unemployed and the total workforce. The method of calculation was changed in July 2004. Since then, only reachable candidates are included in the denominator (i.e. those who are, for instance, ill, imprisoned or in retraining are excluded from the calculation).

Table 15.10. Non-marital childbearing rate by region (percent of liveborns born outside marriage) 1990-2010 (selected years).

	1990	1992	1994	1996	1998	2000	2002	2004	2006	2007	2008	2009	2010
Praha	10.5	12.8	16.5	18.3	19.1	21.2	23.8	27.5	30.2	30.9	32.7	33.8	35.4
Středočeský	7.3	9.1	12.5	14.5	16.3	19.0	22.4	28.0	29.8	31.4	33.4	34.7	37.1
Jihočeský	6.7	8.2	11.8	13.9	16.4	18.2	22.0	28.7	33.2	33.4	35.8	38.0	40.6
Plzeňský	7.8	10.4	14.5	16.2	19.6	20.8	24.7	30.4	34.2	35.3	37.3	41.2	41.8
Karlovarský	17.8	24.6	31.1	35.3	36.3	41.8	44.3	47.6	51.5	51.1	54.1	55.3	58.7
Ústecký	16.6	20.8	27.4	31.7	35.0	39.2	42.2	47.6	48.6	49.8	50.5	53.8	54.5
Liberecký	11.2	13.9	19.6	22.6	25.8	28.8	32.2	36.3	38.3	40.4	40.5	44.9	45.6
Královéhradecký	7.3	8.9	11.7	14.8	17.9	19.6	22.6	29.6	32.1	35.2	36.1	39.1	41.1
Pardubický	6.0	6.9	9.8	11.4	13.2	16.6	20.6	25.6	30.1	30.2	33.1	36.0	38.2
Vysočina	4.1	4.9	6.6	8.1	10.1	11.7	14.4	20.1	25.0	25.4	29.1	32.3	33.9
Jihomoravský	6.4	8.7	11.2	13.2	14.4	16.9	20.2	25.3	27.9	29.0	30.7	33.8	35.9
Olomoucký	6.6	9.5	12.2	14.3	17.0	20.3	25.1	30.2	33.5	34.7	36.8	39.7	40.1
Zlínský	4.7	5.1	7.5	8.8	9.6	12.2	15.1	20.4	23.7	26.0	28.0	30.4	32.1
Moravskoslezský	9.1	10.6	15.6	18.6	21.2	24.5	29.4	35.8	38.2	39.5	41.8	44.4	44.4

Source: CSO (Birth register), author’s computations.

Results of both versions of the measurement are provided for 2004. I used the old measurement in 1990-2004 and then adjusted the values computed with the new method in 2005-2010 by the ratio of the old and new measurement in 2004. The values are plotted in Figure 15.1.

The **non-marital childbearing rate** is the proportion of mothers who are not married in the given context. The values are presented in Table 15.11.

15.1.4 Multiple imputation of missing data

I handle the problem of missing data on partnership arrangement of unmarried mothers with multiple imputation. The technique, introduced by Rubin [1976], fills the missing data in based on the values and variability of observed data. It is done in three steps. First, a model is set to impute the data. The imputation is done several times. Each of the repeated imputations creates plausible values that replace the missing data which leads to a number of alternative 'measurements' of the variable with missing values. Second, each of the imputed datasets is analysed independently with whatever method is considered appropriate. Finally, the results obtained from each analysis of the imputed datasets are pooled according to the rules specified by Rubin [1987].

It is advisable to use as many predictors as possible in the imputation model. The imputation model is not supposed to be parsimonious, but to provide maximum amount of information for the imputation. All relationships that will be evaluated in the analytical steps have to be included in the imputation model to get proper results [Rubin 1996]. For this reason, I used more variables and more detailed categorisation of some variables than what is done in the analysis. I did the whole procedure in the Stata 11 and ran five rounds of imputation.

The maternal family arrangement has three categories: married, partnered unmarried, and single. Partnered and single unmarried mothers cannot be distinguished before 2007, so the detailed measurement of family status is missing in 20 % of cases in the period 1990-2006. The data are missing at random. It means that whether the value is missing does not depend on any unobserved influences, but only on the observed variables (year and marital status). This makes the missing data problem less severe,

because multiple imputation works well with missing at random data [Schafer, Graham 2002].

I imputed a binary variable that indicated whether or not the mother was partnered on the subsample of unmarried mothers. The model used for the imputation was logistic regression. The model included individual predictors: maternal age (5 categories, as above), education (4 categories, as above), parity (3 categories, as above), formal marital status (2 categories: never married, divorced/widowed), child's birth weight (both binary indicator of low birth weight and a continuous measure), gestational age (5 categories, as above). I also included macro-variables as fixed effects. There are a continuous measure of time (in years), region-and-time-specific unemployment rate. Finally, a variable indicating period of 2007-2008 was included to control for a policy-induced bias in the reporting of fathers at this time. This variable has a different purpose than the policy variable, which is used in the analysis of unmarried motherhood. Here I do not study the impact of policy regimes. The purpose of the imputation is to predict the partnership status of unmarried mothers. This is approximated by whether the mother provided data on child's father, which is an indication of a relationship (likely coresidential) between them. Before 2009, some cohabiting mothers misreported fathers to get higher allowances. This is likely to be the case also before 2007, but I am not interested in the formal acknowledgement of fathers. I rather set the model to predict the net single mothers.

As I assume that the association between maternal socioeconomic status and single motherhood may have changed in time, I let the effect of education interact with time and with unemployment rate, the two macro-effects that interacted with maternal education in the analysis of unmarried motherhood.

15.1.5 Labour Force Survey

I used the Labour Force Survey (LFS) for a detailed analysis of unmarried mothers and their coresident partners. I have access to the data for period 1993-2009. LFS is a rotating panel, in which a stratified probability sample of households is interviewed for five following quarters and then replaced. I use only the first wave of interviewing in each household to avoid bias resulting from selective dropout. A big advantage of this

data source is its large sample size. I restricted the dataset to the households with an infant younger than one year (N=8316) and excluded also households without the child's mother to approximate for the family arrangements of mothers. Households with more than one infant were counted only once.

Among the variables included in the dataset, I use the information about household composition and relationships between the members to reconstruct the family arrangements of mothers. The measurement of the relationships between household members was not consistent during the whole period. From 1993 to 2001, only the relationships to the household head are indicated for each member. Since 2002 there are additional indicators of parental and partner relationships between all of the household members. It was then possible to easily identify whether both infant's parents live in the household or not since 2002. The older method of identification of relationship between household members causes difficulties in identification of infant's parents if they are not household heads (17 % of the cases in the 1993-2001 period). To solve this issue, I used the information about relationships to household head, gender, age, and economic status "on maternity leave" to identify potential mothers and fathers in the households (or to prove their absence).

15.1.5.1 Family arrangements of unmarried mothers – description and sensitivity analysis

I distinguished three kinds of family arrangements according to the presence of the infant's father and marital status of the parents: unpartnered mother, unmarried cohabitation, and marriage. The distribution of households by mother's family arrangement is shown in Table 15.11. The incomplete identification of family arrangements in the 1993-2001 period may cause a bias in the proportions. To assess this issue, Figures 15.2 to 15.4 compare the proportions of family arrangements from the final LFS dataset with the proportions of unmarried mothers from birth register and with the subset of the final LFS datafile, which includes only households headed by the infant's mother or her partner (the child's father). These households are fully observed across the whole time series. A discrepancy between the two lines before 2002 would indicate biased measurement in the older part of the data.

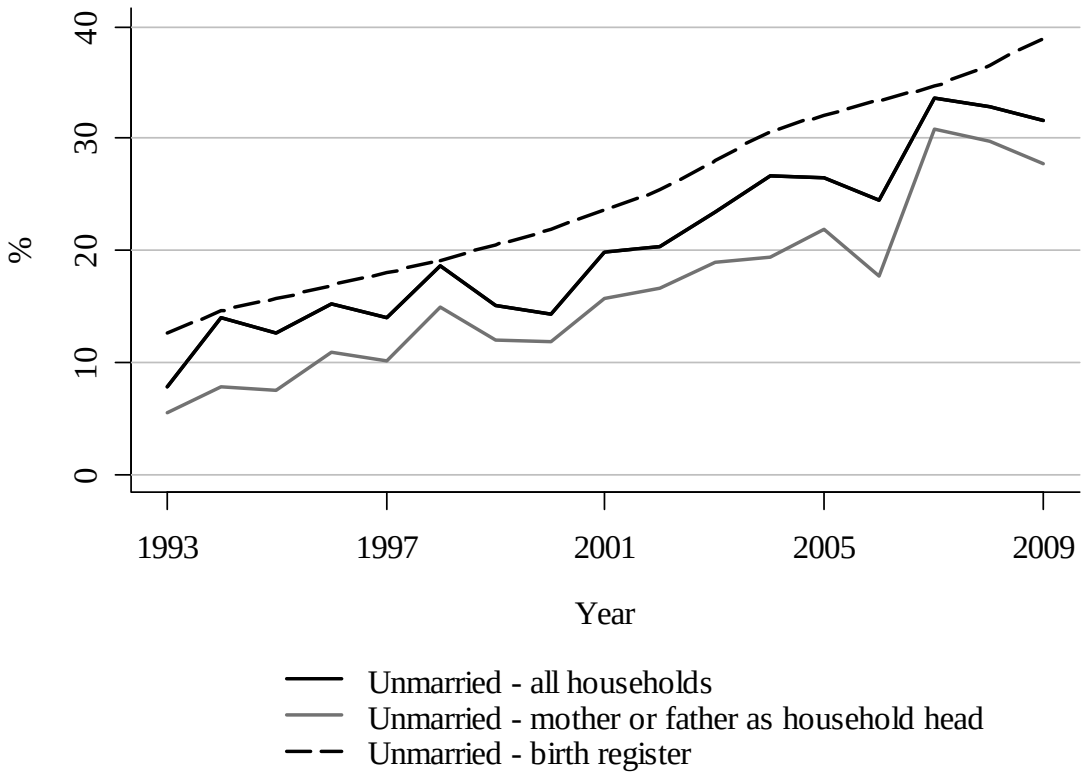
Table 15.11. Relative distribution of mothers by family arrangements. Households with an infant and his/her mother, 1993-2009.

	Married		Cohabiting		Unpartnered		Total	N
	Proportion	SE	Proportion	SE	Proportion	SE		
1993	94.5	1.060	2.7	0.615	2.7	0.888	100%	725
1994	92.1	1.750	4.6	0.986	3.3	1.510	100%	499
1995	92.5	2.290	4.8	1.400	2.7	1.900	100%	232
1996	89.1	1.770	5.7	1.140	5.2	1.450	100%	487
1997	89.8	1.680	5.2	1.040	5.0	1.390	100%	475
1998	85.0	2.000	10.0	1.510	4.9	1.490	100%	472
1999	87.9	1.760	7.8	1.290	4.3	1.290	100%	420
2000	88.1	1.900	7.9	1.470	4.1	1.320	100%	367
2001	84.3	2.220	8.1	1.440	7.6	1.850	100%	390
2002	83.4	2.100	10.4	1.600	6.2	1.530	100%	399
2003	81.1	2.180	12.7	1.690	6.2	1.610	100%	425
2004	80.5	2.200	13.5	1.770	6.0	1.580	100%	439
2005	78.1	2.230	15.1	1.820	6.9	1.580	100%	427
2006	82.2	2.240	11.2	1.610	6.6	1.790	100%	428
2007	69.2	2.260	21.3	1.930	9.5	1.600	100%	480
2008	70.3	2.180	21.8	1.850	7.9	1.530	100%	502
2009	72.3	2.320	19.6	1.970	8.0	1.620	100%	457
Total	78.0	0.524	11.7	0.408	10.3	0.384	100%	7624

Source: Labour Force Survey, author's computations.

Figure 15.2 shows the total proportion of unmarried mothers identified in the LFS. The share of unmarried mothers is somewhat underestimated in most of the time points. Here I focus on the possible bias due to incomplete data in the older part of the data. The grey line plots the proportion of unmarried mothers in the subsample of households headed by either mother or father of the infant. The prevalence of unmarried motherhood is lower in this subsample, which suggests that unmarried mothers are more likely to live in more complex households, mostly with their or their partners parents. It is important difference between the two lines remains approximately constant in across the time series. They both oscillated in similar manner and there is no marked change of the difference between 2001 and 2002 (the border between two methods of recording relationships between household members). So there does not seem to by any substantial bias resulting from the data limitation in 1993-2001 period.

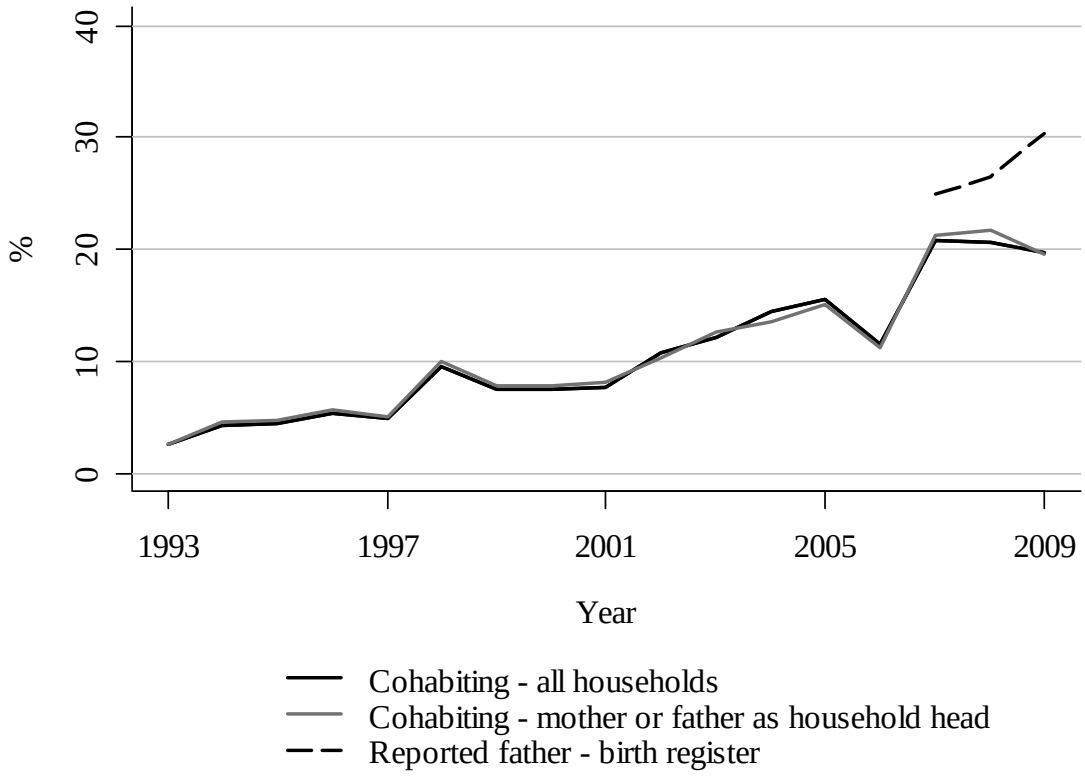
Figure 15.2. Proportion of mothers who are not married, 1993-2009. Households with mothers and infants from the LFS, N=7624; Mothers from the birth register, N= 1,378,350.



Source: CSO (Birth register) and LFS, author's computations.

This is supported also when unmarried mothers are split between those who do and do not live with a partner. Figure 15.3 shows that the proportions of mothers who cohabit overlap almost perfectly in the two versions of the LFS data. There is no sign of any divergence in the two parts of the data series.

Figure 15.3. Proportion of mothers who live in unmarried cohabitation/acknowledged child's father, 1993-2009. Households with mothers and infants from the LFS, N=7624; Mothers from the birth register, N= 1,378,350.



Source: CSO (Birth register) and LFS, author's computations.

The picture is different in the case of single (unpartnered) mothers – see Figure 15.4. Single mothers are most likely to live in household headed by other persons than themselves (mostly their parents). Consequently, they are underrepresented in the limited subsample of the LFS. But again, the trend has a similar shape in and the oscillation of the discrepancy does not seem to be related to the change in data recording policy.

15.1.5.2 Characteristics of mothers

Maternal characteristics used in the analysis are analogical to those from the birth register. **Maternal education** was simplified to only two values to keep a sufficient number of cases in each educational category in each year. The lower education refers to mothers with elementary and lower secondary education. The higher educational category includes mothers with complete secondary and tertiary education. The distribution of the categories is presented in Table 15.12.

Table 12. Relative distribution of mothers by relative age, 1993-2009. Households with an infant and his/her mother.

	Lower education		Higher education		Total	N
	Proportion	SE	Proportion	SE		
1993	49.0	1.858	51.0	1.858	100%	725
1994	51.7	2.239	48.3	2.239	100%	499
1995	53.0	3.284	47.0	3.284	100%	232
1996	54.2	2.260	45.8	2.260	100%	487
1997	52.2	2.294	47.8	2.294	100%	475
1998	46.4	2.298	53.6	2.298	100%	472
1999	51.0	2.442	49.0	2.442	100%	420
2000	47.7	2.611	52.3	2.611	100%	367
2001	46.9	2.530	53.1	2.530	100%	390
2002	43.9	2.487	56.1	2.487	100%	399
2003	42.4	2.400	57.6	2.400	100%	425
2004	43.1	2.366	56.9	2.366	100%	439
2005	45.4	2.412	54.6	2.412	100%	427
2006	41.4	2.383	58.6	2.383	100%	428
2007	45.6	2.276	54.4	2.276	100%	480
2008	39.4	2.183	60.6	2.183	100%	502
2009	38.3	2.276	61.7	2.276	100%	457
Total	46.5	0.571	53.5	0.571	100%	7624

Source: Labour Force Survey, author's computations.

Maternal age is measured in years. The distribution split to five categories (19 and less, 20-24, 25-29, 30-34, 35 and more) is shown in Table 15.13. I also created relative age categories corresponding to those from birth register (the borders of the age categories are taken from the birth register) to be used in the models.

Table 15.13. Relative distribution of mothers by age, 1993-2009. Households with an infant and his/her mother.

	-19		20-24		25-29		30-34		35+		Total	N
	Proportion	SE	Proportion	SE	Proportion	SE	Proportion	SE	Proportion	SE		
1993	6.5	0.915	39.7	1.819	34.8	1.770	14.9	1.323	4.1	0.740	100%	725
1994	8.0	1.217	40.5	2.200	30.7	2.066	13.2	1.518	7.6	1.189	100%	499
1995	7.3	1.715	31.0	3.044	33.2	3.098	21.1	2.686	7.3	1.715	100%	232
1996	5.1	1.001	40.5	2.226	33.5	2.141	14.6	1.601	6.4	1.107	100%	487
1997	3.2	0.803	38.5	2.235	34.7	2.187	16.6	1.710	6.9	1.168	100%	475
1998	2.8	0.754	34.7	2.194	38.3	2.240	15.9	1.685	8.3	1.269	100%	472
1999	3.3	0.877	32.6	2.290	36.7	2.354	18.8	1.909	8.6	1.368	100%	420
2000	1.6	0.663	29.2	2.376	46.0	2.605	17.4	1.983	5.7	1.214	100%	367
2001	3.1	0.876	25.4	2.207	42.6	2.507	21.3	2.075	7.7	1.351	100%	390
2002	2.0	0.703	21.3	2.052	46.4	2.500	23.1	2.111	7.3	1.301	100%	399
2003	2.6	0.771	16.5	1.801	46.6	2.423	25.2	2.108	9.2	1.402	100%	425
2004	3.4	0.868	16.6	1.779	40.1	2.342	30.1	2.191	9.8	1.420	100%	439
2005	2.8	0.801	15.5	1.751	41.2	2.385	28.1	2.178	12.4	1.598	100%	427
2006	2.6	0.766	15.4	1.748	39.7	2.368	32.2	2.262	10.0	1.455	100%	428
2007	2.5	0.713	15.6	1.659	32.7	2.144	36.3	2.196	12.9	1.532	100%	480
2008	2.4	0.682	12.0	1.449	29.5	2.037	37.1	2.158	19.1	1.757	100%	502
2009	1.5	0.575	12.9	1.570	28.0	2.103	39.6	2.290	17.9	1.797	100%	457
Total	3.6	0.214	26.3	0.504	37.0	0.553	23.7	0.487	9.5	0.335	100%	7624

Source: Labour Force Survey, author's computations.

15.1.5.3 Time

Time is coded in years (1993-2009), but I simplified it to six categories (1993-1995, 1996-1998, 1999-2001, 2002-2004, 2005-2007, 2008-2009) when entering into models.

15.1.5.4 Weights

The proportions of mothers by age, education, and parity are somewhat distorted in the LFS dataset. So I created weights for these variables from the birth register and applied them to the LFS data when estimating the proportions of mothers by family arrangement.

15.2 Methods of analysis

The main analytical tool I use is multilevel regression modelling. Some parts of the analysis also use classical (single-level) logistic regression. I estimated all models in Stata 11. Decomposition is used in the analysis of birth weight.

15.2.1 OLS and logistic regression

Regression modeling serves to simplify relationships between variables and clean them from random variation (for introduction see [Agresti, Finlay 2009]). The models predict the dependent variable with a set of independent variables which are expected to influence the outcome linearly. The value of the dependent variable (*Y*) for individual *i* is predicted with a set of independent variables (X_1, X_2, ..., X_k). The unexplained (residual) variability is captured in the term ϵ_i. The model can be described as

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_{ki} X_{ki} + \epsilon_i$$

(Equation 1).

OLS regression requires the outcome variable to be continuous. Binary dependent variables which are more common in my analysis (e.g. unmarried motherhood or low birth weight) have to be transformed before they are modeled to meet the assumption of a continuous dependent variable. The binary outcome (e.g. unmarried status of a

mother) can be conceptualised as a manifestation of certain probability that each particular mother in unmarried. The probability is not equal for all mothers, but differs for mothers with different characteristics (e.g. unmarried motherhood differs by education). The probability is not equal for all mothers, but differs by education. Odds are a relative measure of the probability. They are computed as a ratio of the probability that the event of interest occurs (a mother is unmarried) and the probability that the event does not occur (a mother is married). For instance the odds of unmarried motherhood for a mother with elementary education in 2010 are 0.75 /0.25=3. Her odds of being unmarried are then 3 to 1. The difference between educational groups can be expressed a ratio of odds. Both odds and odds ratios range between 0 and infinity. Odds ratios higher than one indicate that the odds in the groups of interest are higher than in that in the reference category (and vice versa, odds between 0 and 1 indicate a lower odds in the category of interest, compared to the reference).

Logistic regression works with the odds ratios and their natural logarithms. The regression model requires the outcome variable to be continuous. Probabilities range only between 0 and 1, so they are transformed by logit function to meet this assumption. This function first transforms the probability into odds (probability of the positive outcomes/probability of the negative outcome) and then takes natural logarithm of the odds (see e.g. [Powers, Xie 2008: 31-67]). Instead of probability, the dependent variable is then the logit (logarithm of the odds). The transformation can be formally written as

$$\text{Logit} = ln\frac{p}{1-p}$$

(Equation 2)

where *p* is the probability of the outcome of interest. The model then has equation

$$\text{Logit} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \epsilon_i$$

(Equation 3).

15.2.2 Multilevel regression models for continuous and binary dependent variable

Classical OLS and logistic regression assume that the observations are independent on each other, i.e. that the ε_i terms (see Equation 1 or 2) are not correlated. Sometimes, the nature of the data and the problem studied do not conform this expectation. Individuals may form clusters in which observations are more similar to each other than individuals from different clusters. This is the case in my analysis. The individuals I study (mothers and their infants) had children (or were born) at very different social conditions. They span over two decades of very profound social change and over various region. Influence of these structural (macro-) conditions is a subject of my analysis. I take the clustered nature of the data into consideration in analyses where the data allow this approach.[42] Failing to account for the clustered nature of the data could lead to biased estimates of the coefficients and their standard errors. This problem is solved by multilevel modeling (see e.g. [Powers, Xie 2008: 115-165; Rabe-Hesketh, Skrondal 2008]). Multilevel models divide the variability of the dependent variable which has its source at the individual level from the variability that sources from the differences between macro-contexts (clusters). I define these contexts by the combination of time and regions. There are 13 time points and 14 regions. This gives 182(=13*14) contexts (or 4*14=56 context in the analysis of the 2007-2010 data). Theoretically, the model should be three-level: individuals are clustered by time and the time points are clustered by regions. This would be, however, not feasible because the number of observations at each level is not sufficient.

I estimate multilevel models with random intercepts. The model assumes that the context-level variability can be captured by allowing the intercept to vary by contexts.

[42] Another principle of clustering in my data is that some women had more than one child during the study period. The mothers represent clusters and children individual cases within clusters. Mothers who were not married at first birth are more likely to be unmarried also at second birth, compared to mothers who were married at first birth. Similarly, outcomes of infants born to the same mothers are correlated because of shared maternal characteristics (hereditary factors and her life style and living conditions that did not change between births). It is, however, not possible to identify births to the same mothers because of the Czech Statistical Office's privacy protection policy. This is not a big issue for the analysis because I do not focus on life trajectories or on disentangling the causes of birth weight. I am rather interested in the influence of maternal characteristics under varying structural conditions, which is acknowledged in the analysis.

Each context is supposed to have a specific baseline value of the outcome (e.g. probability of unmarried motherhood), the intercept. The model can be expressed in equation

$$Y_{ij} = \beta_{0j} + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_k X_{ki} + \epsilon_{ij}$$

(Equation 4),

where Y_{ij} is the value of dependent variable for individual *i* and context *j* , X_{1i} to X_{ki} are the values of individual-level independent variables and β_{0j} is the random intercept for context *j*.

The model does not treat the intercepts as observed values whose effects are assessed by estimating single constant for each context. Instead, the intercepts are conceptualised as representing values of an unobserved (latent) variable. The values of this variable can be split to a fixed term which is the same for each context and a random term (in fact error term or residual) which adjusts the fixed term according to the specific contexts. This can be described by equation

$$\beta_{0j} = \gamma_{00} + u_j$$

(Equation 5),

where γ_{00} is the fixed part and u_j is the random part of the intercept.

The fixed part of the intercept can be further split into the effects of observed context-level variables and the remaining effect adjusted by the random effect according to the equation

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Z_j + u_j$$

(Equation 6),

where γ_{01} is the fixed part of the intercept influenced by the context-level variable Z and Z_j is the value of this variables in context j. The random intercept model is an efficient way of handling a large number of contexts. Instead of estimating each single intercept, only the common fixed part is estimated together with the variability (standard deviation) of the random intercepts around it.

The relative contribution of the individual level and the context level to the total variability can be compared by the intra-class correlation coefficient (ρ) computed as

$$\rho = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_\epsilon^2}$$

(Equation 7),

where σ_u^2 is the variance of the outcomes variable between contexts and σ_ϵ^2 is the variability within contexts. The intra-class correlation measures the proportion of total variability that takes place at the context level.

All models are estimated with maximum likelihood. This method provides estimates of population parameter that maximize the probability of observing the data we have observed (see [Hox 2010: 40-42] or [Rabe-Hesketh, Skrondal 2008: 258-263] for a more formal explanation).[43] Multiple models are estimated for each analytical task. Two tools are used to decide which models represent the reality precisely but parsimoniously, the likelihood-ratio test and Akaike's information criterion (AIC). Both of these goodness-of-fit statistics rely on the value of the likelihood which is used for the estimation of the model. The likelihood-ratio test is a standard method of comparing nested models (i.e. models estimated on the same population so that the unrestricted model includes all parameters that are included also in the restricted model). It is suitable also for multilevel models [Rabe-Hesketh, Skrondal 2008: 253-254]. The

[43] I used the maximum likelihood estimation also for models with continuous dependent variable (the models of birth weight in Chapters 11 and 12) to keep the model selection (likelihood-ratio test and AIC) criteria consistent across dependent variables. Stata estimates them with least squares, by default but both procedures are asymptotically (i.e. with infinitely large samples) equivalent [Hox 2010: 42]. Estimating these models with the method of least squares did not change the values of the coefficients and did no modify the model selection.

likelihood ratio test examines the null hypothesis that the two models are not significantly different from each other. The test criterion (the likelihood ratio) is computed with the formula

$$\mathrm{LR} = -2 * \ln(L_0/L_1)$$

(Equation 8),

where L_0 is the likelihood of the restricted model and L_1 is the likelihood of the unrestricted model. The Likelihood ratio has a chi-square distribution with degrees of freedom given by the difference in the number of parameters between the two compared models [StataCorp 2009: 949-950].

Beside this classical approach, the information criteria (Bayesian information criterion – BIC and AIC) can be used to decide between models [Hox 2010: 50-51]. The computation of BIC involves the sample size which is ambiguous in the multilevel setting (it is not clear whether number of contexts or number of micro-level observations should be used). Therefore I rely on AIC which is based on the value of likelihood and the number of parameters used in the model:

$$\mathrm{AIC} = -2 * \ln(likelihood) + 2k$$

(Equation 9),

where *k* is the number of parameters. Lower AIC indicates a better fit of the model. Models whose AIC is not more than by 4-7 points larger than the model with minimum AIC are still plausible. More distant ones should not be preferred [Burhnam, Anderson 2004]

15.2.3 Decomposition

I use the method of decomposition in Chapter 11 to evaluate two sources of a trend in mean birth weight and low birth weight rate. It was developed by Kitagawa [1955] as a means to analyse a difference between two rates by separating it into two components,

the effect of population composition and the direct effect. The method is based on the common technique of direct standardisation. The general mean birth weight in a population can be expressed as a weighted mean of sub-population-specific birth weights according to the formula

$$\overline{w} = \sum_{i=1}^{n} w_i * p_i$$

(Equation 9),

where n is the number of categories of the grouping variable, w_i is the group-specific mean birth weight and p_i is the proportion of the group (see e.g. [Preston et al. 2001]). When comparing two populations with different composition, the observed proportions have to be replaced by a standard to discard the compositional influence. The standardized value is then computed by formula

$$\overline{w}_{stand} = \sum_{i=1}^{n} w_i * p_{i\,stand}$$

(Equation 10).

When comparing the birth weight at two time points, the direct effect of changing outcomes within subpopulations can be isolated by standardising the distribution of groups and vice versa. It can be done in two ways, using as standard the values of either of the two time points. To avoid arbitrary decision of choosing the standard, the average of the two possible outcomes is taken (as advised by [Kitagawa 1955]).

$$\overline{w}_2 - \overline{w}_1 = \text{composition component} + \text{direct component}$$

$$= \frac{1}{2}\left[\sum_{i=1}^{n} w_{2i} * p_{2i} - \sum_{i=1}^{n} w_{2i} * p_{1i}\right] + \frac{1}{2}\left[\sum_{i=1}^{n} w_{1i} * p_{2i} - \sum_{i=1}^{n} w_{1i} * p_{1i}\right]$$

$$+ \frac{1}{2}\left[\sum_{i=1}^{n} w_{2i} * p_{2i} - \sum_{i=1}^{n} w_{1i} * p_{2i}\right] + \frac{1}{2}\left[\sum_{i=1}^{n} w_{2i} * p_{1i} - \sum_{i=1}^{n} w_{1i} * p_{1i}\right]$$

(Equation 11).

In this way I decomposed the 1990-2010 trends in mean birth weight and low birth weight rate among married mothers into the direct effect and the effect of composition of married mothers by education, age, and parity. The same decomposition was applied also to the trends among unmarried mothers. This helped me to assess the sources of the closing marital status gap in the two birth weight outcomes.

15.2.4 Models of trends in birth weight by family arrangement

The data limitations do not allow a direct assessment of the trend in the influence of unmarried family arrangements on birth weight. I used multiple imputation to fill in the missing information. In this section, I explain how I evaluated the plausibility of the result on the aggregated data.

15.2.4.1 The idea of the model

The mean birth weight of children born outside marriage at time *y* can be expressed as a weighted mean of two subgroups:

$$\bar{w}(y) = w_p(y) * \pi_p(y) + w_s(y) * \pi_s(y)$$

(Equation 12),

where $w_p(y)$ is the mean birth weight of children born to partnered mothers, $\pi_p(y)$ is the proportion of partnered mothers, and $w_s(y)$ and $\pi_s(y)$ are the same measures for unpartnered (single) mothers.

The π_p and w_p can be expressed in relation to w_s and π_s. A factor a is introduced to capture the magnitude of the advantage of partnered mothers relative to single mothers

$$\pi_p = 1 - \pi_s$$

(Equation 13)

$$w_p = a * w_s$$

(Equation 14).

After inserting these terms in Equation 9, we obtain:

$$w_s = \frac{\bar{w}(y)}{a(1-\pi_s)+\pi_s}$$

(Equation 15).

To estimate the low birth weight rate of children born to unpartnered mothers, I had to make some assumptions about *a* (the ratio of the outcomes of partnered and unpartnered mothers) and the proportions of partnered and unpartnered mothers in the population.

15.2.4.2 Three models

The shares of partnered and unpartnered unmarried mothers resulting from the multiple imputation were shown to be plausible by comparing them to the data from Labour Force Survey (see Chapter 7). There was a policy-induced over-reporting of the single status in the period 2007-2008. The imputation of data in 1990-2006 is not affected because I included a special variable for the 2007-2008 period, which adjusted the bias when the values were imputed. To avoid the bias in subsequent models, I replaced the 2007-2008 shares of single and partnered unmarried mothers with a linear interpolation of the values between 2006 and 2009.

Three models of the disparity between the two groups were created with different values for the parameter *a*, i.e. the ratio of the birth weight of children born to partnered vs. single mothers.

Model A1. First model is the imputed one. The parameter *a* results from the multiply imputed dataset. To locate the results of multiple imputation within a range of possible outcomes, I also created two other models that represent the extreme scenarios of how parameter *a* might have changed during the study period.

Model A2: The second model represents the scenario of a constantly high disparity between children born to single and partnered mothers. It keeps parameter *a* constant at the 2009 level in 1990-2009, irrespective of whether childbearing without marriage was marginal or common in the population.

Model A3: The last model assumes that, as both single motherhood and parenthood within an unmarried relationship were rare and rather deviant forms of parenthood in 1990, there was no difference between the birth weights of children born to all unmarried mothers, without regard to the parental partnership status. The value of *a* is linearly interpolated between 1 and the 2009 value.

Although unlikely, the two extreme scenarios (Models A2 and A3) define the limits of what might have happened with the birth weight disparity by family status and allow an assessment of how realistic the results of multiple imputation are.

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SHRNUTÍ

Práce se zabývá sociálními nerovnostmi ve zdraví novorozenců. Zdraví dětí (a zdraví obecně) je silně ovlivněno sociálními faktory, zejména socioekonomickým postavením rodiny a rodinným uspořádáním. Děti, které se rodí sezdaným párům, se v průměru těší lepšímu zdraví než děti narozené nesezdaným párům nebo svobodným matkám. Výrazný pozitivní vliv na zdraví má také socioekonomický status matky, který zároveň ovlivňuje i její rodinné chování (matky s vyšším statusem častěji rodí děti v manželství). Zdraví dítěte ovlivňuje jeho další životní šance, včetně např. dosaženého vzdělání, a je tedy jedním ze způsobů, kterými se mezigeneračně reprodukují sociální nerovnosti.

Práce se zaměřuje se na zdraví novorozenců v České republice v období mezi lety 1990 a 2010. V této době došlo k rozsáhlým společenským změnám a zásadně se proměnily také reprodukční vzorce. Lidé začali posouvat manželství a rození dětí do vyššího věku, mění pořadí těchto transic a nebo dokonce od manželství zcela ustupují. Práce zkoumá, dvě otázky: 1. jak se proměnilo neprovdané mateřství a jeho socioekonomické okolnosti a 2. jaký vliv měly tyto změny na nerovnosti ve zdraví novorozenců podle rodinného uspořádání, do kterého se narodí. Analyzována byla data z matriky narozených, která byla podrobena víceúrovňovému regresnímu modelování zaměřenému na vysvětlení rozdílů mezi časem a prostorem definovanými kontexty. Zdraví novorozenců je zkoumáno skrze jejich porodní hmotnost. Rodinné uspořádání matek je měřeno jejich rodinným stavem. Neprovdané matky jsou dále rozlišeny podle ustavení otcovství dítěte.

Zdravotní znevýhodnění dětí narozených mimo manželství se ve zkoumaném období výrazně snížilo a mechanismus, který generuje zdravotní nerovnosti mezi manželskými a nemanželskými dětmi se proměnil. Na počátku 90. let bylo rození dětí mimo manželství marginálním fenoménem, který se vzpíral sociálním normám a který byl typické zejména pro málo vzdělané a mladé matky. Děti narozené mimo manželství byly, v průměru, značně zdravotně znevýhodněné touto sociální marginalitou. Společenská atmosféra nově nabyté svobody a liberalizace hodnot vedly k tomu, že ženy začaly intenzivně rodit, aniž by se vdaly. Od poloviny 90. let posílily odklon od manželství také ekonomické vlivy: rostoucí ekonomická nejistota vedla k tomu, že řada párů odložila manželství, které si spojují s dosažením jistého životního standardu.

Rodinná politika navíc způsobila, že pro některé matky bylo výhodné, aby zůstaly neprovdané. Během 90. let posílila asociace neprovdaného mateřství se socioekonomickým statusem a rostl také vliv vzdělání matky na porodní hmotnost dítěte, který se poté ustálil na vyšší hladině než v první polovině 90. let. Ve druhé dekádě sledovaného období začaly také vzdělanější matky intenzivněji rodit děti mimo manželství, čímž se zastavil růst asociace mateřství mimo manželství s nižším socioekonomickým statusem.

To proměnilo mechanismus generování nerovností mezi dětmi narozených do různých rodinných uspořádání. Narostl podíl neprovdaných matek, které mají partnera, a porodní hmotnost dětí těchto matek (která bývá vyšší než porodní hmotnost dětí narozených matkám bez partnera) dominovala celkový trend. Nesezdané soužití se stalo běžným pro páry s individualistickými hodnotami nebo pro ty, které odložily manželství z ekonomických důvodů. Stigmatizace nesezdaných rodin klesla a manželství ztratilo svůj ochranný vliv před ekonomickou nejistotou. To vedlo ke sblížení porodní hmotnosti dětí narozených sezdaným a nesezdaným párům. Přetrvávající znevýhodnění dětí nesezdaných párů není způsobeno nesezdaností samotnou, ale nižším vzděláním jejich matek a tím, že jsou častěji prvorozené (prvorozené děti mívají nižší hmotnost).

Na druhou stranu ale přetrvává velké zdravotní znevýhodnění dětí narozených matkám bez partnera. Toto znevýhodnění je přímo spojené s tímto rodinným uspořádáním a nedá se vysvětlit sociodemografickými charakteristikami matek bez partnera. Sociodemografické charakteristiky, které negativně ovlivňují zdraví novorozenců, se ale velmi často s mateřstvím bez partnera kumulují. Matky, které rodí děti mimo manželství nebo partnerství se typicky rekrutují z málo vzdělaných žen, často jsou velmi nízkého věku nebo mají více než dvě děti. Větší riziko zdravotních komplikací již na samém počátku života je jedním z mnoha faktorů, který omezuje životní šance těchto dětí a přispívá k reprodukci jejich sociálního znevýhodnění. Počet matek, které mají děti mimo stabilní vztah, není velký (10-15%), ale po celé sledované období se zvyšoval. Zdraví jejich dětí by proto měla být věnována zvýšená pozornost.