Early Labour Market Disruption

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Philip Rosenbaum[*]

Abstract: Work interruptions related to birth are expected to affect mothers' wages directly through changes in the formation of human capital. This effect is proposed to be exceptionally strong for young adult childbearing women who are about to start their working careers. This study investigates whether the long-term socioeconomic problems experienced by women with first childbirth before turning 26 are a reflection of pre-existing disadvantages or are a consequence of the childbearing timing? The purpose is furthermore to observe whether a new combination of the best practices of earlier studies on the subject can serve as a better estimation method. This is done by applying a Sister First Difference estimator while using miscarriages as exogenous variation. This exact design has, to my knowledge, never been used before to estimate socio-economic effects of childbearing timing. I find no effects of young adult childbearing on the women's wages.

1. Introduction

Early childbearing is often perceived as a social and an economic problem for both the society and for the mother herself. Having childbirth before turning 26 can have a great impact on the women's working careers. The performances of mothers in the labour market are in general shown to be inferior and the literature suggests that this so-called *mommy-track* is even greater for women having their first childbirth early in their careers.

This study will clarify the causation of why women having their first childbearing in their young adult years have inferior socioeconomic outcomes. This study is conducted on a full longitudinal sample of Danish women who had an early childbearing in the years from 1994 to 1997. The advantage of this data is threefold. First the data are register-based, which makes it possible to involve the entire Danish population and therefore obtain a very large panel. Second, the data includes a large number of demographic, educational, income, labour market and health variables, which allow for great and various controls. The detailed health registers are especially essential for this study, since it is important to distinguish abortions into either miscarriages or induced abortions, in order to acquire a true exogenous variation. Third, the Danish register's historical information is registered with a high degree of reliability. All this makes it possible to make what to my knowledge is the largest study on young adult childbearing women ever conducted.

Young adult childbearing is in this study defined as having the first childbirth before turning 26. Hence, this is not a study on extraordinarily young mothers, but a study on the effects of relatively early

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childbearing on women.[1] This study relates to three different but interconnected branches of the literature; the early childbearing, family-gap and *Scarring*[2] literature.

When is the best time for a woman to get pregnant? Postponing motherhood may reduce the women's overall number of children, since fertility decreases with age. At the same time, there is a predominant belief that early childbearing has a negative impact on the women's educational attainments and diminishes their employment perspectives. Contrary to the common belief, this study finds no evidence that young adult childbearing has a persistent negative effect on women's wages.

I apply a Sister First Difference method on three different Sister-Samples. Each of the three samples is designed in order to shed light on different implications of young adult childbearing. The first Sister-Sample consists of sister-pairs of early and non-young adult childbearing sisters. This sample is assembled to replicate earlier studies and to show whether the same results can be obtained on Danish women. The result obtained on the basis of this sample was that the effect of young adult childbearing on wages is significantly negative in the short run (five years), but insignificant in the long run (ten years).

The Second Sister-Sample consists of young adult childbearing women and their non-young adult childbearing sisters, which have had an abortion at an early age. When using sisters with an early abortion as controls, the effect of early childbearing was very large, implying that the conscious choice of postponing the first childbirth through an abortion separates them from their early childbearing sisters.

The Third Sister-Sample contains women with early childbearing and their non-early childbearing sisters, who suffered a miscarriage at an early age. The effect of early childbearing disappeared when applying a Sister First Difference estimator together with using control sisters who miscarried in an early age.

These results have many implications. First of all, they show that there may remain some unobserved heterogeneity after applying a Sister First Difference method on Sister-Sample 1, implying that there remain systematic differences between the women with young adult childbearing and their sisters. This indicates that results from earlier sister-studies on early childbearing may be biased. The remaining heterogeneity is addressed in Sister-Sample 3, when I use miscarrying sisters as controls.

The main result of this study is therefore that young adult childbearing has no persistent effect on women's wages. I.e. young adult childbearing women's inferior wage outcomes are not due to having a

[1] The distinction of the cut-of age of young adult childbearing are discussed thoroughly in Section 4.1
[2] Scarring refers to the poor work habits developed in periods of labour market disruptions, catalysing persistent labour market detachment and alienation.

child in an early age, but rather due to pre-existing disadvantages in social- and ability factors.

2. Literature Review

Academics face a great challenge in identifying the causal effect of fertility on labour market outcomes, since career and family planning rarely can be separated and often influence one another. This two-way causality is difficult to control for and also seemed to cause bias in some of the earlier cross-sectional (Hofferth 1984) and fixed-effect studies (Taniguchi 1999, Baum 2002).

Women who delay childbirth are experiencing higher wages, which there basically can be two reasons for: 1. The mommy track where childbirth leads to a lower wage rate 2. Reverse causality where early childbearing women essentially would not have performed well at the labour market even without childbearing.

Having an early childbirth can have different effects on the labour market outcome. Just as *Gender Gap* is a notion that describes the discrepancy between male and female wages, *Family Gap* is a notion that describes the discrepancy between mothers and non-mothers wages. The main reason for this is the lower human capital experienced by mothers. Becker's Household Production Theory (1965) implies that the opportunity cost of working increases when getting a child and thus the effort and productivity will decrease at the workplace. This effect has been confirmed repeatedly in empirical studies (Gronau (1974), Bronars & Groggar (1994) and Angrist & Evans (1998)). This effect might be stronger for young adult childbearing women, since they are more likely to live great parts of their lives as single mothers, which might increase the effort needed towards the household and hence decrease the women's productivity (Becker 1985, Hotz *et al.* (1997) and Murphy (2005)).

These disruptions may also have other indirect effects. A drop in the human capital investments - both as a result of disruptions in the education or at the job - are shown to have long term negative effects on the labour market outcome (Gerster et al 2014). This effect is called Scarring and refers to the poor habits developed in periods of labour market disruptions, which catalyse persistent labour market detachment and alienation. (Ellwood (1983), Gartell (2009)). This results in a self-reinforcing spiral of lower employment and therefore slower human capital build-up, ending in inferior career path (Mincer & Ofek (1982), Baum (2002)). Especially young adults face a limited number of entry-level jobs with good advancements possibilities. Those who miss or disrupt good options early in their careers may be locked in unfortunate career paths. Miller (2011) found that motherhood delay in the USA leads to an increase in wages of 3 % per year delay. Support for the mommy-track is also found in Scandinavian in the Swedish study by Light & Ureta (1995), whereas the Danish study by Simonsen & Skipper (2006) only found a small effect on women working in the public sector and no effect on women working in the private sector.

By reversing the causality on the relation of young adult motherhood and adult wages, the timing of the first childbearing can be seen as an indicator of the women's endowed human capital and not a consequence of the time and effort motherhood cost. If there is a reverse causality, then the timing of the first childbirth might be an economic indicator for the woman's productivity and her preference towards a working career.[3] I.e. their price of time is lower than for high-productive women, which is what Gronau (1974) called the shadow-prices of early childbearing. On the contrary, it has been argued that young adult childbearing can help women in maturing and getting well structured, which can lead to better performances in school and on the labour-market (Hotz *et al.* (1997)).

These theories give reasons to believe that young adult mothers can have substantial short- and long-term difficulties on the labour market.

The remainder of this paper is organized as follows. The next Section explains the econometric issues and the econometrics strategy of this study. Section 4 outlines the data used in this study. In Section 5, the various results and robustness checks are presented. Finally, Section 6 concludes. The online Appendix contains further descriptive statistics and some extensive data analysis.

3. Empirical Approach

My empirical strategy is an extension of the methods originally used in the young mother empirical literature and it is specifically designed to elicit the true effects of having a child as a young adult.

There have been two main approaches designed in order to cope with the family heterogeneity and the individual unobserved heterogeneity respectively.[4] The first approach designed to account for family heterogeneity is the within-family estimates. I.e. comparing sisters where one gave birth in her youth while the other did not. The idea is that the remaining differences between the sisters' socioeconomic outcomes primarily will be due to the difference in their age at first childbirth. Geronimus & Korenman (1992) were first to use this idea, but many have reused this method since then (Hoffman et al. (1993), Rosenzweig and Wolpin (1995) and Holmlund (2004)).

The second approach is to exploit exogenous variations or institutional changes in order to account for individual unobserved heterogeneity. The most relevant for this study was originally conducted by Hotz et al. (1997) & (2005), who studied teenage pregnancies, while Miller (2011) studied effects of

[3] Of cause childbirth cannot be planed to the minute, but on average it is possible to time the childbirth in accordance to the women's career plan.

[4] There have been used other identification strategies, which are less relevant for this study, and arguably less precise. E.g. Matching method (Simonen & Skipper 2006),

motherhood timing on career paths, both using miscarriages as an instrument. They looked at early childbearing mothers and compared them with other women who conceived at the same age but underwent a miscarriage and therefore postponed childbearing.

I will estimate the effect of young adult childbearing on the women's yearly wage, by applying a within-family method on three different Sister-Samples of Danish women. The idea is to apply a combination of the two econometric approaches described above. The within-family approach will cope with the unobserved family heterogeneity and conditioning the control sisters – the sisters of the young adult mothers – on having had an abortion or a miscarriage in as a young adult, should work as exogenous variation ensuring a random assignment of the sisters to the control and treatment group. Furthermore, I control for the women's general health history. All together this novel method will remove the biases that otherwise could have poisoned the results.

Next, I will explain the regression strategy followed by an introduction to my sample selection strategy.

3.1 Sister First Differences as a Mean of Removing Bias

Being able to collect information about individuals and their families allows me to organize the dataset in a panel structure. The panel consist of two sisters per family. The sisters have family invariant variables as well as family variant variables.

One way to deal with unobserved heterogeneity is by applying a sister first difference model. Its differencing transformation has a very pleasing application in this situation. I withdraw the sister values from each other:

$$\boldsymbol{y}_{1j} = \gamma YM_{1j} + \beta_1 \boldsymbol{X}_{1j} + \beta_2 \boldsymbol{F}_j + a_j + \mu_{1j} \tag{1}$$

$$\boldsymbol{y}_{2j} = \gamma YM_{2j} + \beta_1 \boldsymbol{X}_{2j} + \beta_2 \boldsymbol{F}_j + a_j + \mu_{2j} \tag{2}$$

Where $\boldsymbol{YM}_{ij}$ is a dummy indicating young adult childbearing, $\boldsymbol{X}_{ij}$ is the family and individual variant variables - such as the woman's age, number of diagnosis, $\boldsymbol{F}_j$ is the family invariant variables – such as region of residence in adolescence, immigration status, parents' education. Let α_j be the unobserved family heterogeneity variable. Unobserved heterogeneity is the same for all members of the same family- e.g. parental involvement.[5] If α_j is ignored and it is correlated with the other explanatory variables, the OLS estimates are bound to be biased. μ_{ij} is the new idiosyncratic error term that meets the Gauss-Markov assumptions.

Only the difference between the sisters will remain after withdrawing y_2 from y_1:

$$\Delta \boldsymbol{y}_j = \gamma \Delta YM_j + \beta_1 \Delta \boldsymbol{X}_j + \Delta \mu_j \tag{3}$$

Equation (3) is the reduced model, where; $\boldsymbol{y}_j = y_{1j} - y_{2j}$, $\Delta YM_j = YM_{1j} - YM_{2j}$, $\Delta \boldsymbol{X}_j = X_{1j} - X_{2j}$, and $\Delta \mu_j = \mu_{1j} - \mu_{2j}$. This transformation removes all the family invariant variables - both the

[5] Some studies have proposed that parental involvement differs between their children. Hence the parents are more involved in their first born life than in the rest of their children. This phenomenon will be discussed further later.

observable, **F**, and the unobservable, α.[6] All of the unobserved heterogeneity will be removed if it only consists of the sisters' shared environment. The least squares estimator for (4) is called the first difference estimator.[7]

3.1.1 Systematic Between Sister Variation

Using sisters may provide a good way of accounting for unobserved family background characteristics, but heterogeneity certainly also exist within families. Siblings may vary in unobservable factors. Such as their endowments or in the extent and fashion in which their parents invest in the sisters. There are surprisingly few economic studies, which examine the between-siblings birth-order effect on adult economic outcomes and the results of these studies are inconsistent, e.g. Berhman & Taubman (1986), Ejrnæs & Portner (2004) and Black (2005). On the other hand, there are many psychological and anthropological studies that show that there are big differences in the adult outcomes between siblings with different birth-order. E.g. the seminal work of Sulloway (1996), Price (2008) and Ladner (1971).

3.1.2 Avoiding Reverse Causality

Even after removing the family-invariant variables, it is still important to choose the explanatory variables carefully in order to avoid endogeneity problems. Generally, explanatory variables that are influenced by early childbearing can cause problems. For instance, wages are correlated with the educational levels, while the obtained educational level is influenced by the women's age of first childbirth. This circular causality must be avoided even though there are some relevant post-birth explanatory variables. Discarding these variables is not a problem, since the focus of this study is to estimate women's labour market outcome as a result of early childbearing, rather than a result of their experience or educational obtainment.

3.2 Sample Selection

It is commonly known that randomized experiments have major advantages on observational studies in making causal inferences. Randomization of subjects to different treatment conditions ensures that the treatment groups, on average, are identical with respect to all possible characteristics, regardless whether these characteristics are observable or not – or even measurable or not. Therefore the Gauss-Markov conditions will automatically be fulfilled, hence leading to unbiased, consistent and efficient estimates.

Performing a randomized experiment to observe the pure effect of young adult childbearing on women's adult wages is not possible and would be quite unethical since experimenting with pregnancies

[6] Notice that the intercept does not appear in this model, because it also is removed through the transformation.

[7] The same estimates can be obtained by using a Fixed Effect model because their only are two sisters per family. If more sisters were included the Fixed Effect model will be preferable

are comprehensive and life changing experiments. I excavate the information in the highly detailed data available on Danish individuals, by using miscarriages as exogenous variation, so that the only systematic differences between the control group and the women with early childbearing are decided by the exogenous random event. Hence, the exogenous variation will remove the danger of systematically distributed and influencing unobserved variables.

As described, the control groups in this study consist of three Sister-Samples. The control sisters in all three Sister-Samples have not had childbirth as a young adult, where the sisters in the second sample had an abortion and in the third sample had a miscarriage as a young adult. Of course, these control groups will never be as good as a control group achieved through a randomized experiment, but have the advantages explained in more details in the following sections.

3.2.1 Designing the Sister-Samples

Young adult childbearing women are not randomly selected. One cannot claim that young adult childbearing is an exogenous event, implying that the event of getting a child in an early age is highly correlated with other life choices that influence socioeconomic variables. This evidently leads to selection bias problems. Whether the sample women resemble the general population on a various observable variables will be investigated below. As a comparison, I use sisters who had an abortion as young adults as controls.

To deal with the selection bias and the unobserved heterogeneity the regression studies are performed on three different and carefully selected samples. All the samples consist of sister-pairs where one sister had an young adult childbearing - before turning 26 - and other sister did not. This is also the only restriction on Sister-Sample 1. In Sister-Sample 2 the non-early childbearing sisters are further restricted by having had an induced abortion before turning 26. In Sister-Sample 3 the non-early childbearing sisters are restricted by having had a miscarriage before turning 26. The sister-pair is placed in Sister-Sample 2 if the non-early childbearing sister had both an early abortion and a miscarriage in a young age. A discussion of the definition of young mothers will follow in Section 4 *Data*.

The selection of sister pairs forms a balanced panel structure from which it is possible to conduct the sister first difference model, as described above, and therefore remove the unobserved family variables. But as already mentioned, there might be large differences between the sisters who chose to get a child as a young adult compared to those who did not.

As a consequence of the possibility of systematic sister differences, the Sister-Sample 2 and 3 are assembled. The specific selection of Sister-Sample 2 and 3 are made to remove some of the unobserved heterogeneity, which probably still remains in the model even after the Sister First Difference transformation. Differentiating between abortions - as a conscious termination of pregnancies – and miscarriages – as a random termination of pregnancies – can have interesting suggestions.

Sister-Sample 2: The selection effect of Sister-Sample 2 is predictively ambiguous. One factor is that both sisters became pregnant as a young adult. This indicates some kind of shared lifestyle between the two of them. On the other hand, the conscious choice of getting an abortion may indicate a discrepancy in the sisters' life planning. The choice of postponing childbearing at an early age may indicate that the woman evaluates and prefers differently than her sister with young adult childbearing. This could be in terms of educational ambitions, career planning and economical responsibility. The question is which of these two opposing factors is the dominant? Or are any of these two factors even present? Is it a bigger lifestyle indicator to get pregnant in an early age than it is to choose to terminate the pregnancy?

Sister-Sample 3: The selection effect of Sister-Sample 3 is relatively one-sided, since miscarriages are not a result of a conscious decision the distribution of miscarriage occurrences can be seen as random. Meaning the miscarriages does not indicate any life planning differences between the sisters. By looking at miscarriages in this light, it might just be random which of the two sisters actually got a child, since both of them were pregnant with no intention of terminating the pregnancy. Because of this randomness in the pregnancy outcomes many of the selection problems disappear since the unobserved variables no longer can be systematically unevenly distributed and create unbiased estimates. But is it that simple, and is miscarriages a perfect exogenous variation?

Unsuitably, doubts on the randomness of miscarriages exist and are probably reasonable. Where the selection of Sister-Sample 2 tends to homogenise the women through their shared lifestyle at the time of pregnancy, the selection of Sister-Sample 3 may in fact do the opposite. This is so if miscarriages are not completely random. Ashcraft, Fernandez-Val & Lang (2013) and Fletcher & Wolfe (2009) found that even if miscarriages are biologically random they are not socially random, so that women who miscarry are women from more disadvantaged backgrounds. The within-family transformation will cope with this predictable bias.

One could suspect that women with inferior general health and unhealthy lifestyle during the pregnancy miscarry more frequently. It might be that miscarriages are unconscious occurrences but indirectly induced by the women's behaviour, which also influences the labour market outcomes and therefore will be problematic. It is generally perceived that people with health problems generally perform worse at the labour market and if the women who miscarry generally experience health problems, it will be difficult to distinguish whether the labour market performance is due to women's miscarriages or their poor health conditions (Smith (2009)). It is therefore of great importance to incorporate a health variable that captures the systematic health deviation between the sisters. The way this is done is described in Section 4 *Data*, while the importance of controlling for health is tested in Section 5 *Results*.

Finally, the experience of having miscarriages can be very traumatising. It can initiate a series of mental illnesses and therefore longer periods of absence from the labour market. Unfortunately, I was not allowed to use and specify psychiatric diagnoses, since this information is very sensitive to public exposure.

If health problems are properly incorporated and there exist no other systematic differences between the sisters, the Within-Family method on Sister-Sample 3 will be suitable for examining the effect of early childbearing. The exogenous variation and the sister first difference will satisfy the conditions - described above – that are needed to obtain an unbiased and consistent estimator.

3.3 The Amenability to Generalization: Global or local treatment effect?

The disadvantages of the extensive process of homogenizing the sister pairs will now be discussed. Hopefully the sample selection process has been so effective that the only systematically difference that remains between the sisters is the timing of their first birth. This is done by restricting the sample, cutting off the unneeded and focusing on the few specific women who look alike. This rather harsh selection comes at a cost. The question is, have the modified samples moved too far away from the general population during this process? Are the women and families so moulded and specified for this specific task and are they very different from the average family? If this is so, it could be that the estimates obtained on the basis of the Sister-Samples, are only local treatment effects, suggesting that the estimates only apply for the specific selected women of this study and not necessarily for the entire population of young adult mothers. It is likely that families where at least two sisters have been pregnant in an early age, and where at least one of them got the child, are not similar to families with fewer coincidences of early pregnancies. Again the more incidences of early pregnancies within a family the less resourceful the family presumably is, Murphy (2005), and the more incidences of early pregnancies within a family the higher the probability for the family to be in Sister-Sample 2 and 3 since every sister is a potential young mother. Hence, the families in Sister-Sample 2 and 3 will on average be bigger.

In Section 4 *Data*, several descriptive statistics are conducted which can indicate whether the women of the Sister-Samples resemble the general population of young adult childbearing women. This could indicate whether the regression results presented in Section 5 are local or global and several tests are therefore conducted to trial the robustness of the results.

4 Data

The empirical analysis is made on data from the Danish Registers Data, using the full Danish population pf early childbearing women over the years from 1994 to 2010. I use four cohorts for the analysis, namely from 1994 to 1997. Cohorts are in this case defined as the years where the women give birth to their first child. The advantage of limiting the number of cohorts is that the institutional and economic conditions are more stable within a shorter period.

By imposing additional restrictions on the women so that they meet the selection criteria of this analysis, the sample sets shrink considerably. Starting out with almost 2.8 million women in the raw data and ending up with fewer than 2 thousand women in the most restricted Sister-Sample 3. One of the advantages of the Danish Register data is that it contains very detailed information on the full Danish population of early childbearing women. Again it must be stated that these restrictions put upon the samples are very strong and thus naturally limit the number of observations that fulfil the criteria. In Table 4.1 it is shown how the observation numbers available decrease from raw data to the Sister-Samples.

Table 4.1 – Number of Observation across the Sisters-Samples

Raw Data		**Acronoym**	**Obs.**
All Women			2,791,452
All Women with at least one sister			1,781,191
Sisterpairs- at least one have given birth			557,735
Samples			
Sister-Sample 1 (SS1)	Young Adult Mothers	1YM	12,604
	Not Young Adult Mother	1NYM	12,604
Sister-Sample 2 (SS2)	Young Adult Mothers	2YM	1,054
	Not Young Adult Mother	2NYM	1,054
Sister-Sample 3 (SS3)	Young Adult Mothers	3YM	384
	Not Young Adult Mother	3NYM	384
Generel Population	All women from the cohorts of 1972/73	POP	68,199
Other Young Adult mothers	Young Adult Mothers with first birth between 1994-1997 who are not in group 1,2 or 3	OYM	29,823

The Sister-Sample sizes are extraordinary large compared to the other studies conducted on early childbearing using a within-family methods or IV-estimation methods based on miscarriages.[8] For the rest of the paper I will use acronyms labelled in Table 4.1 for the different groups of women used in this study.

4.1 Young Adults

The years from 18 to 25 can be very important and it is in these years many set the foundation of their adult life. The career path is decided partly through the education choice and partly through the metier of the first job. These choices are very decisive and the success – or lack of it – can have long lasting consequences.

[8] Geronimus & Korenman (1992) used three different panel data sets, which respectively contained 129, 182 and 223 sister pairs. Hotz *et al.* (2005) had 1.042 women with an early pregnancy, but only 72 of these pregnancies ended in miscarriage.

Denmark is different from the Anglophone countries in various ways. Being 25 and a mother put you in the younger end of first time childbearing in Denmark. Whereas UK and USA have the highest proportion of teenage-mothers among the western countries, Denmark has one of the lowest. In general, Danish women have children much later in life and Denmark has almost none teenage birth compared to British and American women, which may be a consequent of the difference in the society and demographics in general (Murphy (2005), Goodman *et al.* (2004) and Christoffersen (2003)). In 1995, the Danish teenage birth rate was 0.0083 while it was 0.0284 and 0.0544 in England/Wales and USA respectively (Sedgh et al. 2014). Given the size of Denmark and the sample restriction given in Section 3, there are too few teenage mothers to conduct a thorough empirical study.

In the mid- 90s, the proportion of Danish women with first childbirth before turning 26 was almost identical to the proportion of American women with first childbirth before turning 20 (National Vital Service).[9] Childbearing during the education can be an obstacle and may lead to lower educational attainment and therefore also lower adult wages. The Danish population is graduating at a relatively high age. Table 4.2 shows that while the majority of the United Kingdom women graduated in their first twenties the majority of the Danish women graduated in their late twenties. In Table 4.3 the age of entry on the different tertiary education are specified, showing that the average age when entering most tertiary education is on average higher than 26, except for Bachelor educations. Having childbirth before turning 26 might therefore have significant influence on the women's educational outcome.

Table 4.2 –Age Distribution of Graduating First Stage of Tertiary Education in 1998 (Females)

Age	Before 24	25-29	30-34	35-39	40 or over
Denmark	18	51	15	7	8
United Kingdom	66	10	7	7	11

Source: Eurostat

Table 4.3 – Average Age at Entering Different Tertiary Education in 1998 (Whole Population)

	Short	Medium	B.Sc.	M.Sc.	PhD
Average age	26.2	26.8	23.4	27.7	31.1

Source: The Danish Ministry of Education (2000)

Previous Scandinavian studies have also defined young adult mothers as having a child before the age of 26. To name a few Danish; Højberg (2010), Duus (2007), Jørgensen *et al.* (2013) and the Swedish study by Olausson *et al.* (2011)[10] etc. Furthermore, the major private aid organisation for Danish mothers, Mothers Aid,[11] uses 30 as the upper benchmark for young mothers.[12] Even the government's policies for young mothers include women up till the age of 30 years old.

[9] See the American development of age at first birth in figure A.C.1 Appendix C

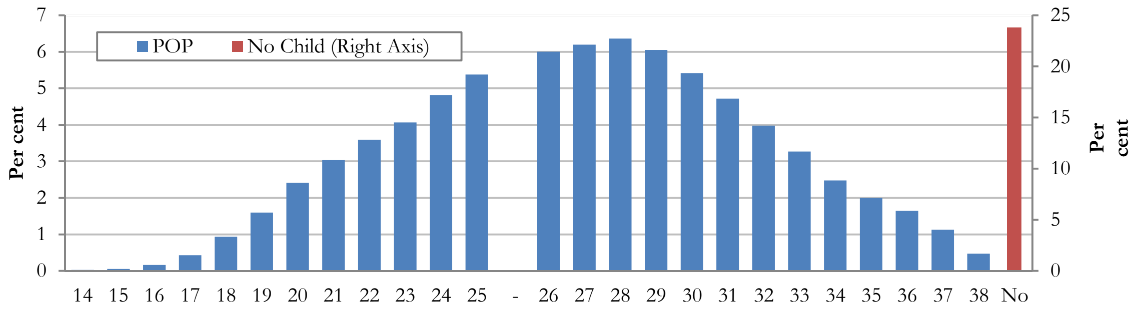
[10] Since Sweden to a large extent share the welfare state and demography of Denmark, it is relevant in this case

[11] In Danish = Mødrehjælpen

[12] See for example The Annual Report 2013 of Mothers Aid

Figure 4.1 shows the distribution of the age at first childbirth in Denmark. The two cohorts are chosen because the average women in my samples are born in 1972/1973. Within these two cohorts 26.5 per cent are young adult mothers by the given definition.

Figure 4.1- Age at First Childbirth, Average of Women Born in 1972 and 1973



Source: Own calculations based on data from Statistics Denmark

4.2 Abortions and Miscarriages

Being able to distinguish between intended and unintended abortions (respectively abortions and miscarriages) is very important for this study. Every time a person is in contact with the Danish Secondary Health Care it is recorded in the Danish National Patient Register. All of the diagnoses are reported in the International Classification of Diseases (ICD) system. Firstly, all pregnancies with abortive outcomes where investigated, both intended and not intended abortion. These diagnoses have the classification from O00 to O08. Every diagnosis is divided into being either an abortion, a miscarriage or unspecified. The unspecified diagnoses are left out of this study. On top of this are pseudo-miscarriages - such as stillborn babies and infant deaths - used as miscarriages since these are pregnancies where the women intended to have the baby, but did not.[13] [14]

4.3 Base year

A "base year"-variable, *event*, is designed to homogenise the timing of measurement of the women's outcome variables. This definition is important since there are differences between the sisters' age and because it takes a few years for the women's work-life to stabilize after giving birth. In the regression analyses all outcome variables will be measured at *event* + *t*. It is fair to measure the women's outcomes at this point since the women, who are compared, by and large, will be in the same stage in their lives. For 1YM and 1NYM the year of the event is the year where 1YM had their first childbirth. As shown in Table 4.6 the age distribution between the sisters in Sister-Sample 1 is rather symmetric and since

[13] Of course the experience of losing a newborn infant is not the same as the experience of an early miscarriage. The emotional costs of losing a newborn will be larger than that of an early miscarriage. If it is assumed that these emotional costs will depreciate over time, then the effect of losing a new-born and early miscarriage will be the same for this study, since the focus is whether having or not having an early childbearing effects women's adult work-life.

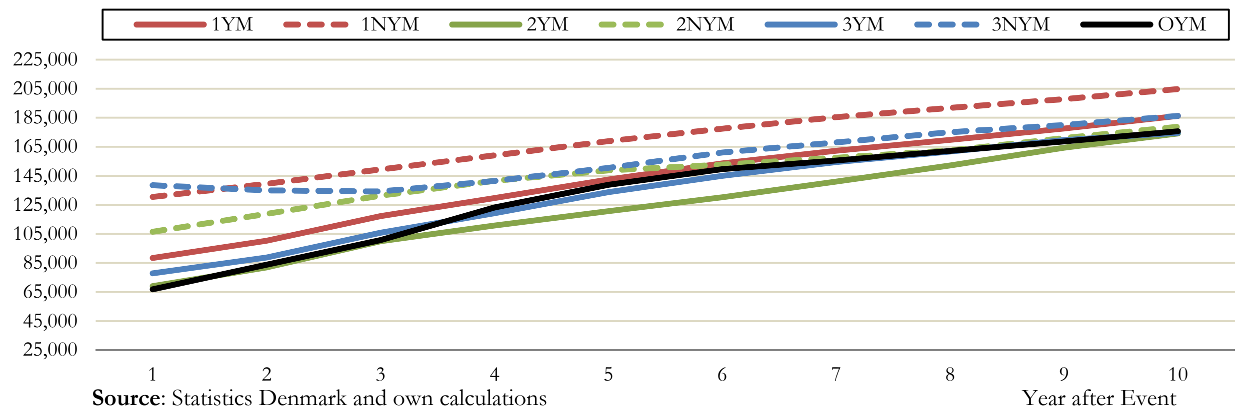
[14] The exact classifications, number of abortions, miscarriages and diagnoses over the years are respectively shown in the internet appendix A.C.3, A.C.4, A.C.5, and A.C.6.

1NYM does not have any seminal event, which could be used as a base year, it seems fair to use the 1YM event as the base year for both sisters. The year of event for Sister-Sample 2 and 3 is defined a little differently. For 2YM it is the year of their first birth, whereas the base year for 2NYM is the year of their first abortion. The same applies for Sister-Sample 3 where 3YM's year of event is the year of their first birth and year of event for 3NYM is the year of their first miscarriage. E.g. if a woman from 3YM delivered her first child in 1995 and her sister from 3NYM had her first miscarriage in 1997, and the Log(wage) is measured in $event_{t+5}$, the 3YM's Log(wage) is measured in 2000 and the 3NYM's Log(wage) in 2002.

4.4 Dependent Variables

In this section the descriptive statistics will be presented. The presentation is initiated with the women's real wages since this is the main outcome variable of this analyses. Figure 4.1 gives a simple overview of the women's wage development over time. The two primary objectives are whether the Sister-Samples resemble the OYM and whether there is a difference between the sisters within each Sister-Sample. The women in POP and 1NYM earn the highest wages on average over the years. 1YM lies below 1NYM but is still above the average of women in the Sister-Samples 2 and 3. 2YM and 3YM earn slightly higher wages than 2NYM and 3NYM respectively. Furthermore, the young adult mothers earn less than their sisters on average, which suggest that they are less productive and doing worse on the labour-market. In general the OYM's average wages fluctuate around the young adult mothers of the Sister-Samples, which suggest that the young mothers in the Sister-Samples resemble the general population of young adult mothers. The standard deviations of the wages are generally quite large, which is because of the large spread in the wages due to the relatively many zero-wages. This is shown in the summary statistics in Table 4.6.

Figure 4.1 – Real Wages



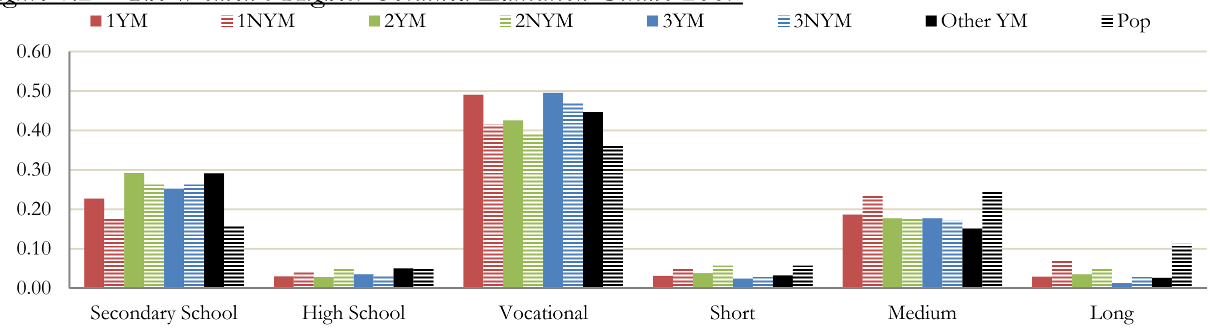
Source: Statistics Denmark and own calculations

Note: 3-year moving average, base year 2009

The differences in the sisters' personal income are quite different from the differences in the sister's wages, which is due to the public transfers that are included in the personal incomes. Table 4.7 shows that the personal income (Log[income]) is higher for the young adult mothers than for their sisters. The public sector actually compensates the young adult mothers so that their personal income exceeds their non-early childbearing sisters. This is true for all the three Sister-Samples in both 5 and 10 years after the event.[15] Because there are very few women with zero personal incomes the standard deviations are much lower than the standard deviations of the women's wages. The OYM personal incomes are at the same level as the incomes of the young mothers in Sister-Samples.

Figure 4.2 shows the women's highest obtained educational level ultimo 2009, where the majority of the women are done with their education.[16] Once again 1YM and POP perform the best and have the highest level of education on average. The average of the women's total years of schooling is shown in Table 4.6. There are no detrimental differences between and within the three Sister-Samples, but there are fewer young adult mothers with further higher education.

Figure 4.2 – The Women's Highest Obtained Education Ultimo 2009



Source: Statistics Denmark and own calculations

4.4 Independent Variables

One of the important controls is the women's number of diagnoses. Table 4.4 shows the women's average number of diagnoses per anno. The Sister-Sample 1, OYM and POP have the lowest number of diagnoses (with no significant difference between the samples).[17] The women in Sister-Sample 2 have in general many diagnoses, while 3NYM stands out by having significantly the most diagnoses. Smith (2009) found that poor childhood health has a quantitatively large effect on the adult household wealth, individual earnings and labour supply, but not on educational obtainment. Table 4.5 shows the Pearson Correlation Coefficient between the health variable and 2NYM and 3NYM. It shows that there is a significant correlation between having an early miscarriage and the number of diagnoses, while there is no correlation between having an early abortion and the number of diagnoses. This confirms the suspicion that miscarriages are not completely random and is therefore important to

[15] Figure A.D.1 shows the development in the women's personal income over the years, equivalent to Figure 4.1

[16] The share of women still in education in 2009: 1YM=0.014, 1NYM=0.008, 2YM=0.026, 2NYM=0.014, 3YM=0.013, 3NYM=0.008 and OYM=0.01

[17] There are performed Welch t-tests on the difference in diagnoses between all the samples and within the three Sister-Samples. Test results can be found in the Table A.B.2 *Appendix*

control for. Hence, if health measures are neglected the estimated effect of having an young adult childbearing in Sister-Sample 3 (the 3YM) could very well be upward biased.

Table 4.4 – Number of Diagnoses per anno

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3		OYM	POP
	1YM	**1NYM**	**2YM**	**2NYM**	**3YM**	**3NYM**		
Diagnoses per year	0.45	0.31	0.51	0.54	0.43	0.61	0.48	0.46
Std. Dev.	(0.34)	(0.32)	(0.35)	(0.49)	(0.31)	(0.54)	(0.34)	(0.35)

Note: Diagnoses regarding pregnancies, pregnancy-preparations and psychiatric conditions are excluded
Source: Statistics Denmark and own calculations

Table 4.5 – The Pearson Correlation Coefficient between diagnoses and the events of abortion and miscarriages

	Sister-Sample 2 2 NYM	Sister-Sample 3 3 NYM
Diagnoses	-0.001	0.199***

Student T-test of zero correlation, *** Non-zero correlation on a 1 % significant level

Another important control is the women's birth orders. There can be various reasons for the existence of a birth-order effect, which were already discussed in Section 3 *Econometric Approach*. If the birth-order has any impact on the women's labour market performances, then it is important to control for in order to get unbiased estimates on Sister-Sample 2 and 3. As Table 4.6 shows, 2YM and 3YM are generally placed a bit earlier in the birth-order.

The parents' income level during the women's adolescence together with the parents' educational level is a good indicator of the social class of the women's families. The parents' educational levels are depicted in table A.C.1 in the *Appendix*. The lowest parental incomes and educational levels are from Sister-Sample 3, which again indicates that the families from Sister-Sample 3 on average are socioeconomically inferior to the other samples' families. On the other hand, there are no significant differences between the parents' educational levels between OYM and Sister-Sample 3.[18]

Table 4.6 – Summary Statistics (Mean Values)

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3		OYM
	1NYM	1YM	2NYM	2YM	3NYM	3YM	-
Birth-Order	2.03	2.14	2.60	1.80	2.52	1.84	2.02
Std.Dev.	(1.03)	(2.77)	(1.08)	(0.89)	(1.17)	(1.08)	(1.01)
Age_2010	38.16	37.65	35.79	36.73	35.53	36.42	36.93
Std.Dev.	(5.77)	(2.77)	(3.53)	(2.40)	(3.82)	(2.21)	(2.44)
Log(Income_M)	11.73	11.73	11.90	11.81	11.79	11.73	11.77
Std.Dev.	(0.87)	(0.82)	(0.57)	(0.65)	(0.66)	(0.66)	(0.79)
Log(Income_F)	12.45	12.44	12.40	12.39	12.34	12.35	12.39
Std.Dev.	(0.44)	(0.45)	(0.55)	(0.55)	(0.64)	(0.64)	(0.44)
Siblings	2.70	2.70	3.24	3.24	3.51	3.51	1.91
Std.Dev.	(1.64)	(1.64)	(1.72)	(1.72)	(1.57)	(1.57)	(1.47)
Years of Edu	13.37	13.10	13.38	13.26	12.99	12.91	12.97
Std.Dev.	(1.76)	(1.58)	(1.65)	(1.59)	(1.44)	(1.41)	(0.94)
Log(Wage $_{t+5}$)	10.85	10.18	10.80	9.68	10.58	10.06	10.10
Std.Dev.	(2.99)	(3.76)	(2.94)	(4.13)	(3.33)	(3.79)	(3.20)
Log(Wage $_{t+10}$)	11.07	10.67	10.74	10.33	10.51	10.33	10.34
Std.Dev.	(3.26)	(3.71)	(3.52)	(4.00)	(3.97)	(4.04)	(4.02)

[18] Significant test and table of the parental years of education are shown in Table A.B.4 in the *Appendix*

Log(Income $_{t+5}$)	12.10	12.30	12.08	12.27	12.26	12.30	12.25
Std.Dev.	(0.92)	(0.47)	(0.61)	(0.62)	(0.38)	(0.32)	(0.40)
Log(Income $_{t+10}$)	12.37	12.45	12.25	12.42	12.34	12.44	12.40
Std.Dev.	(0.78)	(0.52)	(1.13)	(0.54)	(1.09)	(0.27)	(0.31)
Immigrant	0.04	0.04	0.07	0.07	0.06	0.06	0.25
Std.Dev.	(0.19)	(0.19)	(0.25)	(0.25)	(0.24)	(0.24)	(0.44)

Source: Statistics Denmark and own calculations **Note:** Immigrant consists of both first and second generation immigrants

5 Results

The main outcome variable is the logarithm of the women's yearly wage. As mentioned earlier, it takes some years for the women's work life to balance after her childbirth.[19] The main results are therefore based on the wages five and ten years after the event,[20] although there will also be a presentation of the estimates for the effect of early childbearing on the women's wages throughout the first ten years after the event. The two central regressions have the following form:

OLS- Regression 1:

$$Log(Wage)_{ijt} = \beta_0 + \gamma YM_{ij} + \beta_2 Age2010_{ij} + \beta_3 Log(IncomeF)_{ij} + \beta_4 Log(IncomeM)_{ij} + \beta_5 Diagnoses_{ij} + \beta_6 BirthOrd_{ij} + \delta_1 Siblings_j + \delta_2 Immigrant_j + \delta_3 Region_{ij} + \delta_4 Stable_j + \varepsilon_{ij}$$

FD- Regression 2:

$$\Delta Log(Wage)_{jt} = \gamma \Delta YM_j + \beta_2 \Delta Age2010_j + \beta_3 \Delta Log(IncomeF)_j + \beta_4 \Delta Log(IncomeM)_j + \beta_5 \Delta Diagnoses_j + \beta_6 \Delta BirthOrd_j + \Delta u_j$$

The wage and income variables are all in real terms with 2009 as base-year. All OLS-estimates are run with heteroscedasticity robust standard errors to ensure homoscedasticity. *YM* is the young adult mother dummy, A*ge2010* is the age of the woman in 2010, *IncomeF/M* are respectively the fathers' and mothers' income level during the women's adolescence, *Diagnoses* is the average number of diagnoses per anno excluding diagnosis due to pregnancies, *BirthOrd* is the woman's birth order, *Siblings* is the woman's number of siblings, *Immigrant* is a dummy indicating whether the woman or the woman's parents are born in Denmark, *Region* is a categorical variable indicating the woman's region of adolescence, ε is the OLS error term and u is the FD error term. Lastly, the variable, *stable,* is constructed with the following property: if the woman's parents lived together throughout her entire childhood and she only has siblings with the same mother and father (or is an only child), the family dummy indicates that the women's family is stable.

Since the regression has a log-level functional form, the coefficient estimates are to be interpreted as semi-elasticities, meaning that the coefficients have an interpretation of a percentage change in the wage when the explanatory variable changes by one unit. There are however two explanatory variables which

[19] Danish women are entitled to 18 weeks of paid maternity leave, but also have the option to take as much as 46 weeks ("Offentlighedsportalen" – The Ministry of Justice)

[20] To recap; is the event defined as the year of childbirth for 1YM, 1NYM, 2YM, 2YM, while it is the year of abortion and miscarriage for 2NYM and 3NYM respectively.

are also given in logarithm, namely the parental income variables, which means that their coefficients are full elasticities.

5.1 The Primarily Result – The Effect of Early Childbearing

5.1.1 Differences between the OLS and the First Difference Methods

As discussed in Section 3 *Econometric Method*, the OLS-method may create biased estimates, thereby overvaluing the negative effect of young adult childbearing. The bias is a result of the unobserved family heterogeneity, which is presumably removed when applying a Within Family estimation method.

In Table 5.1 the results of the OLS and the First Difference methods are shown in pairs across the samples. What catches the eye is the relatively large difference in the coefficients between the samples. These differences will be discussed in the next section. On the other hand, the coefficients between the two estimation methods within the samples are not very different. Even though the differences in the estimates of the two methods are small, they are significantly different in Sister-Sample 2 and 3.[21] This implies that much of the women's family background variations are already captured in the OLS regression. It is interesting that the differences are so small, since other studies found rather big differences when comparing the OLS estimates with the Within Family estimates.[22] There are two possible reasons why the estimates do not vary as much as previously seen. One reason is that many detailed family-variables are used in the OLS-regression, variables such as parental income, family size,[23] immigration status and the stability of the family. These variables may capture most parts of the variation that stems from the family backgrounds. The other reason is that families within the three Sister-Samples may be very similar, implying that it is the same type of family where one sister had a young adult childbearing while the other had no young adult childbearing but either had an early abortion or an early miscarriage. As seen in the descriptive statistic Table 4.6 this could very well be the case.[24] If this is so, there might not remain considerable systematic unobserved differences between the intra-sample families; hence removing the remaining little unobserved through a Within Estimator will not have any significant impact and therefore no considerable differences will be observed between the OLS and the FD estimates.

Table 5.1 – Regression Estimates Five Years after the Event

	Sister-Sample 1		**Sister-Sample 2**		**Sister-Sample 3**	
	Log(wage)		Log(wage)		Log(wage)	
	OLS	FD	OLS	FD	OLS	FD
YM	-0.337***	-0.333***	-1.157***	-1.022***	-0.121	-0.012

[21] A Welch T-test is used to test whether there are any differences between the OLS and FD estimates within the samples. The test results are to be found in Table A.B.6 in the *Appendix*

[22] E.g. Geronimus & Korenman (1992), Hotz *et al* (2005) etc.

[23] Through the number of sisters

[24] For further comparison between the families of the sister samples see Appendix A.C.3 – A.C.7

	(0.048)	(0.049)	(0.209)	(0.247)	(0.293)	(0.455)
Age	0.079***	0.074***	0.207***	0.139*	0.336***	0.301*
	(0.006)	(0.024)	(0.034)	(0.081)	(0.069)	(0.165)
Siblings	-0.272***		-0.172***		-0.396***	
	(0.023)		(0.064)		(0.120)	
Log(Income_mother)	0.199***	-0.022	0.310***	0.129	0.147	-0.391
	(0.030)	(0.111)	(0.102)	(0.772)	(0.191)	(1.490)
Log(Income_father)	0.624***	0.371*	0.446**	0.130	0.373*	0.630
	(0.051)	(0.218)	(0.158)	(0.768)	(0.213)	(1.530)
Immigrant	-1.234***		-1.552***		-1.937***	
	(0.139)		(0.378)		(0.684)	
Diagnoses	-1.234***	-1.468***	-1.018***	-0.726**	-1.935***	-0.629**
	(0.073)	(0.110)	(0.215)	(0.310)	(0.379)	(0.361)
Stable Family	0.159***		-0.277		-0.606*	
	(0.066)		(0.206)		(0.364)	
Birth Order	0.115***	0.184**	0.162*	0.060	0.330**	0.579
	(0.027)	(0.075)	(0.096)	(0.266)	(0.150)	(0.442)
Constant	-1.630**	-	-5.113*	-	-7.570	-
	(0.766)		(2.752)		(4.631)	
Time_dummies	Yes	Yes	Yes	Yes	Yes	Yes
Individual Observation	22,634	22,634	1,942	1,942	702	702
Family Observation		11,317		971		31.91
R^2	0.1112	0.0576	0.1364	0.0718	0.2115	0.0911

Significant levels: 10% (*), 5% (**), 1% (***), **Note**: Heteroscedaticity robust std. err. in the parenthesis
Source: Statistics Denmark

5.1.2 Difference between the Samples

As discussed earlier, the unobserved heterogeneity stems not only from unobserved family variation, but it can also stem from unobserved individual variation, where sisters within the families differ in a systematic unobserved manner. This type of heterogeneity has been addressed partly through the design of the models, which includes the control variables *Diagnoses, Birth-Order* and *Age*. Just as importantly, the Sister-Samples 2 and 3 are selected in order to deal with the unobserved individual heterogeneity.

One of the important results shown in Table 5.1 is that the estimated effect of young adult childbearing is quite different across the three samples. This can indicate big dissimilarities in the between sister differences over the three samples. Hence, I evaluate the estimates with the sample differences in mind. The discussion in Section 3 *Econometric Approach*, proposed what the inter-sample differences between the sisters could consist of.

In Sister-Sample 1 - with the least set of restrictions on the sister pairs - the sisters can vary quite a lot. Both the OLS and the FD estimates predict that having a young adult childbearing affects the yearly wage negatively by about 33 per cent five years after the event. It is important to keep in mind that the wages, over the samples in general, are not very high and that there are many women with zero-wages, hence a 33 per cent difference can seem to be quite large but in absolute terms it is not. The effects in absolute terms will be presented in Section 7.5 together with the other robustness tests.

Turning to Sister-Sample 2; where the expected effect of being a young adult mother compared to her sister with early abortion is ambiguous. In Section 3 *Econometric Approach* two opposing effect were predicted. One effect was that the sisters resemble each other because of the shared event of early pregnancy. The other predicted effect was that the sisters differ from each other because of the decisive choice to keep the child contra get an abortion. The results clearly indicate that the second effect is dominating. The FD-estimate of young adult childbearing is -1.022. Actually, the coefficients obtained from the regression are only approximations of semi-elasticities, but for small coefficients the approximations are quite precise. Since a coefficient of -1.022 is rather large I need to transform it. The transformed coefficient is -1.78.[25] That is, non-young adult mothers, ceteris paribus, have 178 per cent higher wages than their early childbearing sisters five years after their pregnancy. Again, this estimate might be very biased since it indicates that there probably are some important systematic differences between 2YM and 2NYM, which over-estimate the negative effect of young adult childbearing on wages. It shows that the active and decisive choice of terminating the pregnancy is a strong behavioural indicator, indicating that these women want to postpone their childbearing in order to finish their studies and engage in a working career. This estimate obtained from Sister-Sample 2 does not serve as a good estimate of the effect of early childbearing effect on adult yearly wage, since it is based on the difference between two very different sisters, but the result is certainly interesting and can tell us something about the differences between two sisters where one chose to abort and the other did not.

The estimates based on the last Sister-Sample however show a whole other relation between young adult childbearing and adult wage, where no significant effect of young adult childbearing is found. The coefficient of the First Difference (and OLS) of early childbearing is very small and insignificant on Sister-Sample 3. In Section 3 *Econometric Approach* the prediction was that the individual unobserved differences between sisters in Sister-Samples 3 would be smaller than in the two other Sister-Samples. This prediction was made on the assumption that miscarriages serve as an exogenous variation since they are more or less a random event, especially after controlling for health differences. If the predictions that this Sister-Sample removes most of the unobserved individual heterogeneity and that the Sister First Difference method removes the remaining unobserved family heterogeneity from the OLS method is true, then it cannot be rejected that young adult childbearing has no influence on the yearly wage five years after the event.

[25] Exp(1.022) – 1 = 2.78 – 1 = 1.78

5.1.3 Testing for Endogeneity

As mentioned earlier, the key consideration in choosing between the OLS and the First Difference method is whether the unobserved heterogeneity, α_j and the explanatory variables are correlated. The Hausman Test is conducted to test whether this assumption holds or not.[26] Table 5.2 shows that there is some endogeneity, which is caught by the First Difference Estimator for Sister-Sample 1 and 2. For Sister-Samples 3 it cannot be rejected, that there is no difference in the consistency of the estimates obtained from the First Difference model and the Random Effects Model. This can indicate one of three things. Either that there are too few observations in the Sister-Sample 3 to observe any significant differences, or that there is some unobserved individual heterogeneity that is contaminating both the Random Effects and the First Difference estimates, or that the specific sample-selection and detailed family variables have already coped with the unobserved heterogeneity. Since the sample-size are fairly big and we assume random assignment of sisters in sample 3, the insignificance of the Hausman test must be due to the latter explanation.

Table 5.2- Hausman Test

	Sister-Sample 1	Sister-Sample 2	Sister-Sample 3
H	146.17***	29.05**	22.04

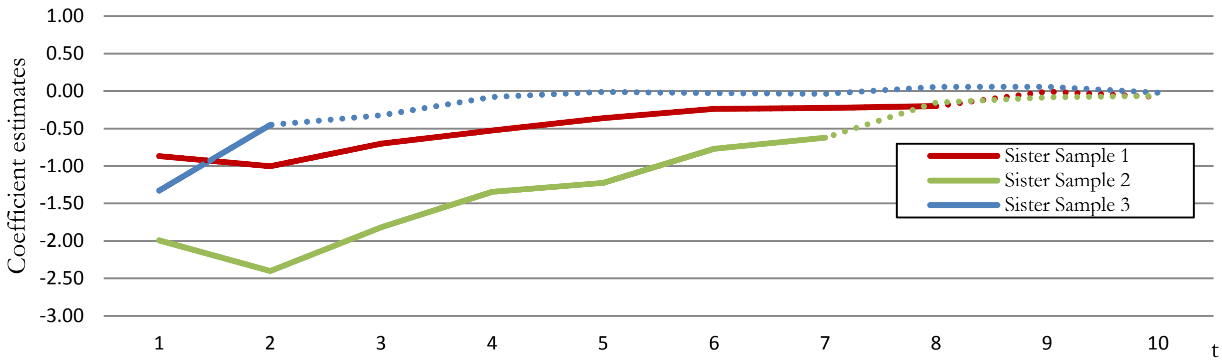
Significant levels: 10% (*), 5% (**), 1% (***)

5.1.4 The Development of the Coefficient of Early Childbearing over Time

The effects discussed above are of early childbearing on women's wages five years after the event. It is therefore important to control whether this is the effect at this specific timing or whether the effect is consistent over time. Furthermore it can be interesting to see the development in the young adult childbearing coefficient over time. Figure 5.1 shows the FD-estimates of the three Sister-Samples over the period one to ten years after the event. As the figure shows, the FD-estimates on Sister-Sample 3 are only significant and negative in the first two years after the event. The estimates are not significantly different from zero already three years after the event. This suggests that it takes the young adult mothers 3 years to stabilize their wage-income after their first childbirth. Another interesting result, given by the figure, is that the estimates from Sister-Sample 1 and 2 both become insignificant respectively 8 and 9 years after the event. This shows that when using a Sister First-Difference method, the effect of young adult childbearing disappears after 9 years - regardless the Sister-Sample.

Figure 5.1- The FD-Estimates of Early Childbearing over Time

[26] $H = (\hat{\delta}_{FD} - \hat{\delta}_{RE})'\left[Avar(\hat{\delta}_{FD}) - Avar(\hat{\delta}_{RE})\right]^{-1}(\hat{\delta}_{FD} - \hat{\delta}_{RE}) \sim \chi^2_M$, where $\hat{\delta}_{RE}$ and $\hat{\delta}_{FE}$ are the vectors Random and Fixed effects estimates without the coefficients of family invariant variables. Avar is the robust variance matrix.



Note: Dashed curve indicates insignificant estimates, t=0 is the year of event, t=0 it the year of event
Baseyears 1994-1997, **Source:** Statistics Denmark and own calculations

5.2 Secondary Results – Other effects on women's yearly wage

In this section I will briefly highlight the most important remaining coefficient estimates that also appear in Table 5.1.

One of the important variables is the health variable since miscarriage is systematically correlated with general poor health, as was shown in Section 4 *Data*. The coefficients for *Diagnoses* are negative, large and significant for all the regression outputs which indicate the importance of controlling for health regardless of the sample selection. This together with the fact that health is negatively correlated with the control sisters of Sister-Sample 3 indicates that if the health variable is omitted, the coefficient estimates of YM will probably be strongly biased.

The effect of birth-order is not clear or consistent over all the regressions, confirming the discussion in Section 3 *Econometric Approach*. The age of the women has a significant positive effect on wages, which is not surprising since the average wage in Denmark increases with age up until the age group 45-54.[27] Since there are small between-sister differences in the parental income, they are included in the FD-model.[28] But the coefficient estimates are not significant, implying that these differences are quite small. By and large the results are consistent with what was expected.

5.3 Discussion

These results are very significant but some uncertainties remain. Some of the concerns will be discussed in the next few paragraphs, while others will be discussed and tested in the next section.

One concern is whether the health-variable is specified optimally. It will not serve as a good variable if it does not capture the important difference between the sisters and control for all of the between sisters differences in health. The important differences that a health variable should capture are the factors that are highly correlated with having or not having a young adult childbearing. These factors

[27] Statistic Denmark, *Indkomster 2011* (2013).
[28] Because the variables are defined as the parental income during the women's adolescent

will differ systematically between the sisters in the samples. For Sister-Sample 3 the health-variable should capture the potential correlation with the event of miscarriages and with the women's wages. The health variable of this study is defined as all the non-pregnancy related diagnoses divided by the women's age. This is by far not a perfect measure by the standard given above, since it weights all diagnoses equally. As shown in Table 4.4 and 4.5 there is a correlation between the women's general health level and their number of diagnoses. Obviously, there are big differences between the different diagnoses' impact on the women's labour-market performance. A broken arm may not influence the women's wage as much as cancer. Likewise, the incident of a broken arm is probably not correlated with the propensity to miscarry, whereas cancer might be correlated. E.g. smoking causes cancer and also increases the risk of miscarrying.[29] Developing a more sophisticated health variable is an aim for further studies.

Another idea is to include the women's educational obtainment at the year of the event as Holmlund (2005) did. An education variable by this design will not be endogenous which otherwise was the concern with including the women's educational obtainment in the first place. The question is whether there is any significant difference in education level between the sisters at that point of life. Danish children have obligatory schooling till the age of 15-16 and as figure 4.2 shows there are no big differences between the young mothers' and their sisters' educational level even several years after the normal age of ended education, which may indicate that this pre-event educational level may not be that important. Another idea is to use the women's high school GPA. These grades might serve as a good indicator of the women's intelligence level when they were 18-19 years old. The high school GPAs are recorded in Statistics Denmark's registers, but the problem is that many of the women have not completed high school at all.[30]

In the next section, other concerns will be discussed and also tested, to see whether the econometric and data choices have critical importance on the results.

5.4 Robustness Tests

5.4.1 The Functional Form and Zero Wages

Another specification which can have an unwanted impact on the results is the functional form of the wages, namely log-transformation of wages. As described in Chapter 3 *Data*, I have used an approximation of wages, where I added one DKK to every woman's wages.[31] [32] It is a necessary

[29] Chatenoud *et al. (*1998) George *et al.* (2005), Venners *et al* .(2004)

[30] Furthermore, the data on high school grades are only recorded from 1997 and on, which makes it difficult to use the variable especially for the Sister-Sample 2 and 3, where the number of observations already is limited.

[31] $Wage_{approx} = (1+Wage)$

[32] 1 DKK is 0.18 US$ (24.05.2014)

approximation if the zero wages are to be included. This approximation can however cause an overvaluation of the zero-wages, since the relative differences between zero-wages and small wages are quite big compared to the absolute wage difference, due to the concave nature of the logarithm scale. To observe if this log-transformation of the approximated wages has an unwanted impact on the directions of the estimates obtained in Table 5.1 all of the same regressions are run again, but with the absolute yearly wage as the dependent variable. The estimates of young adult childbearing are shown in Table 5.3. Generally, the same picture remains. The regressions functional form are now Level-Level, which means that the coefficients present the absolute changes in the wage due to a change of one unit in the explanatory variable. The FD-estimates of early childbearing from Sister-Sample 1 are negative and significant on about DKK 16.7 thousands in the annual wage. The Sister-Sample 2 gives a larger negative and significant estimate of around DKK 36.8 thousands. Lastly, the estimate obtained from Sister-Sample 3 is still not significantly different from zero. The functional form does not influence the overall implication of the effect of early childbearing on wages.

There is a clustering of the wages caused by many zero-wages, which could be a problem. It could be that the zero-wages are accountable for the obtained estimates. So what the estimates actually show is the effect of the differences between being employed or not, instead of estimating the wage differences between the sisters. To see if this is the case, I have run the FD-regressions again, where all the women with zero-wages are excluded. These conditional expectation estimates are reported in Table 5.3. The estimates obtained from Sister-Sample 1 and 2 are definitely less negative than the original estimates, but they are still significantly negative. Sister-Sample 3 still gives insignificant estimates of the effect of early childbearing. It is not surprising that the estimates of Sister-Sample 1 and 2 are numerically smaller, since removing the lowest wages (i.e. the zero-wages) from the samples will, ceteris paribus, remove some of the cases where there are big inter-sister differences in the wages. It confirms the robustness of the prior results since the directions and implications of the results remains the same.

Table 5.3- Sister First Difference Estimates of Early Childbearing - Five years after the event

	Sister-Sample 1		**Sister-Sample 2**		**Sister-Sample 3**	
	FD		FD		FD	
	Wage	Log(Wage)¤	Wage	Log(Wage)¤	Wage	Log(Wage)¤
YM	-16,677.45***	-0.054***	-36,702.93***	-0.2811***	3,709.57	0.067
	(1,455.40)	(0.018)	(7,290.39)	(0.106)	(12,244.06)	(0.156)
Individual Observation	22,635	20,730	1,943	1,756	703	633
Family Observation	11,003	9,098	931	744	325	255

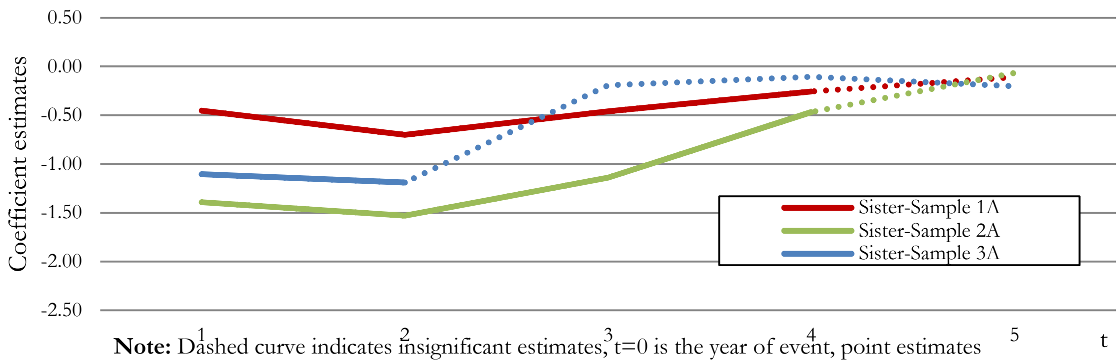
Note: The rest of the explanatory variables coefficient estimates can be found in Table A.E.2 in the Appendix
Heteroscedaticity robust std. err. in the parenthesis, ¤: Wage=0 is excluded,
Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

5.4.2 Further Sample Restrictions and Time-Period Consistency

I have conducted several robustness tests and not all will be reported in this paper. I tested whether the teenage mothers in the sample have a large impact on the results, which they did not. I tested whether the few sister-pairs with big age differences have a significant impact on the estimates and essentially are the source to the estimated effects in Table 5.1. Again I found no evidence of this. These tests are done with sister-samples both including and excluding zero wages.[33] The implications of the results remain the same as found in the primary results reported above.

The next test is to observe whether the results are time period consistent. The question is whether the same results would be obtained if the regressions were run on different sister-pairs from another period of time. To test this, I have conducted the same *FD-Regressions* on other sister-pairs which fulfil the same sample-criteria but where the young adult mothers had their first childbirth between the years 2000 to 2005. The regressions are run on the women's wages 1 to 5 years after the event, since it is not possible to follow enough of the sister-pairs for a longer period. The estimates of young adult childbearing on wages are shown in Figure 5.2. The overall picture remains the same. The speed in which the young adult childbearing women catch up with their sisters is faster than in the original samples. This test suggests that the estimated effects of young adult childbearing are rather time consistent and that the skewed age distribution in the original Sister-Sample 1A and 2A did not have any critical impact.

Figure 5.2 - The FD-Estimates of Early Childbearing over Time



Note: Dashed curve indicates insignificant estimates, t=0 is the year of event, point estimates are shown in Table A.E.8 in the *Appendix*, **Source:** Statistics Denmark and own calculations

All of these robustness tests indicate that the estimated effect- or rather missing effect - of early childbearing on wages is quite robust. By changing the samples in various ways new estimates are obtained, all of which show that young adult childbearing has a short-term negative effect, but there still does not seem to have any long-term influence on adult wages.

[33] The regression outputs of the tests are shown in Appendix table *A.E.3*

5.4.3 The Effect of Early Childbearing on other Outcome Variables

In this section I substitute the dependent variable of *Log(wage)* with other variables that might contribute to the understanding of the effect of young adult childbearing. The specific variables are chosen not only to find the effect of early childbearing on other aspects of the women's lives, but also as a robustness test of the outcome variable *Log(wage)*. That is, whether the implications of these other outcome variables is in line with what was found earlier in this study.

Table 5.5 shows the regression outputs on the women's personal income five and ten years after the event. It shows that the effect of having an early childbearing has the opposite effect on the personal income than it has on the wages five years after the event. Only the FD-estimate on Sister-Sample 3 ten years after the event remains insignificantly different from zero. There is actually a positive effect of having an early childbearing five years after the event. It is important to recall the structural differences between the personal income and the wage. The personal income includes public transfers, whereas the wages only consist of the women's earnings from the labour market. The difference in the estimated effects of young adult childbearing on the personal incomes and on the wages must primarily be due to the differences in the received public transfers, where the young adult childbearing sisters receives more in cash benefits and child support.[34] The FD-estimate of Sister-Sample 3 indicates that the between-sister difference disappears after ten years. But the short-time results are still interesting. Even though the effect of young adult childbearing presumably does not have any effect on wages five years after the event, it does have a positive effect on the women's total income. This also indicates that the welfare system is trying to compensate the young adult mothers for the extra economic burden of having a child to take care of.[35]

Table 5.5 - Sister First Difference Estimates of Early Childbearing on Log(Income)

	Sister-Sample 1		**Sister-Sample 2**		**Sister-Sample 3**	
	Log(Income)		Log(Income)		Log(Income)	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
YM	0.195***	0.090***	0.137***	0.170**	0.119***	0.050
	(0.010)	(0.009)	(0.046)	(0.072)	(0.041)	(0.070)
Time dummies	-	-	-	-	-	-
Family Observation	11,910	12,029	1,054	1,004	372	371
R^2	0.202	0.060	0.103	0.050	0.212	0.091

Significant levels: 10% (*), 5% (**), 1% (***), **Note**: Heteroscedaticity robust std. err. in the parenthesis
Same control variables as in *First Difference Regression 1,* which coefficient estimates can be found Table A.E.9 in *Appendix* **Source:** Statistics Denmark

In Table 5.6 the estimated effects of the age at first birth on yearly wages are presented, where age at first birth is used instead of a young adult childbearing dummy. The results have almost the same

[34] Figure A.D.3 – A.D.5 in the *Appendix* shows that early childbearing women receives more public transfers
[35] The compensation to the young mothers is not only by the public transfers. E.g. women with low wage-incomes tend to get discount fees or free kindergarten.

implications as the original estimates obtained through the young adult childbearing dummy. The Sister First Difference estimates from Sister-Sample 1 and 2 indicate that the wages increase with the age of first childbirth. Even the wages ten years after the event are affected by the age according to the estimates on Sister-Sample 1 and 2. The estimates on Sister-Sample 3 are again different from the others, where the estimates are neither significant five or ten years after the event. This again indicates that the women's age at first birth does not influence adult wages, when the unobserved heterogeneity is controlled for. It is necessary to state, that these estimates cannot be directly compared with the other estimates obtained using the early childbearing dummy. When using the continuous variable of age at first birth, all women, who have not had a child are excluded, since their variable does not exist. Hence, the samples are a little different than the original ones.

Table 5.6- Sister First Difference Estimates of Early Childbearing on Log(Wage),(Continues Birth Age Variable)

	Sister-Sample 1		**Sister-Sample 2**		**Sister-Sample 3**	
	Log(wage)		Log(Wage)		Log(Wage)	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
Birth Age	0.104***	0.093***	0.175***	0.174**	0.051	0.043
	(0.011)	(0.011)	(0.03)	(0.074)	(0.073)	(0.072)
Family Observation	9,787	9,742	779	713	329	281
R^2	0.202	0.060	0.076	0.023	0.109	0.072

Significant levels: 10% (*), 5% (**), 1% (***),
Note: Same explanatory variables are used as in FD-Regression 1, which coefficient estimates can be found in Table A.E.10, **Source:** Statistics Denmark

The last output variable that will be investigated is the years of education obtained in 2009. In general the effects are small or non-existing. The estimate on Sister-Sample 1 is that early childbearing has a negative effect of about 0.2 years of schooling. In Sister-Sample 2 and 3 the FD-estimates of young adult childbearing are not significantly different from zero. 2009 was more than ten years after the event for the vast majority of the women. So the findings of no effect on years of schooling from young adult childbearing go together with the finding of no effect of young adult childbearing on the yearly wages ten years after the event. There were very few of the women who were still studying in 2009.[36] The findings are in line with what Holmlund (2005) found. She found modest effects of birth timing on educational attainment, whereas Ribar (1994) found no or small effect. Ashcraft *et Al.* (2013) found small, positive but insignificant effect of early childbearing on high-school graduation, which is different to the effect of early childbearing found by Hotz *et Al.* (1995), where the effect was negative on high-school graduation.

Table 5.7 – The Effect of Early Childbearing on Years of Education Obtained in 2009

	Sister-Sample 1		**Sister-Sample 2**		**Sister-Sample 3**	
	Years of Education		Years of Education		Years of Education	
	OLS	FD	OLS	FD	OLS	FD
YM	-0.231***	-0.191***	-0.204***	-0.012	-0.087	0.077

[36] Percentage of the women who study in 2009: 1NYM= 0.8, 1YM=1.4, 2YM=2.6, 2NYM=2.6, 3NYM=0,78, 3YM=1.3

	(0.021)	(0.020)	(0.100)	(0.074)	(0.117)	(0.162)
Observation	19,816	9,941	1,764	882	654	327
R^2	0.076	0.023	0.088	0.023	0.109	0.072

Significant levels: 10% (*), 5% (**), 1% (***),
Note: Same explanatory variables are used as in OLS-Regression 1 and FD-Regression 2, which coefficient estimates can be found in Table A.E.11 in the *Appendix*

The estimates obtained on the years of education also indicate that the Sister First Difference removes the unobserved heterogeneity between the sisters. Concluding on the results of Sister-Sample 3, the prevailing between-sister differences are not caused by having young adult childbearing.[37]

6. Conclusion

Young adult childbearing women's wages are lower than wages of the average Danish women of the same ages. The question is, whether this is due to the young adult childbearing or the women's backgrounds, attributes and pre-birth situations? The purpose of the study was to estimate the true effect of young adult childbearing on the Danish women's adult wages. The purpose was furthermore to observe whether a new combination of the best practices of earlier studies on the subject could serve as a better estimation method. The new estimation method consists of combining a Sister First Difference method with using miscarriages as an exogenous variation.

The Sister First Difference method without the use of miscarrying sisters estimated the effect of young adult childbearing on wages to be significantly negative in the short run (five years), but insignificant in the long run (ten years). The effect of early childbearing disappeared when applying a Sister First Difference estimator together with using control sisters who miscarried in an early age. This indicates that there remained some unobserved heterogeneity after removing the family fixed effects and that the remaining unobserved heterogeneity could be removed when homogenising the sisters by using miscarrying sisters as controls. Controlling for health was also found important when using miscarrying sisters as controls, since miscarriages are correlated with general inferior health. The main result of this study is that young adult childbearing does not have a persistent effect on women's wages.

Other outcome variables were also studied in this study. Young adult childbearing was found to have a positive effect on the personal incomes in the short run, which mainly is because the young adult mothers receive higher public transfers than their sisters. The effect tends to disappear in the long run. Young adult childbearing was found to have no effect on the women's years of educations.

Another interesting finding of this study is that there are significant differences in using control sisters with young adult miscarriages contra control sisters with young adult abortions. When using sisters with an early abortion as controls the effect of young adult childbearing became very large, implying that the

[37] The Hausman tests for the regression with years of education as the dependent variable are shown in Table A.B.5 *Appendix*, again are the test significant for Sister-Sample 1 and 2, implying that the within estimator is preferable.

conscious choice of postponing the first childbirth through an abortion separates these women from their young adult childbearing sisters when it comes to adult wages. The women's choice of terminating their pregnancies can be seen as an indicator for greater preferences towards engaging in careers compared to their young adult childbearing sisters.

The results were tested in various ways in order to trial their robustness. It was shown that the results are robust to different changes in the samples and the regressions functional forms. Sister-Samples was assembled which consisted of women with their first childbirth six to ten years after the women's childbirths from the original Sister-Samples. The overall implications of the estimated effects remained the same, implying that the results are time period consistent.

The risk that the sisters and families used in this analysis are unusual was discussed in order to evaluate whether the results are relevant for the entire population of young adult childbearing women. It was shown that the sister pairs in general come from less resourceful families, but it was also shown that the women from the Sister-Samples resemble the general population of young adult mothers. The resemblance gives reasons to believe that the results obtained on the basis of the Sister-Samples are not due to a local treatment effect, but apply to the whole Danish population of young adult childbearing women.

The young adult childbearing women have lower adult wages than the average women; nevertheless it is not because of their young adult childbearing, but rather due to their pre-birth backgrounds, attributes and circumstances.

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Appendix

Table A.1 Variables in the dataset

Variable name	Variable description
Pnr	ID-number of the women
PnrM	ID-number of the women's mother
PnrF	ID-number of the women's father
Age 2010	The woman's age primo 2010
Age First Birth	The woman's age at her first childbirth
Children	The woman's number of children
Birth Year	The year of the woman's first childbirth
Abortion Dummy	Whether the woman have had an abortion
Abortion Year	The year of the woman's first abortion
Miscarriage Dummy	Whether the woman have had an miscarriages
Miscarriage Year	The year of the woman's first miscarriages
Age Difference	The age difference between the sisters
Education	Highest level of education obtained in 2009
Edu Mother	The woman's mother's highest level of education obtained
Edu Father	The woman's father's highest level of education obtained
Income Mother	The woman's mother's average income during the women's adolescence
Income Father	The woman's father's average income during the women's adolescence
Immigration	Dummy whether the woman is native or an immigrant
Siblings	The woman's number of siblings
Stable Fam	See definition in the text
Region	Region of adolescence
HS Grade	High school GPA in Danish, mathematics and the overall average
Wage (1994-2009)	Yearly wages
Income (1994-2009)	Yearly personal income
Unemployment (1994-2009)	The ratio of unemployed days during the year
Occupation (1994-2009)	Primer occupation during the year
Sickness B (1994-2009)	Yearly Sickness benefits
M Leave (1994-2009)	Days on maternity leave during the year
Diagnoses	The women's average number of diagnoses per year
Student dummy	Whether the woman is in school the giving year
Year dummy	A dummy that captures the year differences
Pension	Yearly public pension
SU	Yearly government education stipend
Tax	Yearly tax payments
Cash Benefits	Yearly Cash Benefits

A.B. Test Results

Table A.B.1 – The Welch T-test of the Difference in the Between Sister Number of Children (t-Value)

	Sister-Sample 1	Sister-Sample 2	Sister-Sample 3
T-score	-46.64***	-17.30***	-9.23***

Significant levels: 10% (*), 5% (**), 1% (***)

Source: Statistic Denmark and own calculations

Table A.B.2- The Welch T-test of the Between Groups Differences in the Annual Average Number of Diagnoses(t-Value)

1YM & 2YM	1YM & 3YM	2YM & 3YM
-7.38***	1.87*	6.46***

1NYM & 2NYM	1NYM & 3NYM	2NYM & 3NYM	OYM & 3NYM
-20.61***	-14.16***	-3.50***	-7.73***

SS1	SS2	SS3
1YM & 1NYM	2YM & 2NYM	3YM & 3NYM
47.21***	-2.22**	-9.34***

Significant levels: 10% (*), 5% (**), 1% (***)

Source: Statistic Denmark and own calculations

Table A.B.3 - The Welch T-test of the Differences in the Women's Number of Sisters (t-Value)

SS1 & SS2	SS1 & SS3	SS2 & SS3	OYM & SS3
-13.68***	-16.74***	-4.41***	-12.48***

Significant levels: 10% (*), 5% (**), 1% (***)

Source: Statistic Denmark and own calculations

Table A.B.4 - The Welch T-test of the Differences in the Fathers Years of Education (t-Value)

SS1 & SS2	SS1 & SS3	SS2 & SS3	OYM & SS3
-0.52	4.98***	4.49***	1.56

Significant levels: 10% (*), 5% (**), 1% (***)

Source: Statistic Denmark and own calculations

Table A.B.5- The Hausman test for Endogeneity – Of the regressions with years of education as the dependent variable

	Sister-Sample 1	Sister-Sample 2	Sister-Sample 3
H	217.2***	41.3***	18.9

Significant levels: 10% (*), 5% (**), 1% (***)

Table A.B.6 – The Welch T-test of the Difference between the OLS and FD Estimates within the Samples

	Sister-Sample 1	Sister-Sample 2	Sister-Sample 3
T-value	-1.19	-11.63***	-0.91

Significant levels: 10% (*), 5% (**), 1% (***)

A.C. More Descriptive Statistics

Table A.C.1 The Parent's Years of Education

	Sister Sample 1		**Sister Sample 2**		**Sister Sample 3**		**OYM**	
	Father	**Mother**	**Father**	**Mother**	**Father**	**Mother**	**Father**	**Mother**
Years of education	12.191	11.837	12.231	11.805	11.64	11.577	11.469	10.006
Std. Dev.	(2.30)	(1.96)	(2.36)	(2.07)	(2.12)	(0.97)	(2.04)	(0.14)
Observations	12,403	12,512	1,010	1,054	380	384	32,190	32,215

Figure A.C.2 An Overview of the Danish Educational System

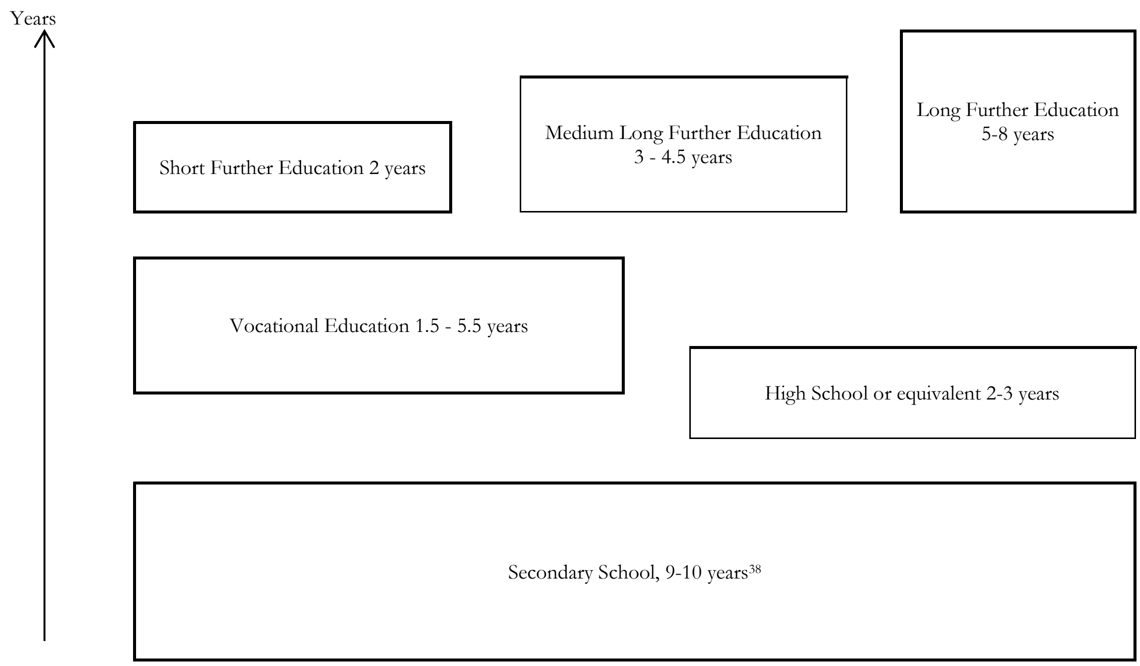
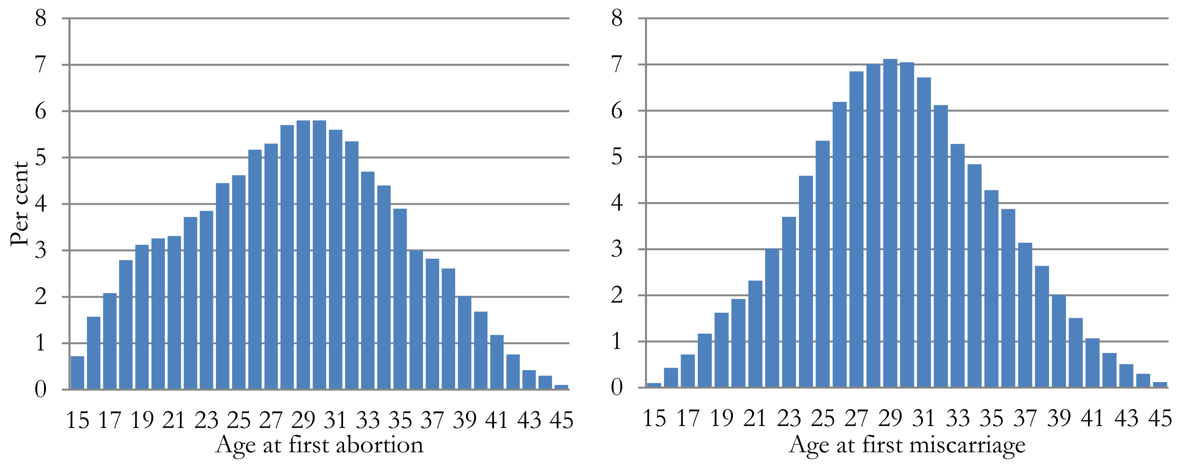


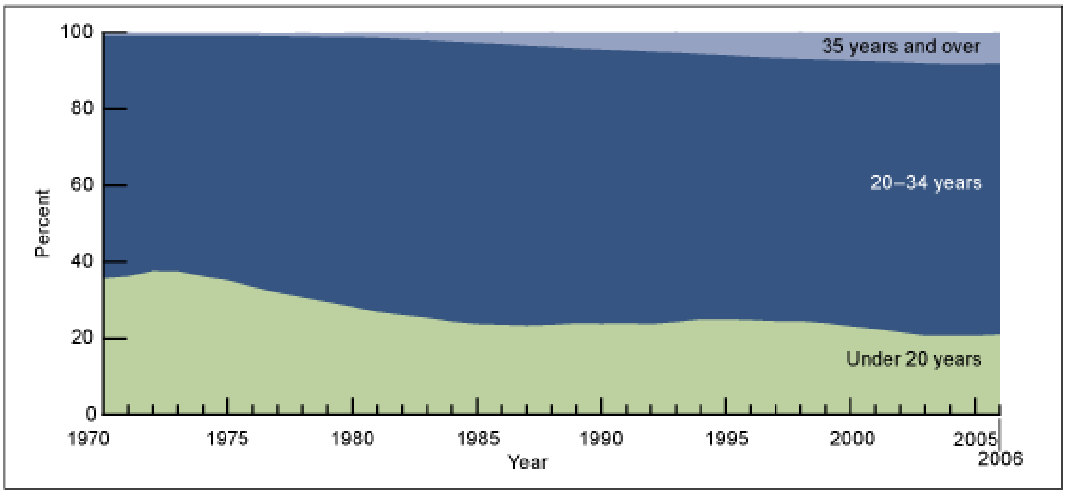
Figure A.C.3 – The Age Distribution of the Women at their First Abortion or Miscarriage



Source: Statistics Denmark and own calculations, **Note:** Only women with at least one sister

[38] In Danish: Grundskole (0th to 9th or 10th grade)

Figure A.C.4 Percentage of First Births, by Age of Mother, United States



Source: National Vital Statistics System

Table A.C.5 ICD-10 Classification of Abortions and Miscarriages

		Abortion	Miscarriage	Unspecified
O 00	Ectopic pregnancy		X	
O 01	Hydatidiform mole		X	
O 02	Other abnormal products of conception		X	
O 03	Spontaneous abortion		X	
O 04	Medical abortion	X		
O 05	Other abortion			X
O 06	Unspecified abortion			X
O 07	Failed attempted abortion			X
O 08	Complications following abortion and ectopic and molar pregnancy			X
P 95	Fetal death of unspecified cause		X	
R 95	Sudden infant death syndrome		X	
Z 37.1	Single infant, stillborn		X	
Z 37.4	Twins infant, both stillborn		X	
Z 37.7	Other multiple births, all stillborn		X	

Source: WHO IDC-10

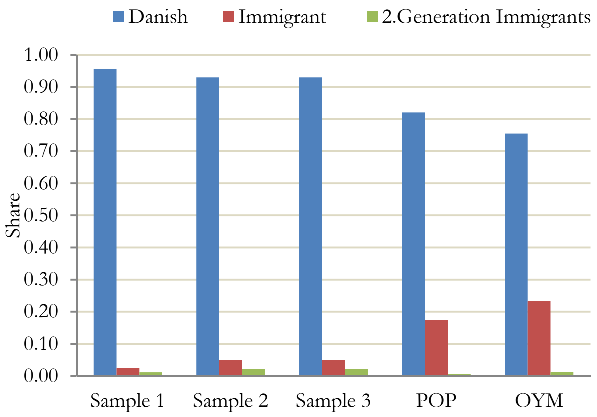
Table A.C.6 Number of Women Experienced a Miscarriage or Abortion

	Miscarrying Women	Abortive Women
1994	6,070	16,270
1995	6,329	16,117
1996	6,274	16,741
1997	6,331	15,846
1998	6,408	15,323
1999	6,373	15,367
2000	6,434	15,261
2001	6,301	14,754
2002	6,153	14,412
2003	6,438	14,832
2004	6,324	14,638
2005	6,330	14,289
2006	6,403	13,687
2007	6,375	13,779
2008	7,361	14,293
2009	7,184	13,916
2010	7,131	13,281

Source: Statistics Denmark and my own calculations, **Note:** Maximum one incident per women per year

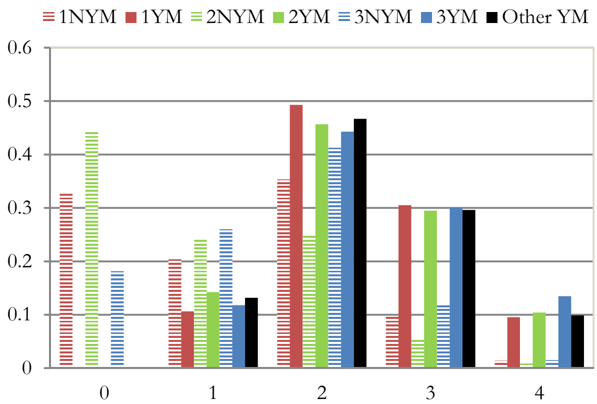
Figure A,C.4 – A.C.7 – Demographics

A.C.4 Immigration Status



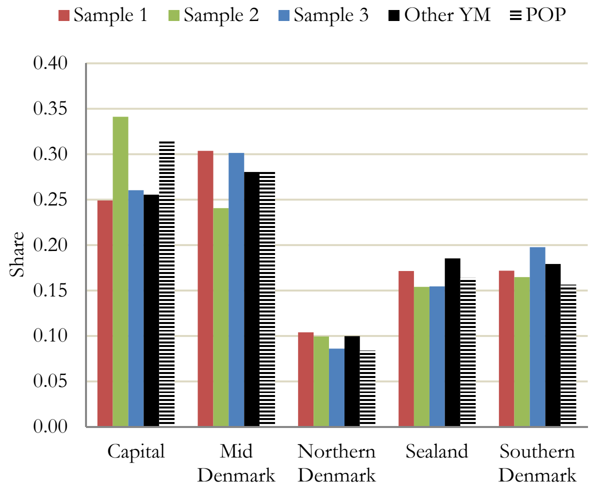
Source: Statistics Denmark and own calculations

A.C.5 Number of Children in 2010



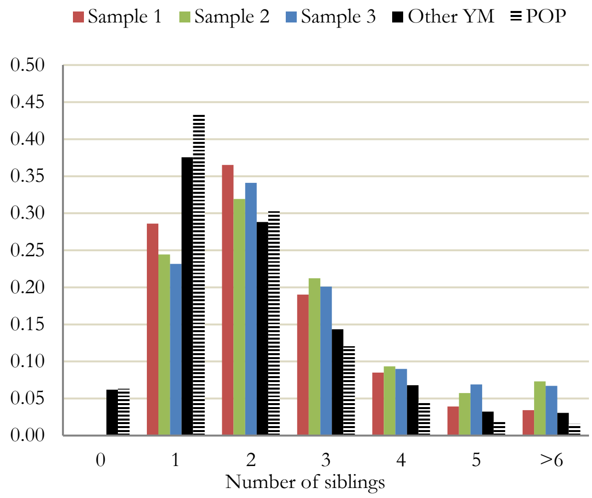
Source: Own calculations based on data from Statistics Denmark

A.C.6 Region of Adolescence



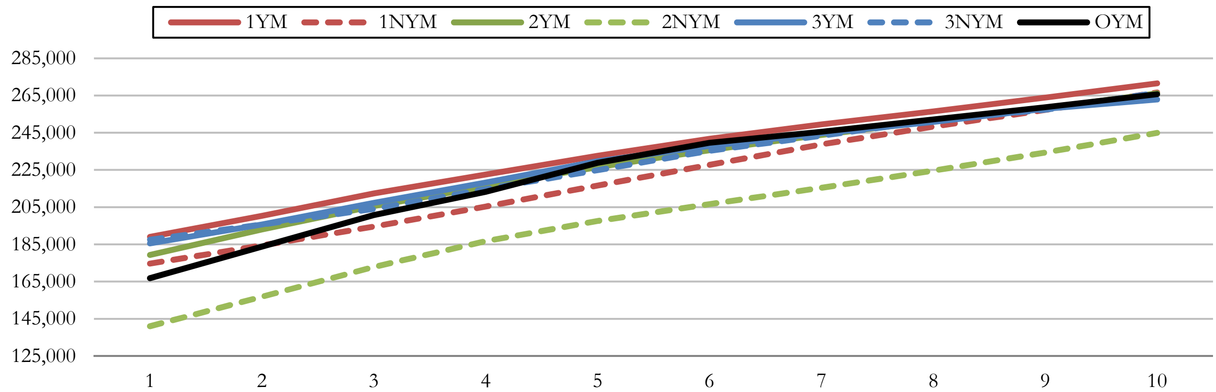
Source: Statistics Denmark and own calculations

A.C.7 Number of Siblings



Source: Statistic Denmarks and own calculations

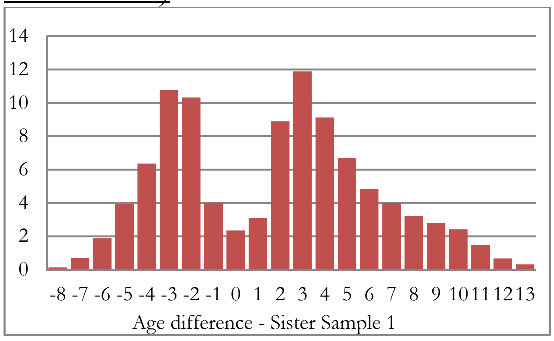
Figure A.D.1 – Personal Income

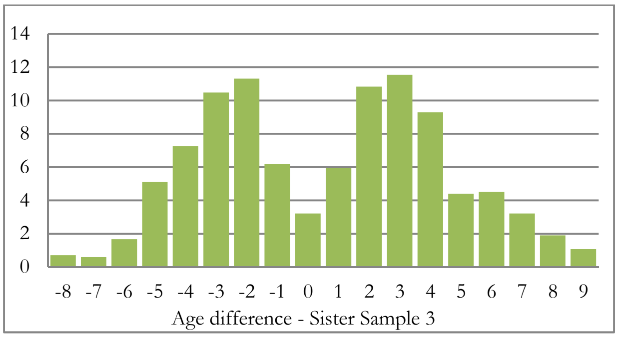


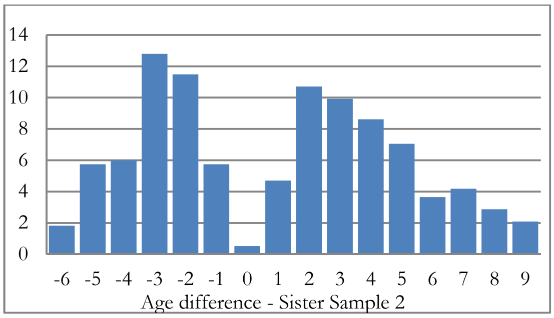
Source: Own calculations based on data from Statistics Denmark

Note: 3-year moving average , base year 2009

Figure A.D.2 – The Distribution of the age differences Between the Sisters of The New Sister Samples (YM's first birth in 2000-2005)

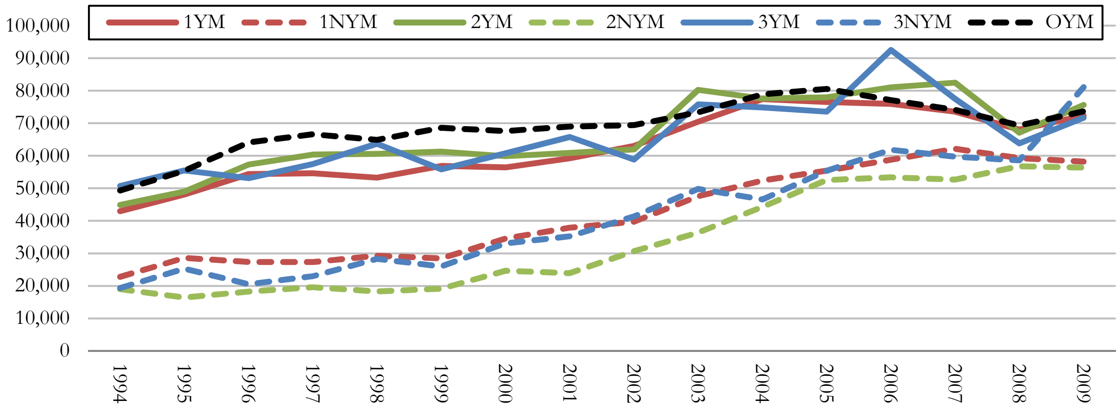






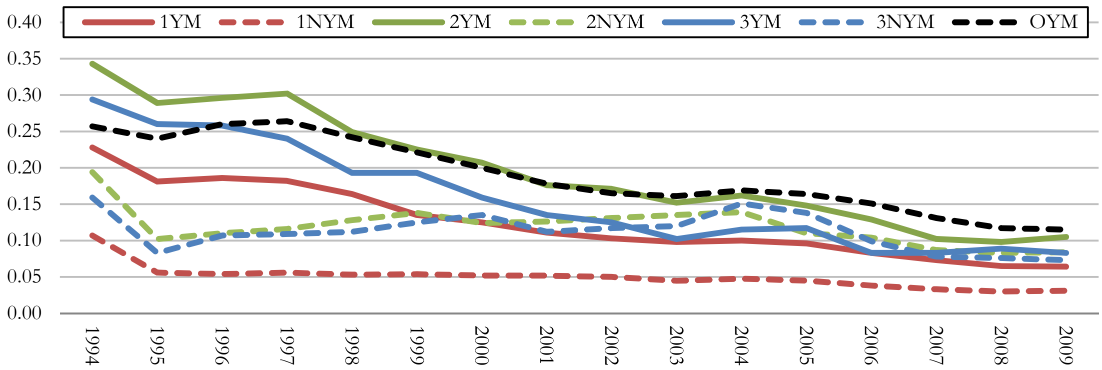
Source: Own calculations based on data from Statistics Denmark

Figure A.D.3 Yearly Cash Benefits- The average for the receiving women



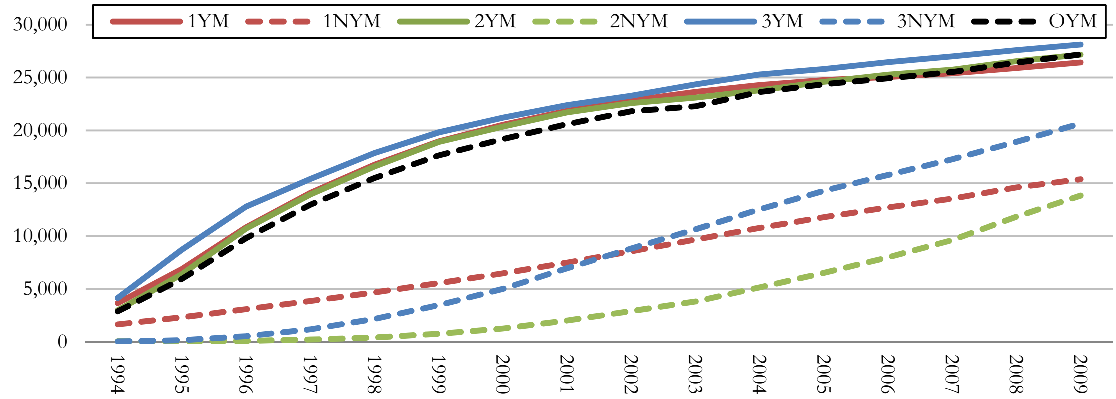
Source: Own calculations based on data from Statistics Denmark
Note: Base year 2009, average of the cash help receivers

Figure A.D.4 Share of Cash-Benefit Receivers



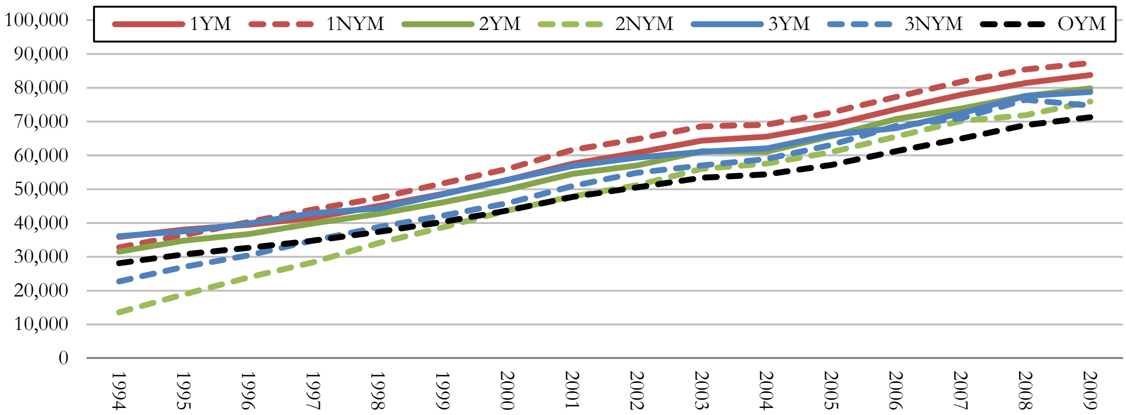
Source: Own calculations based on data from Statistic s Denmark

Figure A.D.5 Annual Average Government Child Support



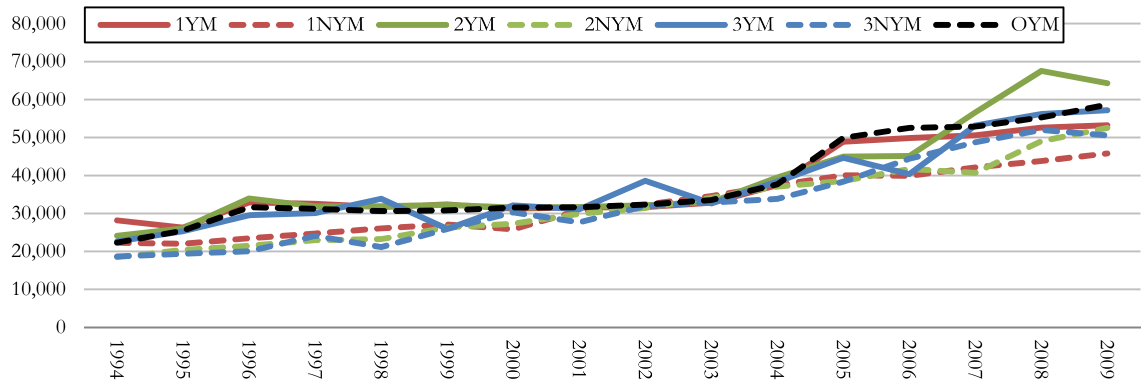
Source: Own calculations based on data from Statistics Denmark
Note: Base year 2009, average of all the women in the samples

Figure A.D.6 Annual Tax Payments



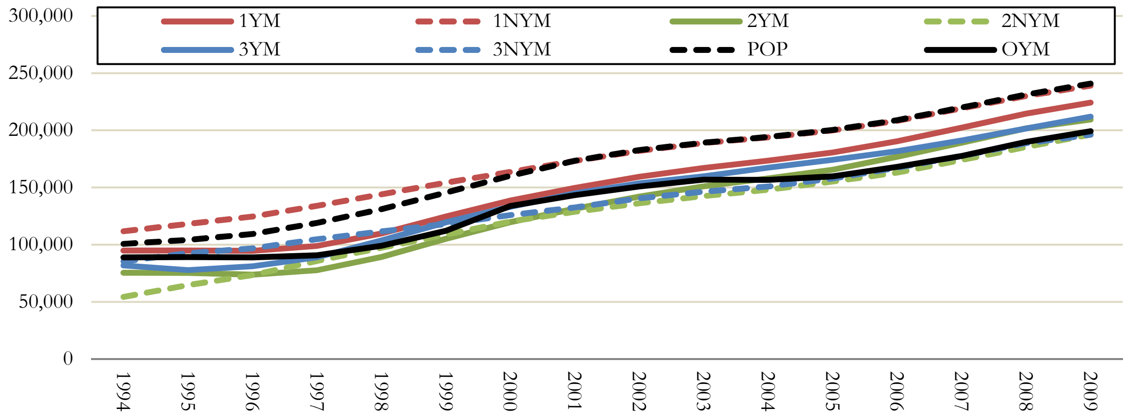
Source: Own calculations based on data from Statistics Denmark
Note: Base year 2009

Figure A.D.7 The Government Education Stipend – average of the receiving women



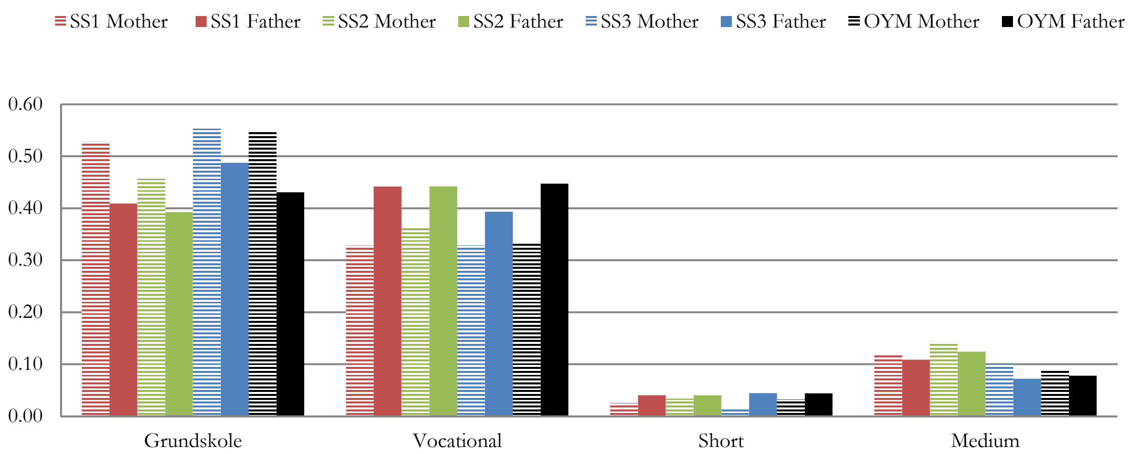
Source: Own calculations based on data from Statistics Denmark
Note: Base year 2009, average of the Stipend receivers

Figure A.D.8 – The Yearly Wage (Inclusive the population mean)



Source: Own calculations based on data from Statistics Denmark
Note: 3-year moving average , base year 2009

Figure A.D.10 – The Parents' Educational Level



Source: Own calculations based on data from Statistics Denmark, OBS. Few observations

The Regression Outputs

Table A.E.2 – Full Regression Outputs for Table 5.3

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3	
	Wage	Log(wage)¤	Wage	Log(wage)¤	Wage	Log(wage)¤
Age	9271.03***	0.085***	9122.68***	0.074**	9243.49**	0.053
	(597.39)	(0.007)	(2325.70)	(0.031)	(4641.64)	(0.061)
Log(wage_mother)	-890.48	0.037	-7262.27	-0.059	-11849.16	-0.089
	(3671.47)	(0.042)	(21746.17)	(0.299)	(50305.52)	(0.652)
Log(wage_father)	9198.67	0.124	-19830.42	0.086	34838.19	0.587
	(9050.48)	(0.981)	(24174.80)	(0.302)	(42375.72)	(0.517)
Diagnosis	-33370.55***	-0.441***	-673.93	-0.132	17850.71**	-0.260**
	(3475.06)	(0.042)	(9241.07)	(0.134)	(9046.12)	(0.121)
Birth Order	6020.77***	0.097***	-8591.5	-0.01	9805.46	0.008
	(2249.73)	(0.27)	(8039.07)	(0.108)	(13027.64)	(0.161)
Individual Observation	22,635	20,730	1,943	1,756	703	633
Family Observation	11,003	9,098	931	744	325	255
R^2	0.153	0.103	0.126	0.071	0.058	0.0866

Note: Heteroscedasticity Robust Std. Err. In the parentheses
¤: Wage=0 is excluded, **Significant levels**: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

Table A.E.3 – Robustness Regressions; Sister First Difference Estimates of Early Childbearing on Log(wage)

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3	
	Log(wage)		Log(wage)		Log(wage)	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
(1)	-0.407***	-0.0006	-1.081***	-0.060	0.039	0.119
	(0.059)	(0.061)	(0.281)	(0.310)	(0.476)	(0.491)
(2)	-0.281***	-0.020	-0.888***	0.079	0.029	0.074
	(0.192)	(0.050)	(0.201)	(0.314)	(0.452)	(0.466)
(3)	-0.309***	0.052	-1.014***	0.064	0.080	-0.012
	(0.059)	(0.060)	(0.302)	(0.324)	(0.474)	(0.510)
(4)	-0.121***	-0.030	-0.289**	-0.238**	0.104	0.135
	(0.023)	(0.024)	(0.115)	(0.129)	(0.180)	(0.192)

1: Regression 2, intersister age difference below 6 years
2: Regression 2, first childbirth between the age of 20 and 26
3: Regression 2, intersister age difference below 6 and first childbirth between the age of 20 and 26
4: Regression 2, intersister age difference below 6 and first childbirth between the age of 20 and 26, without zero-wages
Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark
Note: Same control variables as in *First Difference Regression 1,* which coefficient estimates can be found in Table A.E.3 – 5 *Appendix*

Table A.E.3.a – Full Regression Outputs for Table 7.5

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3	
	RR1		RR1		RR1	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
Birth Order	0.012	-0.100	0.215	0.830*	0.252	0.448
	(0.11)	(0.11)	(0.41)	(0.44)	(0.58)	(0.68)
Age_2010	0.005	-0.014	0.181	0.284*	0.116	0.157
	(0.04)	(0.04)	(0.15)	(0.17)	(0.26)	(0.30)
Diagnoses	-1.508***	-1.338***	-0.881**	-0.843	0.002	-1.088
	(0.12)	(0.13)	(0.40)	(0.57)	(0.66)	(0.74)
Log(Income_mother	0.047	-0.092	0.191	0.567	-2.647	-3.260*
	(0.19)	(0.19)	(1.33)	(1.68)	(1.84)	(1.88)

Log(Income_father	0.405	-0.030	0.220	0.236	-0.649	0.190
	(0.30)	(0.32)	(1.30)	(1.78)	(2.66)	(4.14)
Family Observation	8,237	8,325	704	697	276	275
R^2	0.071	0.03	0.081	0.016	0.155	0.013

Note: Heteroscedasticity Robust Std. Err. In the parentheses
Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

A.E.3.v – Full Regression Outputs for Table A.E.3

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3	
	RR2		RR2		RR2	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
Birth Order	0.191***	0.009	-0.075	0.513	-0.048	-0.029
	(0.07)	(0.07)	(0.26)	(0.34)	(0.45)	(0.58)
Age_2010	0.066***	0.010	0.073	0.143	0.111	-0.077
	(0.02)	(0.02)	(0.08)	(0.11)	(0.17)	(0.23)
Diagnoses	-1.427***	-1.254***	-0.809***	-0.789	-0.059	-0.814
	(0.11)	(0.11)	(0.31)	(0.53)	(0.56)	(0.65)
Log(Income_mother	-0.061	0.119	1.013	0.545	-0.624	-2.983*
	(0.12)	(0.12)	(0.72)	(1.19)	(1.45)	(1.77)
Log(Income_father	0.417*	0.439*	-0.195	0.079	0.211	0.244
	(0.22)	(0.24)	(0.78)	(1.25)	(1.50)	(2.38)
Family Observation	11,150	11,221	888	872	343	341
R^2	0.052	0.029	0.059	0.012	0.075	0.086

Note: Heteroscedasticity Robust Std. Err. In the parentheses
Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

Table A.E.3.c – Full Regression Outputs for Table A.E.3

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3	
	RR3		RR3		RR3	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
Birth Order	0.017	-0.081	0.276	0.807*	-0.197	0.169
	(0.11)	(0.11)	(0.39)	(0.43)	(0.58)	(0.68)
Age_2010	0.006	-0.000	0.188	0.334**	0.042	0.009
	(0.04)	(0.04)	(0.15)	(0.17)	(0.26)	(0.31)
Diagnoses	-1.488***	-1.341***	-1.003***	-1.444**	0.344	-1.169
	(0.13)	(0.13)	(0.38)	(0.59)	(0.65)	(0.74)
Log(Income_mother)	0.060	-0.026	-0.029	0.353	-2.741	-3.136*
	(0.19)	(0.19)	(1.23)	(1.62)	(1.80)	(1.88)
Log(Income_father)	0.490	0.063	-1.708	-1.701	-0.325	0.487
	(0.31)	(0.33)	(1.46)	(1.93)	(2.97)	(4.38)
Family Observation	7,733	7,794	593	586	250	249
R^2	0.059	0.028	0.074	0.026	0.14	0.093

Note: Heteroscedasticity Robust Std. Err. In the parentheses
Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

Table A.E.3.d – Full Regression Outputs for A.E.3

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3	
	RR4		RR4		RR4	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
Birth Order	0.026	-0.028	-0.126	0.202	0.134	0.056

	(0.04)	(0.04)	(0.17)	(0.16)	(0.22)	-0.27
Age_2010	0.053***	0.015	0.020	0.108*	0.134	0.036
	(0.01)	(0.01)	(0.06)	(0.06)	(0.09)	-0.12
Diagnoses	-0.370***	-0.279***	-0.306*	0.478**	-0.424	-0.105
	(0.05)	(0.05)	(0.17)	(0.24)	(0.27)	-0.34
Log(Income_mother	0.111	0.040	0.198	0.389	-0.052	-0.408
	(0.07)	(0.07)	(0.50)	(0.59)	(0.97)	-0.94
Log(Income_father	0.084	0.039	0.126	1.313**	1.726*	0.977
Family Observation	8,082	8,163	691	663	266	256
R^2	0.069	0.038	0.083	0.066	0.127	0.236

Note: Heteroscedasticity Robust Std. Err. In the parentheses

Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

Table A.E.3.d – Full Regression Outputs for A.E.3

	Sister-Sample 1		Sister-Sample 2		Sister-Sample 3	
	RR5		RR5		RR5	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
Birth Order	0.109***	0.012	0.018	0.029	0.049	-0.256
	(0.03)	(0.03)	(0.10)	(0.13)	(0.16)	(0.23)
Age_2010	0.084***	0.038***	0.094***	0.047	0.032	-0.035
	(0.01)	(0.01)	(0.03)	(0.04)	(0.06)	(0.09)
Diagnoses	-0.421***	-0.295***	-0.119	0.531**	-0.252	0.219
	(0.04)	(0.04)	(0.13)	(0.21)	(0.21)	(0.29)
Log(Income_mother	0.018	0.049	-0.009	-0.014	-0.549	-0.595
	(0.04)	(0.05)	(0.28)	(0.43)	(0.65)	(0.88)
Log(Income_father	0.149*	0.222**	0.182	0.716	0.493	0.505
	(0.08)	(0.09)	(0.31)	(0.45)	(0.52)	(0.85)
Family Observation	10,927	10,991	835	744	333	316
R^2	0.097	0.048	0.054	0.071	0.086	0.22

Note: Heteroscedasticity Robust Std. Err. In the parentheses

Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

Table A.E.8- FD Regression Output for Figure 5.2, (new Sister-Samples)

	Sister-Sample 1A		Sister-Sample 2A		Sister-Sample 3A	
	(2000-2005)		(2000-2005)		(2000-2005)	
	Event+3	Event+5	Event+3	Event+5	Event+3	Event+5
Birth Order	-0.105	-0.021	0.465	0.576**	0.537	1.453***
	(0.09)	(0.09)	(0.31)	(0.29)	(0.47)	(0.50)
Age_2010	0.021	0.029	0.199*	0.125	0.323**	0.399**
	(0.02)	(0.02)	(0.10)	(0.10)	(0.16)	(0.17)
Diagnoses	-0.035***	-0.034***	-0.053***	-0.053***	-0.069***	-0.032*
	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)
Log(Income_mother	0.374	0.223	-0.191	-0.286	-0.063	-3.101
	(0.24)	(0.23)	(1.06)	(0.97)	(1.82)	(1.97)
Log(Income_father	0.497*	0.313	-0.820	-1.157*	3.749**	2.421
	(0.28)	(0.27)	(0.65)	(0.60)	(1.74)	(1.78)
Family Observation	6,180	6,179	797	797	364	363
R^2	0.091	0.072	0.142	0.115	0.203	0.189

Note: Heteroscedasticity Robust Std. Err. In the parentheses

Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

Table A.E.9 – FD Regression Output for Table 5.5 – Outcome variable is the Logarithm of The Personal Income

	Sister-Sample 1		**Sister-Sample 2**		**Sister-Sample 3**	
	Log(Income)		Log(Income)		Log(Income)	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
Age	0.082***	0.041***	0.049***	0.035	0.040***	0.001
	(0.004)	(0.004)	(0.013)	(0.026)	(0.016)	(0.032)
Log(Income_mother)	-0.008	0.042	-0.03	0.171	-0.08	-0.314
	(0.226)	(0.032)	(0.139)	(0.310)	(0.134)	(0.280)
Log(Income_father)	0.025	0.034	-0.056	0.09	-0.079	0.024
	(0.044)	(0.044)	(0.139)	(0.303)	(0.135)	(0.351)
Diagnoses	-0.010	-0.040**	0.018	-0.041	-0.147***	-0.022
	(0.021)	(0.020)	(0.057)	(0.128)	(0.055)	(0.104)
Birth Order	0.080***	0.030**	0.035	0.028	0.015	-0.056
	(0.014)	(0.014)	(0.048)	(0.087)	(0.035)	(0.090)
Family Observation	11,910	12,029	1,054	1,004	372	371
R^2	0.202	0.06	0.103	0.05	0.2115	0.0911

Note: Heteroscedasticity Robust Std. Err. In the parentheses

Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

Table A.E.10 – Regression Output for Table 5.6 – Continuous Birth-Age Explanatory Variable

	Sister-Sample 1		**Sister-Sample 2**		**Sister-Sample 3**	
	Log(wage)		Log(Wage)		Log(Wage)	
	Event+5	Event+10	Event+5	Event+10	Event+5	Event+10
Diagnoses	-1.007***	-0.990***	-0.515	-0.824	-0.337	-0.520
	(0.12)	(0.13)	(0.50)	(0.64)	(0.68)	(0.76)
Birth Order	0.081	0.076	-0.482	-0.277	0.390	-0.368
	(0.08)	(0.08)	(0.35)	(0.39)	(0.49)	(0.58)
Age_2010	0.025	0.047**	-0.069	0.036	0.369*	-0.034
	(0.02)	(0.02)	(0.11)	(0.13)	(0.20)	(0.25)
Log(Income_mother)	-0.097	-0.086	0.277	0.309	0.026	-3.235*
	(0.12)	(0.12)	(0.89)	(1.26)	(1.56)	(1.77)
Log(Income_father)	0.691***	0.668***	-0.318	-0.260	-0.275	-2.257
	(0.25)	(0.25)	(1.17)	(1.46)	(1.76)	(2.25)
Family Observation	9,787	9,742	779	713	329	281
R^2	0.202	0.06	0.076	0.023	0.109	0.072

Note: Heteroscedasticity Robust Std. Err. In the parentheses

Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark

Table A.E.11 – Regression Output for Table 5.7 – Education as Outcome Variable

	Sister-Sample 1		**Sister-Sample 2**		**Sister-Sample 3**	
	OLS	FD	OLS	FD	OLS	FD
Diagnoses	-0.165***	0.009	-0.365***	-0.044	-0.052	-0.088
	(0.04)	(0.03)	(0.10)	(0.08)	(0.15)	(0.11)

Birth Order	-0.042***	-0.006	-0.084**	0.053	-0.017	0.068
	(0.01)	(0.02)	(0.04)	(0.07)	(0.05)	(0.10)
Age_2010	-0.019***	-0.009	0.015	-0.009	-0.038	-0.037
	(0.00)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
Log(Income_mother)	0.282***	0.045	0.519***	-0.109	0.359***	-0.067
	(0.01)	(0.04)	(0.06)	(0.21)	(0.09)	(0.31)
Log(Income_father)	0.715***	0.064	0.442***	0.019	0.276***	-0.101
	(0.03)	(0.07)	(0.07)	(0.18)	(0.09)	(0.32)
Stable	0.042		0.055		-0.109	
	(0.03)		(0.08)		(0.13)	
Immigrant	0.304***		0.471***		0.194	
	(0.07)		(0.16)		(0.26)	
Constant	2.041***		1.505		6.740***	
	(0.40)		(1.30)		(1.93)	
Observation	19,816	9,941	1,764	882	654	327
R^2	0.076	0.023	0.088	0.023	0.109	0.072

Note: Heteroscedasticity Robust Std. Err. In the parentheses, Baseline: Region Capital

Significant levels: 10% (*), 5% (**), 1% (***), **Source:** Statistics Denmark