# The Effect of School Start on Women's Labor Force Participation in Norway



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#### **Preface**

My paper is written in cooperation with the Business School at The University of Stavanger. The problem for discussion was constructed as a part of a research on how Norwegian welfare, family and educational policies could give children better and similar opportunities in their education and work lives. I would like to thank the project leader Mari Rege and the project administrator Åse Lea for the opportunity to write a paper on this subject, it has been both interesting and educational. In addition I would like to give a great thanks to my supervisors, Venke F. Haaland and Mari Rege, for all the help, support and feedback during this period of writing.

#### **Abstract**

In 1997 the Norwegian government implemented a large primary school reform, Reform 97, making it mandatory for all children to start school at the age of six and attend primary school for ten years. Using Norwegian registry data, I investigate the effect of the change in school starting age on mothers' labor force participation. I estimate a difference-in-difference model which exploits differences in mothers' exposure to the reform, using the introduction of it as a natural experiment. Only when dividing the sample into mothers with and without younger children, I found significant positive estimates and then only on mothers with younger children, indicating that these mothers worked more due to the introduction of the reform.

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#### 1 Introduction

Female labor force participation in Norway has expanded rapidly during the last decades. 30 years ago, under half of the Norwegian female were working or looking for work<sup>1</sup>. Compared to the United States, where 50 percent of women between the ages of 25-54 years were working in 1970, the amount was almost the same. By 2008 this share had increased to 75 percent in the United States<sup>2</sup> and by 2009 more than 85 percent of women between the ages of 25-54 years were working in Norway. Today, compared to ten years ago, fewer women work part-time, but still, 41 percent of employed women in Norway are only part-time employed.

At the same time, the number of children in the kindergartens has increased considerably. In 1975 a little above 30 000 children in Norway had a place at a day care center. By 2009 this amount had increased to over 270 000 children from the age of 0 to the age of 6. For children between the age of 1 and 5 the coverage was 88.5 percent<sup>3</sup>. This shows that the dramatic increase in female labor force participation has changed the way young children are being raised. During this time period, a law that changed the school starting age (Reform 97) was adopted and from 1997 and beyond children started school at the age of six instead of seven. A school day for young children (in 1<sup>st</sup> to 4<sup>th</sup> grade) is about 4 hours, which adds up to 20 hours a week. Compared to children in the kindergartens, where almost <sup>3</sup>/<sub>4</sub> are being supervised by someone else than their parents at least 33 hours each week, school children need more supervision from their parents if they don't attend other day care programs besides school.

It is unclear whether the change in the school starting age affected mothers' labor force participation. A full-time employee in Norway works almost 40 hours each week, leaving their children in 1<sup>st</sup> to 4<sup>th</sup> grade with almost 20 hours of unsupervised care if they don't have someone to look after them. The Norwegian schools are required to offer some kind of after school care program to these children; this program is financed through state and municipal grants and fees from the parents. In addition, the Norwegian school system is characterized by extensive homework assignments and the after school care program has been criticized for its low level of quality due to low staff-student ratio and lack of staff qualifications. The effect

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<sup>1</sup> Statistics Norway: www.ssb.no

<sup>&</sup>lt;sup>2</sup> OECD Labor Market Statistics: stats.oecd.org

<sup>&</sup>lt;sup>3</sup> Statistics Norway: www.ssb.no

on maternal labor supply, therefore most likely depends on how parents see this program as a substitute to their own care (Becker, 1981) and what other options the parents may have<sup>4</sup>. If parents have access to high quality day care programs, their children might improve their outcomes (Blau and Currie, 2004) in relation to what they would have if they were to stay at home with one of their parents. However, if the alternative is unsupervised care at home, children would learn less discipline and could have less self-confidence (stated by Brooks, Hair and Zaslow, 2001) than if they were supervised either by their parents or adults at other day care alternatives. It is also the case that if the mother is working, this most likely is going to increase the family income, and these increased family resources could help children in their development (Becker and Tomes, 1986; Blau, 1999; Dahl and Lochner, 2009). There are a lot of questions concerning the welfare of young children that might affect maternal labor supply either in a positive or in a negative way, so there is no clear conclusion on this matter.

My research focuses on figuring out if and how the school starting of young children affects their mothers' labor force participation. I study a unique, natural experiment, which changed the school starting age in Norway from seven to six year olds and increased the mandatory schooling for young children from nine to ten years. The reform, Reform 97, applied to all children born in 1991 or later, which started school at the age of six the school year of 1997/98 and my main focus is: did this reform change the amount of full-time employment among mothers from 1997 onwards.

In my analysis I needed data on the mothers and their children. Here I use data from an extensive and longitudinal register database with annual records of every person in Norway from 1992 – 2003 (FD-Trygd). I focus on the years from 1994 – 1999 since this is the years prior to and post the introduction of the reform. In my main analysis, I identified 613 751 mothers with six children or less where the oldest child was from three to six years old. Depending on the age of the child, the mothers' labor force participation may be affected by the introduction of the reform.

I estimate a difference-in-difference model which exploits the differences in mothers' exposure to Reform 97. My identification is mothers with children in different cohorts (children aged 3, 4, 5 and 6) in the different years (1994, 1995, 1996, 1997, 1998 and 1999).

<sup>&</sup>lt;sup>4</sup> Some children might have grandparents or other people who are able to look after them while their parents are at work or otherwise unable to look after them.

In my main analysis and in my robustness and specification analysis I found no evidence that the reform affected maternal labor force participation; there is no clear pattern in the estimates that could make me draw this conclusion. In my first subsample analysis, when taking maternal education into account, the results stay the same; still no clear pattern that could indicate that Reform 97 had any effect on maternal labor supply. When considering the fact that younger children might affect their mothers' labor force participation, however, I found results that could indicate that mothers with more than one child increased their labor supply due to the introduction of the reform, presented in the other subsample analysis, and this pattern is still visible when focusing on full- or part-time employment.

The reminder of this paper is organized as follows: In Section 2 I will be discussing existing literature concerning this subject. In Section 3 I present the institutional background, with institutional differences and how things are in Norway first in Section 3.1, Reform 97 and its background in Section 3.2 and other family reforms in Section 3.3. Section 4 presents the labor supply theory and the hypotheses I am going to test in this paper. Section 5 gives the data and sample description and in Section 6 I describe the empirical strategy I am going to follow. Section 7 presents my empirical results, with the descriptive results first in Section 7.1, main results in Section 7.2, robustness and specification analysis in Section 7.3 and subsample analysis concerning the mothers' educational level and younger children in Section 7.4. Section 8 concludes the paper.

#### 2 Existing Literature

Studies concerning how school enrollment for young children affects their mothers' labor force participation are somewhat limited, and are normally concentrated on how school enrollment of young children affects maternal labor force participation in the United States. The main findings are that children's school enrollment has a positive effect on mothers' labor supply (Gelbach, 2002; Cascio, 2007); inducing mothers to work more as their children enroll in school.

Gelbach's study "Public Schooling for Young Children and Maternal Labor Supply" from 2002 uses 1980 Census data to estimate the effect of public school enrollment for a woman's five year old on measures of labor supply and public assistance receipt. In the United States, the parents may choose to hold their children back a year or enroll them in private schools, Gelbach deals with this choice by using five year olds quarter of birth (QoB) variables as instruments for public school enrollment status<sup>5</sup>. The result from this study provide significant estimates that public school enrollment has a substantial effect on maternal labor supply. Gelbach found that among single women whose youngest child was five, free public schooling for the five year old increased labor supply measures by 6 – 24 percent while reducing public assistance receipt by 10 percent. Among single mothers with both a five year old and a younger child, he found that the estimates imply no significant impact of public school enrollment for the five year old. When it comes to married mothers of five year olds, he estimated the effect to between 6 and 15 percent increase in labor supply measures, with little variation whether the mother also had a younger child.

In her study Cascio (2007) found similar effects as Gelbach (2002) among single mothers whose youngest child was five, but did not find any affect among neither married mothers nor mothers who also had a younger child, regardless of marital status. She found that four out of ten single mothers with no younger children than the five year old entered the workforce when the five year old enrolled in public school. In her study she uses data from five Censuses<sup>6</sup> to predict labor supply among mothers of five year olds in a difference-in-difference framework using variation across states and over time in kindergarten supply.

<sup>&</sup>lt;sup>5</sup> This because parent's ability to enroll a child in public kindergarten in the academic year when the child turns five typically depends on the calendar date of the child's birth.

<sup>&</sup>lt;sup>6</sup> From the 1950 to 1990 Decennial Census Public-Use Microdata Samples (PUMS).

Public schools do not only serve to provide children with valuable skills they need but they do also provide parents with a subsidy of their care. There is a significant variation across countries in the generosity of this subsidy. For instance<sup>7</sup>, in France and Sweden, young children are eligible to attend preschools at a low to no-cost. In these two countries the public education is highly integrated with the female labor market, with no additional costs of childcare if both the mother and the father choose to work.

Both studies mentioned above concerns the United States and how children in the US affect their mothers' labor supply. Historically, the public schooling in the United States begun at the age of five on a half-day basis, but in the recent years this has changed. Now, some of the American schools have introduced full-day kindergartens and pre-kindergarten programs for children under the age of five (Cascio, 2007). In Norway, however, the young children still attend school only on a half-day basis, and other childcare alternatives are therefore needed if both parents are to work full-time<sup>8</sup>. These kinds of childcare alternatives often costs money, and therefore the role childcare cost play on maternal labor supply must be taken into account.

There are a lot of studies concerning childcare costs and how this affects maternal labor supply (Blau and Robins, 1988 and 1989; Kimmel, 1998; Ribar, 1992; Conelly, 1992). Most of these studies have found evidence of a negative labor-supply response to child care prices among married mothers; as the price of child care increases women tend to reduce their labor supply to be able to provide the care their children need themselves.

In their study, Blau and Robins (1988) finds that both the decision to become employed and the decision to purchase market childcare are sensitive to childcare costs<sup>9</sup>. They find similar results in their study from 1989; that higher childcare costs lead to an increase in the rate of leaving employment and a reduction in the rate of entering it. Kimmel (1998) finds that child care prices affects mothers' employment decisions significantly, with single mothers exhibiting less responsiveness in their labor force participation behavior to child care price changes than married mothers.

<sup>&</sup>lt;sup>7</sup> Cascio (2007)

<sup>8</sup> Some children may have grandparents or other people that are able to look after them for free while their parents are at work, but for most children in Norway this is not the case.

<sup>&</sup>lt;sup>9</sup> Their empirical analysis is based on data from the 1980 baseline household survey of the Employment Opportunity Pilot Projects (EOPP).

Furthermore, some studies concerning child care and maternal labor supply emphasizes the fact that the mothers' education may impact her employment status. For instance, Heckman's study from 1974; "Shadow Prices, Market Wages, and Labor Supply" presents estimates that shows that the effect of education is to raise the offered wage more than the asking wage and the differences are significant. This means that the wage the women is offered in the labor market exceeds the wage she demands in order to work (her reservation wage), and this implies that ceteris paribus more educated women work more frequently, and work longer hours than less educated women.

Another study concerning mothers' educational level and the effect this has on maternal labor supply is Gronau (1973). Gronau found similar results as Heckman did in his study from 1974; that given the child's age, the effect of a child on his mother's value of time <sup>10</sup> is not uniform but varies with her education. Gronau found that education has a considerable effect on the women's value of household productivity: the shadow price of time of college graduates exceeds that of elementary school graduates, other things being equal, by 20 percent. He found that that the effect of children on the shadow price of time of mothers seemed to vary with both the child's age and the mother's education, meaning that mothers' education play a large role when looking at maternal labor supply.

It is also worth mentioning that family size has an impact on maternal labor supply and on this topic the literature is wide. There are hundreds of empirical studies reporting estimates of the relationship between family size and female labor supply and the vast majority of these studies find a negative correlation between the two (Angrist and Evans, 1998).

<sup>10</sup> And thereby if the wage she is offered in the market induces her to work or not.

#### 3 Institutional Background

#### 3.1 Institutional Differences and how things are in Norway

Most of the literature in the previous section is concentrated on the United States and how the children affect their mothers' labor supply there. In Norway, the school system is a little bit different from the US; today young children in 1<sup>st</sup> to 4<sup>th</sup> grade (children aged six to nine) attend school for four hours each day, which adds up to twenty hours a week. In comparison, a workweek for a full-time employee in Norway is almost forty hours. If both parents shall be able to work full-time (or work more than 20 hours a week) they need some kind of childcare during the hours they work which exceeds the hours their children attend school; every hour both parents work in the market which exceeds the hours their children attend school, requires one additional hour of care by someone else<sup>11</sup>. Many parents in Norway use an after schools care program (SFO) where their children are being supervised while they are at work or otherwise unable to look after them.

The after school care program (SFO) in Norway is publicly subsidized, but parents that choose to use this program must pay a fee and the amount depends on how many hours a week the child attends. An example is the municipality of Time<sup>12</sup> where the after school care program (SFO) costs about USD 450<sup>13</sup> a month if your child is to be there all day, both before and after the school day (from 07.30 to 16.00). In comparison, in the same municipality as mentioned, it costs at most USD 430<sup>14</sup> a month to have your child in kindergarten on a full-time basis (5 days a week).

The after school care program in Norway (SFO) provides the children with the opportunity of playing with each other under adult supervision, but has been criticized for its lack of scholastic focus due to low staff-student ratio and lack of staff qualifications. In addition, the Norwegian school system is characterized by extensive homework assignments<sup>15</sup>; so many parents (especially mothers) may feel compelled to work only part-time or not at all in order to help their children with their homework.

<sup>11</sup> Blau and Robbins (1988)

<sup>&</sup>lt;sup>12</sup> Municipality of Time: www.time.kommune.no

<sup>&</sup>lt;sup>13</sup> NOK 2 460, exchange rate: 5.4

<sup>&</sup>lt;sup>14</sup> NOK 2 330, exchange rate: 5.4

<sup>15</sup> Bettinger, Hægeland and Rege (2011)

#### 3.2 Reform 97 and its background

9<sup>th</sup> of September 1994 the Norwegian government adapted a new law that lowered the school starting age in Norway to the year the children turned six<sup>16</sup>. Previously the school starting age had been the year the children turned seven and the mandatory schooling up until this point had been nine years (from seven year olds to sixteen year olds). This also changed with the new law<sup>17</sup>, and mandatory schooling in Norway was increased to ten years (from six year olds to sixteen year olds). When this law entered into force the children had not just a right but a duty to attend primary school for ten years starting the year they turned six. The 23<sup>rd</sup> of June 1995 it was decided that the law from 1994 would apply from 1<sup>st</sup> of July 1997<sup>18</sup>.

Up until the law was passed in 1994 there had been several attempts and reports trying to figure out how best to provide six year olds with the education they needed. Starting in 1986 there was conducted an experience with six year olds in 42 (of 431<sup>19</sup>) of the municipalities in Norway which included 100 kindergartens, 100 schools and 1 500 children<sup>20</sup>. The experiment looked at three different models and tried to sort out the best of them, the models were<sup>21</sup>:

- An offer to the six year olds given in the kindergarten
- An offer to the six year olds given in the school
- An offer to the six year olds given in a cooperation between the kindergarten and the school

The experiment did not give any clear answers, and the debate on where children should start their education, what they should learn and how they should learn it continued up until the law was adapted in 1994.

One important reasoning<sup>22</sup> for implementing Reform 97 was that if children started school at a younger age, this would counteract the effects of differences in learning ability and learning will which came as a result of different growth conditions and social background. For instance, immigrant children would be secured a Norwegian speaking environment and adjusted training one year prior to if they were to start school at the age of seven. In addition,

<sup>17</sup> No. 58 of 1994

<sup>&</sup>lt;sup>16</sup> NOU 1995: 18

<sup>&</sup>lt;sup>18</sup> NOU 1995; 18

<sup>&</sup>lt;sup>19</sup> In 2006 there were 431 municipalities in Norway; St.meld. no. 12 (2006 – 2007)

<sup>&</sup>lt;sup>20</sup> NOU 2010: 8

<sup>&</sup>lt;sup>21</sup> NOU 2003: 16

<sup>&</sup>lt;sup>22</sup> NOU 2003: 16

the fact that Reform 97 was mandatory secured that all children were covered by the reform unlike school preparation actions in the kindergartens, which only applied to children in the kindergartens. It was also stated that an educational program that was mandatory would provide the best opportunities for continuity and coherence of the content from the age of six onwards, leaving all children from the age of six with the same possibilities of learning.

The implementation of Reform 97 first entered into force the school year of 1997/98<sup>23</sup>, making it mandatory for all children turning six in 1997 to start school in August this year. From August 1997 all children started school in 1<sup>st</sup> grade the year they turned six and finished in 10<sup>th</sup> grade the year they turned sixteen. This affected all children born in 1991 or later, through that they had to start school one year prior to children born before 1991 and attend primary school for ten years.

In addition to changing the school starting age and the years of mandatory schooling, Reform 97 also implemented a new curriculum, L97<sup>24</sup>. One condition for implementing school starting age to six year olds were that 1<sup>st</sup> grade should be characterized by kindergarten education, meaning that it should be introduced more varied methods of learning, like projects and other student controlled activities in the primary school training. Because of this, preschool teachers were able to teach in 1<sup>st</sup> grade and, with one additional year of relevant education also in 2<sup>nd</sup> to 4<sup>th</sup> grade.

When the law was passed in 1994, 42 percent<sup>25</sup> of the municipalities in Norway already had some kind of offer to the six year olds, and in the years leading up to 1997 this share increased regularly. Even if the six year olds used the school facilities in their education, the participation was voluntary and the children did not account as students in the school they attended before 1997<sup>26</sup>. It was up to the parents and the child if the six year old were to attend this program and "start" school at the age of six. In the fall of 1997 the program became mandatory and the entire cohort of six year olds (61 500) started school and the new curriculum, L97, was introduced in the primary school, the high school and the adult education.

<sup>&</sup>lt;sup>23</sup> NOU 2010: 8

<sup>&</sup>lt;sup>24</sup> NOU 2010: 8, NOU 2003: 16 and Guidelines and brochures 14.11.1996 published by the Ministry of Education and Research (in Norwegian: Kirke-, utdannings- og forskningsdepartementet).

<sup>&</sup>lt;sup>26</sup> Some schools called this 0. grade and, some called it 6-year group.

Reform 97 did not only affect the schools, it also led to changes in the kindergartens<sup>27</sup>. The age composition changed since the six year olds now were transferred to the schools, which opened up day care places in the kindergartens and gave room for younger children. The kindergartens had to take this into consideration and both a new kindergarten law and the first National Curriculum ever for kindergartens entered into force in 1996.

With reform 97 there also came changes in the after school care program (SFO)<sup>28</sup>, now the primary school had a responsibility concerning children's environment and to give children aged six to nine an offer of care and supervision both before the school day started and after it ended, if children and parents wanted to. Through the Education Acts<sup>29</sup> § 13-7 all municipalities are imposed to offer some kind of after school care program, but the capacity and availability is not closer defined. Since children older than nine are not eligible to attend the after school care program, this could be seen as if that they are old enough to take care of themselves and can therefore not be used as a control group when looking at if mothers' labor supply were affected by their children starting school.

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<sup>&</sup>lt;sup>27</sup> NOU 2010: 8

<sup>&</sup>lt;sup>28</sup> NOU 2003: 16

<sup>&</sup>lt;sup>29</sup> In Norwegian: Opplæringsloven

#### 3.3 Other Family Reforms

During the 1980s and 1990s the Norwegian government implemented several work-family related policies other than the school reform of 97. In particular, there was a large extension in paid parental leave between 1986 and 1993. In 1986, the paid parental leave was 18 weeks, but during the years until 1993 it increased to 42 weeks; several increases had been performed during these years, for instance in 1988 it was 22 weeks, in 1991 it was 32 weeks and in 1992 it were increased to 35 weeks before it finally stopped increasing in 1993 and ended up at 42 weeks. In 1993, there was also introduced a paternity quota of four weeks; of the 42 weeks of paid parental leave, four week was now reserved for the father.

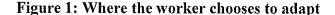
Studies concerning the extension of paid parental leave and the introduction of the paternity quota, presents convincing evidence that these reforms affected mothers' and fathers' labor force participation (Caneiro, Løken and Salvanes, 2009; Rege and Solli, 2010). However, this reform were introduced at least three years prior to the introduction of Reform 97 and affected parents of younger children than the ones who were to start school at the age of six in 1997.

Furthermore, in August 1998 there were introduced a Cash-for-Care allowance, which was given to parents who did not utilize publicly subsidized day care programs, like kindergartens. Any family with a one or two year old child could claim this allowance. Kornstad and Thoresen (2007) found that the home care allowance reduced the mothers in the target group's market work by approximately 9 percent.

In both cases described above, the mothers of children aged three to six years old may have younger children and therefore be affected through these. This I have taken into account in my robustness analysis in Section 7.3.1 where I include number of children. In Section 7.3.2 I also look at how mothers' labor force participation is affected when focusing on the age of a youngest child between the age of three and six years old (and between six and nine years old). Furthermore, in Section 7.4.2 I perform a subsample analysis where I divide the sample between mothers with younger children and those without younger children than the one mentioned by their age in the regressions.

#### 4 Labor Supply Theory and Hypotheses

According to labor supply theory individuals seek to maximize their well-being by consuming goods (and/or services) and spending time on household production (and/or leisure<sup>30</sup>) (Borjas, 2010). Each and everyone must decide whether to work and, once employed how many hours to devote to the job. Most people are not independently wealthy and must therefore work in order to earn money required to by the goods and services that makes life more enjoyable. The tradeoff here is clear: A person who doesn't work can spend a lot of time on household production, but have to get by without the goods or services he or she wants to consume. However, people who do work, will be able to afford at least some of these goods and services, but must give up time spent on household production. A model that helps explain this relationship, and gives an example on one worker's preferences for consumption of goods and services versus time spent on household production represented by an utility function (see Equation (1) below), is illustrated in Figure 1<sup>31</sup>.



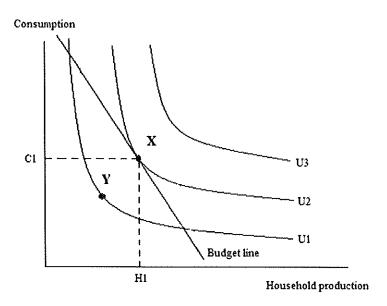


Figure 1: A utility-maximizing worker chooses the consumption-household production bundle given by point X, where the indifference curve is tangent to the budget line, giving her H1 hours of household production and a consumption of C1.

<sup>30</sup> Hereafter only referred to as household production since the main part of the time spent in the home by mothers is on household production, and the hours spent sleeping can be seen as in addition to the time represented in the model (a person cannot work in the market or in the household when he/she is sleeping and therefore we can ignore the hours spent sleeping in the models in this section).

<sup>&</sup>lt;sup>31</sup> The utility function and thereby the tradeoff between consumption of goods and services is unique for every worker and therefore the indifference curves for different workers are never the same, because of this, this is only an example on how one worker's preferences over consumption of goods and services versus household production will look like.

The optimal consumption of goods and services versus time spent on household production for a worker is constrained by her time and by her income, represented by the budget line<sup>32</sup> illustrated in Figure 1 above. A worker will adapt where the budget line is tangent with one of her indifference curves, like point X in Figure 1, giving her the highest possible utility she can achieve given her indifference curves and budget line. At point X, her hours spent on household production will be H1, leaving her hours spent working to be a total of hours spent awake, let's call this amount T, less her hours spent on household production (H1), T-H1, and, her consumption of goods and services to be C1.

However, not all people choose to work and the decision whether or not to be employed boils down to a simple question: Are the "terms of trade" – the rate of which household production can be traded for additional consumption – sufficiently attractive to get the worker into entering the labor market?

As mothers get children or something happens in their children's lives, like a change in the school starting age, it might be that the mothers' indifference curves change as a result, because they might want to spend more time at home with their children or they can now use more time in the labor market. The indifference curves could change if the mother faces a utility function like this:

(1) 
$$U = u(C, H; N) = C^{a}H^{(1-a)} + Nf(H)$$

where

C = Consumption of goods and services

H = Time spent on household production

N = Number of children/something happening in the child's life/ the

introduction of a new reform, like Reform 97

a = A positive number that describes the workers preferences

f(H) = A function of H which can either be positive or negative

The utility function described here, does not change the indifference curves if nothing happens to the child that affects the mother to change her labor force participation, or if the

<sup>32</sup> The budget line is given by the equation: C = wh + V, where w is the wage for each hour worked, h is the number of hours worked and V is the nonlabor income.

introduction of a reform, like Reform 97 does not induce her to work more or less, or if she don't have any children, because N would then be zero. If for instance the mother changes her labor supply when her child starts school, N could be a dummy variable with the value one if the child attend school and the value zero otherwise. Then the change in this mother's indifference curves is represented by the term f(H). This represents that the effect is a function of time spend on household production and this term could either be negative or positive, depending on this mothers' preferences and if the change in the child's life makes her want to spend more or less time on household production, i.e. at home instead of in the labor market. If some mothers seem to change their work force participation due to the introduction of Reform 97, this can be explained by the fact that the variable N in the equation above then takes the value one for these mothers when the reform is being introduced, which changes their indifference curves and with this their reservation wage and hours of work due to the term Nf(H) in the utility function. This does however not mean that these mothers' preferences change, preferences are constant and does never change, but in their utility function they have a term that takes the value f(H) when something happens, like the introduction of a reform, when N=1, see Equation (1) above.



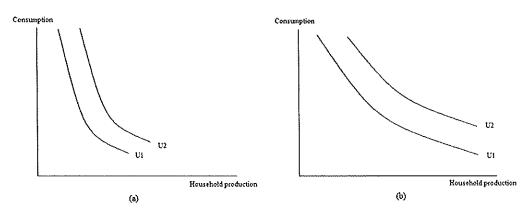


Figure 2: (a) The indifference curves to the left are relatively steep, indicating that the mother requires a substantial wage in order to give up an additional hour of household production. (b) The ones to the right are relatively flat, indicating that the mother attaches a much lower value to her time spent on household production.

If the mother is working or not boils down to how her utility function and, thereby her indifference curve, and budget line looks like. In other words, if the mother choose to work or not and, in the case of working how many hours to devote to the job, depends on her preferences for consumption of goods and services versus her preferences for household

production; if she prefers to spend most of her time on household production, meaning that she requires a substantial wage in order to give up an additional hour of this, her indifference curves would be relatively steep (like the ones in figure (a) above), meaning that her reservation wage is relatively high. If however she attaches a lower value to her time spent on household production, her indifference curves would be flatter (like the ones in figure (b) above), meaning that her reservation wage would be lower than in the first case and, with the same budget line in the two graphs, the mother in figure (b) would work more than the mother in figure (a).

Section 2 "Existing Literature" presented several studies about how children affect their mothers' labor force participation. To summarize the main findings in previous literature there were two studies concerning the effect school starting of young children had on their mothers' labor supply; Gelbach (2002) and Cascio (2007). Gelbach (2002) found significant estimates showing that free public schooling for five year olds increased mothers' labor supply measures with between 6 and 24 percent, depending on marital status and the age of the youngest child. For single mothers with both a five year old and a younger child, he found no significant estimates on the impact. In relation to labor supply theory this means that the indifference curves of married mothers both with and without younger children than the five year old and the indifference curves of single mothers with a five year old as their youngest child gets flatter when their five year old child starts school; the term f(H) in their utility function kicks in due to a change in N from zero to one. This means that the reservation wage decreases and their labor supply increases as the results from Gelbach's paper from 2002 suggests. That the indifference curves gets flatter and the reservation wage decreases means the wage the mother needs in order to give up an additional hour of household production is less than before, and thereby her hours working in the marked increases<sup>33</sup>. As her child starts school, the mother does not need to stay at home to take care of this child anymore and, can instead use this time in the labor market; she shifts time and effort from household production to the labor market. This is shown in Figure 3 by the new adapting point Y, where her time spent on household production decreases from H1 (household production in the old adapting point, point X) to H2 (household production in the new adapting point, point Y). With this decrease in household production comes a corresponding increase in time spent in the labor market, which leads to an increase in consumption from C1 to C2 due to increased earnings.

<sup>&</sup>lt;sup>33</sup> If the mothers' reservation wages increases, her hours working in the market decreases, making the indifference curves steeper.

Cascio's findings in her study from 2007 are similar to what Gelbach found in his among single mothers whose youngest child is five, but she did not find any affect neither among married mothers nor mothers who also has a younger child. This means that the indifference curves gets flatter and the reservation wage decreases among single mothers whose youngest child is five; as their youngest child starts school, they get more spear time due to less childcare performed by themselves and could therefore shift time and effort from household production to the labor market and earn more money to buy required goods and services, as shown in Figure 3 below. Cascio found no effect on married mothers where the youngest child was either five years old or younger or on single mothers whose youngest child was younger than five's indifference curves or reservation wage. One explanation for mothers with younger children not changing their labor supply is that even though the five year old starts school, they have younger children who still need care and are therefore not able to increase their participation in the labor market. When it comes to married mothers they have husbands that might be able to provide for both them and their children, so the mothers can use their time at home on household production even when not having any younger children to care for at home.

Figure 3: Different indifference curves with and without free public schooling for five year olds

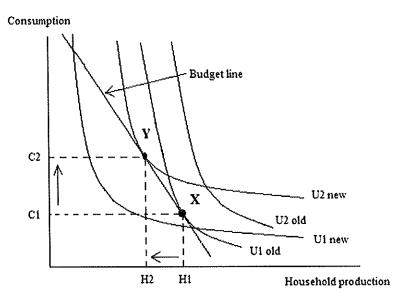


Figure 3: U1/U2 old represents one affected mother's indifference curves if her five year old were not able to attend school and U1/U2 new represents the mother's indifference curves if her five year olds were able to attend school and she has a utility function with the term Nf(H) that changes her indifference curves when the five year old starts school, when N=1. The mother then adapts in point Y instead of point X (which was the old adapting point). Hours spent on household production decreases from H1 to H2, increasing hours spent in the labor market. Consumption thereby increases from C1 to C2.

The two studies mentioned above, Gelbach (2002) and Cascio (2007) raises the first hypothesis I am going to test about Reform 97 in this paper:

**Hypothesis 1:** The change in the school starting age in Norway induced mothers of six year olds to increase their labor force participation

The second topic discussed in section 2 "Existing Literature" was that childcare costs play a large role on maternal labor supply. Most studies concerning this relationship have found evidence of a negative labor-supply response to child care prices among married mothers. There are also studies indicating that single mothers exhibit less responsiveness in their labor force participation behavior to child care prices than married mothers (Kimmel, 1998). In addition, the Norwegian school system is characterized by extensive homework assignments and the after school care program has been criticized for its low level of quality due to low staff-student ratio and lack of staff qualifications<sup>34</sup>. As a result of both the cost of care, the extensive homework assignments and the low level of quality of the after school care program, mothers might want to stay at home with their children or only work part-time in order to save money on childcare they can perform themselves since the after school care program (SFO) in Norway costs just as much as a kindergarten place<sup>35</sup> and/or in order to help their children with their homework. All the factors affecting maternal labor supply here induces the mothers to reduce their labor supply. According to labor supply theory, this means that the term Nf(H) in Equation (1) also kicks in here, just in the opposite direction as described above, making the indifference curves steeper, indicating that the mothers need more wage in order to work the same amount of time as before; the value they place on their time increases, represented by an increase in their reservation wage<sup>36</sup>. This change in the indifference curves is illustrated by the new adapting point, Y, in Figure 4 on the next page.

The relationship between the cost of childcare and maternal labor supply leads to the second hypothesis I am going to test about Reform 97 in this paper:

**Hypothesis 2:** The change in the school starting age in Norway induced mothers of six year olds to reduce their labor force participation

<sup>36</sup> Which is a measure on the value the mothers place on their time.

 <sup>&</sup>lt;sup>34</sup> See Section 3.1 "Institutional Differences and how things are in Norway".
 <sup>35</sup> See Section 3.1 "Institutional Differences and how things are in Norway".

Figure 4: Different indifference curves depending on the cost of care

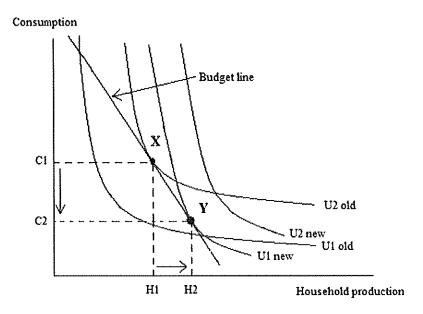


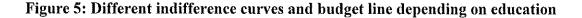
Figure 4: U1/U2 old represents one affected mother's indifference curves without childcare cost of sending her child too school and U1/U2 new represents the mother's indifference curves when it costs money to have children in school on a full-day basis and she faces a utility function like the one described in Equation (1). The mother then adapts in point Y instead of point X (which was the old adapting point). Hours spent on household production increases from H1 to H2, decreasing hours spent in the labor market. Consumption thereby decreases from C1 to C2.

Some studies also emphasize the effect mothers' education has on their labor supply, for instance Heckman (1974) and Gronau (1973). Heckman (1974) found that more educated women work more frequently and work longer hours than less educated women. Gronau found that education has a considerable effect on the women's value of household productivity: the shadow price of time<sup>37</sup> of college graduates exceeds that of elementary school graduates, other things being equal, by over 20 percent. More educated women also tend to receive higher wages than less educated women (Heckman, 1974) and thereby according to labor supply theory more educated women faces a different set of indifference curves<sup>38</sup> and a different budget line<sup>39</sup> than less educated women, see example in Figure 5. This means that the effect can go either way; mothers with more education can either be more or less affected than less educated mothers, according to the shape of the indifference curves and the slope of the budget line.

<sup>39</sup> Because of higher offered wage.

<sup>&</sup>lt;sup>37</sup> Her asking wage or reservation wage.

<sup>38</sup> Because of higher reservation/asking wage.



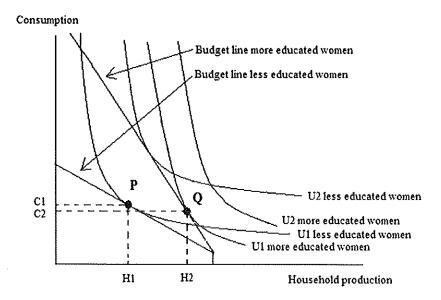


Figure 5: One mother with more education adapts in point Q, giving her a consumption of C2 and household production of H2, while one mother with less education adapts in point P giving her a consumption of C1 and household production of H1. This means that the more educated woman in this case spend more time on household production and less time in the labor market than the less educated woman, spending almost the same amount on consumption.

The connection between education and maternal labor supply, leads to the third hypothesis I am going to test about Reform 97 in this paper:

## Hypothesis 3: The change in the school starting age in Norway affected mothers of six year olds labor force participation different according to their educational level

The last thing mentioned in section 2 "Existing Literature" was how family size affects female labor supply. Many studies concerning this relationship reports a negative correlation between the two (Angrist and Evans, 1998), meaning that as more children is born in a family, the mother tend to reduce her labor supply. According to labor supply theory, this affects the indifference curves to get steeper, indicating that the mother now needs higher wage in order to work in the labor market instead of spending time on household production; her reservation wage increases. This relationship however, is more concentrated around the birth of children and not on children starting school, which can be thought of as twenty hours free childcare a week, and therefore the mother may have more spear time to use in the labor market when her child starts school. This is however not the case for mothers with younger children, since they must take care of their younger children no matter if their oldest are enrolled in school. When

Reform 97 were introduced, six year olds started school which opened up daycare places in the kindergartens. These "new" daycare places could now be given to the mothers' younger children and therefore induce them to shift time and effort from household production to the labor market. This change could also apply to mothers with a child younger than six years old as their oldest, for instance a child aged either four or five, by now being able to send either this child or their younger children to the kindergarten. According to labor supply theory, mothers with more than one child will then react similar to the mothers described in the beginning of this section concerning children starting school and increase their labor supply as their reservation wage decreases, due to the term Nf(H) in Equation (1) making the indifference curves flatter as illustrated in Figure 3.

This leads me to the last hypothesis I am going to test about Reform 97 in this paper, concerning the effect more than one child have on maternal labor supply:

Hypothesis 4: The change in school starting age in Norway induced mothers with more than one child to increase their labor force participation

#### 5 Data and Sample Description

In this paper I look particularly at the effect Reform 97, and the year the school starting age changed from seven to six year olds had on mothers' labor supply. My main focus is on full-time employment, i.e. mothers who work 30 hours or more each week, but I will also be looking at full- or part-time employment, i.e. mothers who work 4 hours or more each week and total pension income.

In my empirical analysis I use register data provided by Statistics Norway, called "FD-Trygd". This database contains a number of different variables with information about every person in Norway from 1992 to 2003. There are individual demographic variables (birth date, gender, number of siblings, marital status, immigration status, number of children), socioeconomic variables (income, education, public transfer, pension, wealth, municipality of residence) and current employment status (full-time, part-time, minor part-time, self-employed).

The information in "FD-Trygd" is obtained from different administrative records, and the data are usually per time. In some of the records, the data are put together and provide information continuously through time periods, for instance over a year. The data in this database are collected and contains information from these sources<sup>40</sup>:

- NAV<sup>41</sup>
- Tax reports<sup>42</sup>
- and other records in Statistics Norway

As mentioned above, the dataset originally consists of records of every person in Norway from 1992 to 2003. First, I start by sorting out the women with children, i.e. the mothers. When I have done this, I exclude the mothers who have more than six children; mothers with seven children or more are becoming more and more rare, and they also tend to be completely out of the labor force, see Table 1 below, and therefore I exclude them from the sample.

<sup>40</sup> Statistics Norway: http://www.ssb.no/mikrodata/

<sup>&</sup>lt;sup>41</sup> Formerly known as National Social Insurance (in Norwegian: Rikstrygdeverket) and Employment Services (in Norwegian: Aetat).

<sup>&</sup>lt;sup>42</sup> In Norwegian: Skattedirektoratet

Table 1: How much mothers work in relation to how many children they have

#### Workforce participation

	Not Working	Minor Part- Time	Part-Time	Full-Time	Total
1	665 476	188 235	166 759	694 020	1 714 490
2	742 509	328 425	312 570	806 384	2 189 888
3	349 238	158 529	123 841	214 506	846 114
4	78 470	26 543	15 760	23 060	143 833
5	15 850	3 233	1 498	2 087	22 668
6	3 869	467	218	232	4 786
7	1 261	96	33	44	1 434
8	512	37	12	8	569
9	243	15	5	7	270
10	106	6	2	5	119
11	37	4	-	_	41
12	22	2			24
13		<u></u>	-	-	3
Total	1 857 596	705 592	620 698	1 740 353	4 924 239

Table 1: Shows how much mothers work in relation to how many children they have<sup>43</sup>.

Number of children

Then, I restrict my sample to include the mothers who has an *oldest*<sup>44</sup> child aged three, four, five or six years old, to ensure that no mother in the control group is treated through an older child. In addition, I expect that it is when the oldest child starts school that the mothers adjust their labor supply. I restrict my sample to mothers of three to six year olds in order to get a clean comparison group. Older children than six year olds are also affected by the SFO program which came as a result of the introduction of Reform 97 and thereby not a good comparison group. In addition, mothers of younger children than three year olds are affected by other reforms like the introduction of the Cash-for-Care allowance and the change in parental leave.

Third, since the reform was introduced in 1997, I restrict the sample to include the years from 1994 to 1999. This because 1994 was three years prior to the introduction of Reform 97, and

<sup>&</sup>lt;sup>43</sup> The table only shows mothers who has an oldest child aged 16 years old or less, since older children are unlikely to affect maternal labor supply, the entire sample period (i.e. the years from 1992 until 2003).

<sup>&</sup>lt;sup>44</sup> In the specification analysis in Section 7.3.2 when controlling for the age of the youngest child I restrict my sample to include mothers who has a youngest child aged three, four, five or six years old and in Appendix Table 3, I restrict my sample to include mothers with a youngest child aged six, seven, eight or nine years old.

the likelihood of parents of three year olds in 1994 adjusting their labor supply to the fact that their children are to start school at the age of six instead of seven at this time is small. Furthermore, in 1999 the reform has been in force for three years (1997, 1998 and 1999) and therefore I should be able to see some kind of pattern from 1997 to 1999 if the reform affected mothers' labor supply.

Other studies concerning children and maternal labor supply divides the sample into married and single mothers (Gelbach, 2002; Cascio, 2007; Kimmel, 1998). In my sample almost 80 percent of the women are either married or living together with the father of at least one of their children and for the rest of the mothers the marital status is not given. Because of this, I choose to not divide my sample into married and single mothers, since a large part of the mothers are married or living together with the father of at least one of their children and I do not know how many of the other mothers that are married to someone else than their children's father since the variable used to explore this don't contains information about their marital status.

Finally, the dataset I ended up with consists of 613 751 mothers, distributed as follows:

Figure 6: Distribution of mothers with six children or less with their oldest child aged three to six years old from 1994 to 1999

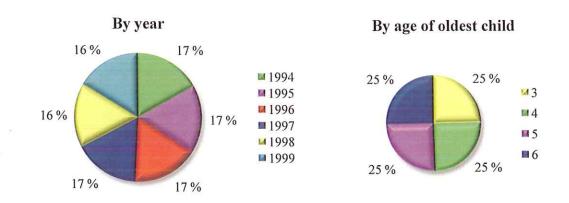


Figure 6: Distribution of mothers in the sample by year and by age of oldest child

#### Outcome variable

My main focus is as mentioned full-time employment, and in this context I am going to use a dummy variable with the value 1 if the mother is full-time employed, i.e. if the mother works 30 hours or more each week, and 0 if not, as the outcome variable. In the beginning of this

section I also mentioned that I am going to be looking at full- or part-time employment, and when doing this my outcome variable will still be a dummy variable, but will now take the value 1 if the mother is full- or part-time employed and 0 if not, i.e. 1 if the mother works 4 hours or more each week and 0 if she doesn't. None of these measures will capture self-employed mothers, since the variable I use to create these dummy variables in "FD-Trygd" does not have a value or has the value 0 if the mother is self-employed. Therefore self-employed mothers will fall in under the same category as the ones that don't work, and the dummy variable for self-employed mothers will take the value 0 in all cases.

I also mentioned that I will be looking at the mothers' total pension income when trying to figure out if school staring of children affects their mothers' labor supply. Here my outcome variable will be total pension income measured in NOK 100<sup>45</sup> and not log (total pension income) because there are many mothers that go in and out of the labor force and therefore there are many zero earners, and the value using log (total pension income) will therefore be too high in many cases.

#### Control variables

In my main analysis, I use year and age (of oldest child) fixed effects as control variables.

Additionally, I include several covariates in my robustness analysis. These variables include:

 Mother characteristics: number of younger children, age of birth of first child and dummy variable for educational level (not completed high school, high school degree, university degree)

Summary statistics of all observations of mothers in my sample are presented in Table 2 on the next page. Mothers in my sample are on average 26 years old when having their first child. 42.4 percent of all mothers in the sample have not completed high school, 36.9 percent have a high school degree and 20.7 percent have a university degree. The mothers have on average got 1.7 children.

-

<sup>&</sup>lt;sup>45</sup> NOK 100 is equal to approximately USD 20

Table 2: Summary Statistics
Means (and standard deviations)

Outcome variables	
Mothers working full-time	0,348 (0,001)
Mothers working 4 hours or more each week	0,597 (0,001)
Control variables	
Mother's age of birth of first child	26,016 (0,006)
Number of children	1,722 (0,001)
Age of oldest child	4,512 (0,001)
Age of youngest child	2,581 (0,002)
Mothers number of years in school	12,592 (0,004)
Mother not completed high school Mother high school degree Mother college degree	0,424 0,369 0,207
N (observations)	613 751

#### 6 Empirical Strategy

To estimate the effect of Reform 97 and the change in school starting age of children on mothers' labor supply, I focus on mothers' employment status. Earlier studies have used employment and hours worked last week (Gelbach, 2002; Cascio, 2007) when examining if and how school starting of children affected their mothers' labor supply. In addition, Gelbach (2002) also use employment, weeks of work and usual weekly hours in 1979 and 1979 wage and salary income in his study "Public Schooling for Young Children and Maternal Labor Supply" when investigating the effect.

As mentioned in Section 5 "Data and Sample Description" my main focus is *full-time* employment and the age of the mothers' *oldest* child. I focus on the age of the oldest child because I assume that it is when this child starts school that the mother adjusts her labor supply to a normal status for her. In my specification analysis, I will do a regression where I focus on the mothers' youngest child, to see if the results are the same when focusing on these children as when focusing on the age of the oldest.

As mentioned I use the mothers' employment status, and thereby hours of work. My main focus is on full-time employment, i.e. mothers who work 30 hours or more each week, to see if school starting of the children at the age of six reduced (or increased) the amount mothers being full-time employed<sup>46</sup>.

When looking at the difference in employment status between mothers of children of various ages after a reform has been introduced relative to before, the best approach is a difference-in-difference estimate. A difference-in-difference approach is usually implemented by comparing the difference in average behavior before and after the reform for the eligible group with the before and after behavior for the comparison group. In my study I am going to use the introduction of Reform 97 as a natural experiment in a difference-in-difference approach to measure if and how the change in school starting age affected mothers' labor supply. A natural experiment approach attempts to find a naturally occurring comparison

<sup>&</sup>lt;sup>46</sup> I will also look at full- or part-time employment, i.e. mothers who work 4 hours or more each week, and see if the amount of mothers working full- or part-time were reduced (or increased) due to the change in children's school starting age.

group that can mimic the properties of the control group in the properly designed experiment<sup>47</sup>.

The difference-in-difference approach measures the average effect of the treatment on the treated by removing unobservable individual effects and common macro effects by relying on two critical identifying assumptions<sup>48</sup>:

- 1. Common time effects across groups
- 2. No systematic composition changes within each group

This means that trends in the groups are the same and that the only thing that is changing across time is the treatment.

The school starting age changed from seven to six year olds in 1997, therefore I start by looking at the difference in full-time employment between mothers of children aged five and six in 1996 and 1997. The difference-in-difference coefficient then looks like:

(2) 
$$\eta_{6,1997} = (FT_{6,1997} - FT_{5,1997}) - (FT_{6,1996} - FT_{5,1996})$$

where  $FT_{a,y}$  is a dummy variable indicating full-time employment<sup>49</sup> in year y when the mother's child is a year old. The first term  $(FT_{6,1997} - FT_{5,1997})$  measures the difference in full-time employment between mothers of five and six year olds in 1997 and the second term  $(FT_{6,1996} - FT_{5,1996})$  measures the corresponding difference, measured in 1996.

This difference-in-difference coefficient identifies the effect on the mothers' labor force participation of the school reform and the change in school starting age. If the difference-in-difference coefficient for mothers of six year olds in 1997 ( $\eta_{6,1997}$ ) are negative (positive) this means that mothers of six year olds work less (more) relative to mothers of five year olds in 1997 than they did in 1996, and if this is the case this could indicate that Reform 97 had an effect on maternal labor supply.

As mentioned above, there are two identifying assumptions that must be satisfied if the difference-in-difference coefficients are not to be biased. Relative to the equation above the

<sup>&</sup>lt;sup>47</sup> Blundell and Costa Dias (2009)

<sup>48</sup> Blundell and Costa Dias (2009) and Borjas (2010)

<sup>&</sup>lt;sup>49</sup> I.e. working 30 hours or more each week.

first assumption (i) common time effects across groups means that the time trend of mothers of six year old's labor force participation would be the same absent the primary school reform, as the time trend in labor force participation of mothers of five year olds. The second assumption (ii) no systematic composition changes within each group means that there is nothing systematic, other than the reform, that makes mothers of children aged five or six start or stop working full-time in this period. These kinds of systematic composition changes could for instance be that mothers of five year olds in 1997 on average have more education than mothers of five year olds in 1996, which could make them react different to Reform 97.

The coefficient above looks at mothers of six year olds relative to mothers of five year olds in 1996 and 1997, but since the reform was passed as a law in 1994, mothers of five year olds in 1996 already knew that their children were to start school the next year, and they might adjust their labor supply thereafter already in 1996. Because of this, it might be other explanations for a positive or negative coefficient in the difference-in-difference approach (2) and not that this is a result from Reform 97. To get a constant time trend, and thereby be able to derive any results from the coefficient to come from the reform, I choose to expand the sample to include more mothers, and I do so by including mothers of children aged three to six years old in the years from 1994 to 1999<sup>50</sup>. In the rest of this empirical strategy I follow the empirical approach of Rege and Solli from their paper "The Impact of Paternity Leave on Father Involvement" from 2010 closely and I use the same notation as they used in their study.

When including a bigger selection of mothers the difference-in-difference coefficient will look like:

(3) 
$$\eta_{a,y} = (FT_{a,y} - FT_{control\ age,y}) - (FT_{a,control\ year} - FT_{control\ age,\ control\ year})$$

Here, there are no given reference group, and thereby the control age and control year is not decided. I have chosen to set the reference group to mothers of three year olds in 1994, because the law deciding that children were to start school at the age of six was passed in September 1994 and the implementation date was not set until June 1995 and I therefore assume that mothers in 1994 had not started adjusting to the new school starting age, and 1994 will therefore work as a control year. Furthermore, when it comes to the reference age of

<sup>&</sup>lt;sup>50</sup> See discussion in Section 5 " Data and Sample Description".

children, I choose to set these to mothers of three year olds as mentioned. When the child is three, there is still three year until he or she starts school, and the possibility of the mother having started adjusting her labor supply to the school starting of her child at this time is small. In addition, the likelihood of her job situation has come back to normal after having her first child when this child is three years old is bigger than if this child were younger<sup>51</sup>.

When including a bigger selection of mothers and the control age and year in the differencein-difference approach, the estimates will look like:

(4) 
$$\eta_{a,y} = (FT_{a,y} - FT_{3,y}) - (FT_{a,1994} - FT_{3,1994})$$
 where  $y = 1994, 1995, ..., 1999$   
 $a = 3, 4, ..., 6$ 

where the first term  $(FT_{a,y} - FT_{3,y})$  measures the difference in full-time employment among mothers of children aged a and children aged 3, in a given year, y. The term  $(FT_{a,1994} - FT_{3,1994})$  measures the corresponding difference, measured in 1994. If treated mothers (mothers of six year olds from 1997 and beyond) work less (more) than mothers in the comparison group (mothers of three year olds) compared to the difference in 1994, my difference-in-difference estimate,  $\eta_{a,y}$ , for mothers of six year olds from 1997 onwards will be negative (positive).

In order to find the difference-in-difference-coefficient,  $\eta_{a,y}$ , I use the following regression:

(5) 
$$FT_{iay} = \alpha + \gamma_y Y_y + \delta_a A_a + \eta_{a,y} (Y_y * A_a) + \beta X_{iy} + \epsilon_{iay}$$

where:

 $FT_{iay}$  = Full-time employment of mother i of a (oldest) child aged a (a = 3, 4, ..., 6) in year y (y = 1994, 1995, ..., 1999)

 $\alpha$  = Constant

 $Y_v = Year dummy variable$ 

 $\gamma_y$  = Coefficient on year dummy variable

 $A_a = Age dummy variable$ 

 $\delta_a$  = Coefficient on age dummy variable

 $\eta_{a,y}$  = The difference-in-difference-coefficient

<sup>&</sup>lt;sup>51</sup> For further reasons see the discussion on why I only include mothers with an oldest child aged three, four, five or six year olds under Section 5 "Data and Sample Description".

 $X_{iy}$  = Vector of characteristics in year y (y = 1994, 1995, ..., 1999) on mother i

 $\beta$  = Coefficient on mothers characteristics

 $\varepsilon_{iay}$  = Error term for mother i of a (oldest) child aged a (a = 3, 4, ..., 6) in year y (y = 1994, 1995, ..., 1999)

There might be changes in employment status of mothers from year to year and this also depends on the child's age, and therefore I include age of the oldest child and year dummy variables in the regression to extract the year and age fixed effects, captured by  $\gamma_y$  and  $\delta_a$ . In the robustness analysis in Section 7.3.1 I also include the covariates mentioned in Section 5 "Data and Sample Description"; number of younger children, the mothers' age of birth of the first child and dummy variable for educational level, to ensure that there are no systematic composition changes within each group. If the estimates change a lot when including these covariates, this could indicate that the second identifying assumption<sup>52</sup> does not hold. The effects of the covariates described above on maternal employment are visible through the coefficient  $\beta$  in Equation (5).

When including more covariates I must keep in mind that the covariates might be endogenous, which means that they are correlated with the error term and affected by the dependent variable. In a regression there can't be any endogenous variables since the effect on these will get picked up by the error term as well as the coefficient on the variable in the regression. This could potentially affect my covariates, and I might therefore not be able to use them in the robustness analysis. When it comes to the educational level and the mothers' age when having her first child, the likelihood of these being affected by Reform 97 is not big, since the mothers of these children gave birth to their first born before they knew that Reform 97 would enter into force and change the school starting age from seven to six years old and as for their educational level the possibility of children's age when starting school affecting their mothers' years of schooling is rather small. When it comes to number of younger children this could potentially be affected by Reform 97, in the way that many women get an additional child when their first born starts school, to be able to stay at home and help and support their child in school activities. When reducing the school starting age with one year, younger children might be born one year prior to what was originally the plan, and therefore mothers of six year olds might have one additional younger child than they would have if the

<sup>52 &</sup>quot;No systematic composition changes within each group"

school starting age was seven years old. But in relation to mothers of seven year olds they would have the same amount of younger children since it is only the year the child is born that potentially could be affected and not the number of children the parents have. This means that none of the covariates presented in Section 5 is endogenous and I can therefore use them in the robustness analysis.

The coefficient of interest in Equation (5) is captured by the matrix  $\eta_{a,y}$ , which measures the incremental change in full-time employment for mothers of children of a given age, a, compared to mothers of three year olds in a given year, y, compared to the same difference measured in 1994. If the change in school starting age had a negative (or positive) effect on maternal employment, this should be identified by a pattern associated with treated or non-treated mothers in the estimates of  $\eta_{a,y}$ . In the matrix for the results from the regression I should be able to see significant negative (or positive) coefficients corresponding to the dark shaded cells in the table below but no significant coefficient corresponding to the white cells in this table (the mothers represented in these cells have children who are to start school at the age of six, but not jet), especially not in the cells with the number 7 (since the mothers represented in these cells are untreated), if Reform 97 had any impact on maternal labor supply.

Table 3: School starting age of children from 3 to 6 years old in 1994 to 1999

Age/Year	1994	1995	1996	1997	1998	1999
3	6	6	6	6	6	6
4	7	6	6	6	6	6
5	7	7	6	6	6	6
6	7	7	7	6	6	6

Table 3: The numbers in the different cells are when children of various ages starts school and the dark shaded cells represent the year the children start their education, i.e. the number 6 in the cell 1994/3 represents that children who are three years old in 1994 will start school at the age of six. The dark shaded cells 1997/6, 1998/6 and 1999/6 represents that these children have started school.

If there are to be significant coefficients in any of the cells representing non-treated mothers (the cells with the number 7 in Table 3), this will be a violation of my identifying assumption; that time trends in full-time employment are similar for mothers of children aged three to six years old absent the reform.

## 7 Empirical Results

## 7.1 Descriptive Results

Before presenting the difference-in-difference coefficients, I am going to look at the descriptive results. Table 4 below shows the amount of mothers that are full-time employed depending on the year and the age of their oldest child, for example, the number 0.3487135 in cell 1996/4 means that about 35 percent of mothers of four year olds were full-time employed in 1996.

Table 4: Summary Statistics of full-time employment among mothers by age of their oldest child and year

### Year

	1994	1995	1996	1997	1998	1999
3	0,3441982	0,3519529	0,3519932	0,3582696	0,3603128	0,344331
	(0,4751151)	(0,4775887)	(0,4776015)	(0,4795017)	(0,4801008)	(0,4751591)
4	0,339704	0,3453096	0,3487135	0,3528253	0,3631951	0,3439245
•	(0,4736177)	(0,4754781)	(0,4765724)	(0,4778585)	(0,4809301)	(4750258)
5	0,3319735	0,3412546	0,3498623	0,3589684	0,3614864	0,3546245
	(0,4709306)	(0,4741396)	(0,4769353)	(0,4797073)	(0,4804407)	(0,478409)
6	0,3212998	0,3371106	0,343512	0,3485973	0,3583479	0,3402173
	(0,4669848)	(0,4727321)	(0,4748895)	(0,4765352)	(0,4795244)	(0,4737916)

Table 4: Summary statistics, amount of full-time employed mothers divided into year and age of the *oldest* child, standard deviation in parenthesis.

As shown in Table 4 there are no big changes in the amount of full-time employed mothers in any of the years for any age of the children; the amount of full-time employed mothers range from little above 32 percent for mothers of six year olds in 1994 to about 36.3 percent for mothers of four year olds in 1998.

When looking at the numbers in Table 4, it does not seem like Reform 97 had any effect on maternal labor supply since it seem to have been an even increase in the amount of full-time employed mothers the years from 1994 to 1998. The numbers in 1999 shows a little decrease

from 1998 for mothers of children of all ages in the sample. The increase from 1994 to 1998 seems to have happened for all mothers in the sample, and not just for mothers of six year olds who were affected by the introduction of Reform 97. In addition, there were not any big changes in the amount of full-time employed mothers from 1996 to 1997 when the six year olds started school, either for mothers of six year olds or for mothers of children in the other age cohorts. Figure 7 show the same development:

Figure 7: Development in full-time employment of mothers of three, four, five and six year olds from 1994 to 1999

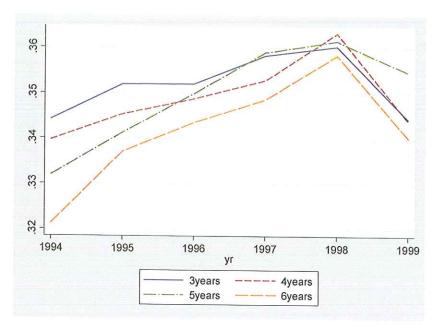


Figure 7: Graph that shows the development in the amount of full-time employed mothers who had an oldest child aged three, four, five or six years old from 1992 to 2003.

The graph in Figure 7 show the development in the amount of full-time employed mothers of three, four, five and six year olds the years from 1994 until 1999. There has, as mentioned above and shown in the graph here, been an even increase in the amount of full-time employed mothers up until 1998, but in 1998 it seems like something happened in the labor market that induced mothers of children of all ages to reduce their labor force participation.

As shown in the graph (and in Table 4), there are no big changes in the amount of full-time employed mothers of six year olds in 1997, when Reform 97 entered into force, relative to mothers of children in the other age cohorts. As a matter of fact, the development of full-time employed mothers look rather similar to each other for mothers of children of all ages the entire period in question, with no bigger spacing than little above 2 percent, which occurred

between mothers of three and mothers of six year olds in 1994. The big change in the development seems to have come in 1998, but this change affected full-time employed mothers of children of all ages and did not increase the distance in labor supply between mothers of children in the different age cohorts.

When it comes to the decrease in the amount of full-time employed mothers in 1999 this could come from the fact that the cash for care subsidy was introduced in 1998, and the mothers represented in the graph above could have younger children who were affected by this reform. Bettinger, Hægeland and Rege (2011) and Kornstad and Thoresen (2007) both documented a negative effect of the Cash-for-Care program on mothers' labor supply. One other explanation could be that the unemployment had fallen from 1993 to 1998 with almost 3 percent, but in 1998 it stopped falling and started increasing again<sup>53</sup>. I am not going to devote any more time into figuring out which, if any of these, resulted in the decrease in maternal labor supply in 1999.

Had Reform 97 changed mothers' labor supply there most likely would have been a change in the graph in Figure 7 and the numbers in Table 4 from 1996 to 1997 when the reform entered into force. In addition, this change would most likely only apply to mothers of six year olds, since this particular reform only applied to six year olds. Because of this and the fact that the increase seems to have been just as large for mothers of children in the other age cohorts the likelihood of Reform 97 have affected maternal labor force participation is not big.

However, it is not easy to detect small changes in summary statistics, and therefore I am going to examine the hypothesis from Section 4 "Labor Supply Theory and Hypotheses" and try to uncover if Reform 97 had any effect on maternal labor supply using the empirical strategy described in Section 6 in the following empirical results.

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<sup>53</sup> Statistics Norway: http://www.ssb.no/arbeid/

## 7.2 Main Results

If Reform 97 changed mothers' labor supply I expect to see significant results, either positive, i.e. mothers increased their labor supply, or negative, i.e. mothers reduced their labor supply, in the difference-in-difference coefficients representing mothers of six year olds from 1997 onwards (treated mothers) and no significant results in the cells corresponding to the untreated mothers (mothers of four and five year olds as well as mothers of six year olds prior to the introduction of the reform).

In Table 5 below I present the ordinary least square (OLS) estimates of the difference-in-difference-coefficients ( $\eta_{a,y}$ ), standard errors are presented in parentheses. Table 5 shows how mothers of children between the age of four and six changed their labor supply relative to mothers of children aged three in the years from 1995 to 1999 compared to the same difference in 1994. Included in the regression are vectors for year and age dummy variables,  $Y_y$  and  $A_a$ , where  $\gamma_y$  and  $\delta_a$  captures the year and age fixed effects, see Equation (5) in Section 6 "Empirical Strategy".

Table 5: Incremental effect on full-time employment among mothers by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
3	-	-	_		_	_
4		-0.0021	0.0012	-0.0010	0.0074	0.0041
	16 6 E E	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
5	-	0.0015	0.0101+	0.0129*	0.0134*	0.0225**
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
6		0.0081	0.0144*	0.0132*	0.0209**	0.0188**
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)

Table 5: The table shows the incremental effect on full-time employment among mothers by age of their oldest child and year. No. of observations: 613 751. Adjusted  $R^2 = 0.000$ . Mean full-time employed mothers: 0,348. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

The difference-in-difference coefficients ( $\eta_{a,y}$ ) presented in the table above shows how much more (+) or less (-) mothers of children aged a (a = 4, 5 or 6) worked compared to mothers of three year olds in year y (y = 1995, 1996, 1997, 1998 or 1999) than they did in 1994. To

illustrate;  $\eta_{5,1997} = 0.0129*$  in the cell 1997/5 measures the difference in full-time employment of mothers of children aged five relative to mothers of children aged three in 1997, less the same difference measured in 1994, like this<sup>54</sup>:

(6) 
$$\eta_{5,1997} = (FT_{5,1997} - FT_{3,1997}) - (FT_{5,1994} - FT_{3,1994})$$

where FT represent full-time employment. Further, the signs behind some of the coefficients in the table, +, \* and \*\*, means that the coefficient in that cell are significantly different from zero on, respectively, a 10, 5 and 1 percent significance level.

Table 5 does not only reveal significant results on the mothers' labor force participation from the year the school starting age changed from seven to six years old, in 1997, but also in other cells. There are significant changes in eight of the fifteen cells in the table, but none that shows a clear pattern that Reform 97 had any effect on mothers' labor force participation. The difference-in-difference-coefficients are positive and significant for mothers of children aged five and six in the years from 1996 to 1999, so it seems like the change is coming in 1996 and affected mothers of five year olds as well as mothers of six year olds and induced them to work more relative to mothers of three year olds than they did in 1994. The coefficients are small and not significantly different from zero in the cells corresponding to mothers of four year olds the entire period in question as well as for mothers of five and six year olds in 1995.

Even though the change is not only for mothers of six year olds, this could have something to do with the introduction of the reform. As the reform was introduced all the six year olds started school and there were freed child care places in the kindergartens that previously had been taken by the six year olds. This could potentially affect mothers of four and five year olds to get kindergarten places for their young ones and therefore be able to increase their amount of work in the market. This means that Reform 97 could have an effect on mothers with younger children than six year olds' labor supply; it could induce them to work more due to the school starting of six year olds, which gave room for younger children in the kindergartens.

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 $<sup>^{54}\,\</sup>eta_{5.1997} = (0,3589684 - 0,3582696) - (0,3319735 - 0,3441982) = 0,0129$ 

This could explain why mothers worked more from 1997 onwards, when the six year olds were enrolled in school instead of kindergarten, however, it does not explain the significant results in 1996. It was decided in June 1995 that the school starting age was to be lowered to six year olds in 1997, so it could be the case that parents already in 1996 had started adjusting their labor supply towards the school starting of their children. If this is the case, the significant coefficients in 1996 in Table 5 could come from the introduction of the reform. This is however doubtful, since mothers of six year olds in 1996 also increased their labor supply; there are significant results showing that mothers of six year olds in 1996 worked more compared to mothers of three year olds than they did in 1994. Mothers of six year olds in 1996 were not affected by the reform at all since their children were to start school at the age of seven in 1997; they are untreated. This means that the results here provide evidence that could mean that mothers' labor force participation were affected by something else than the reform.

From the table above there are no clear results indicating that mothers' labor supply were affected by the introduction of the reform. The table yields positive significant estimates for mothers of five and six year olds from 1996 onwards, meaning that mothers of five and six year olds worked more from 1996 until 1999 compared to mothers of three year olds, than they did in 1994. In relation to the two hypothesis described in Section 4 "Labor Supply Theory and Hypotheses" that are relevant here (1) *The change in the school starting age in Norway induced mothers of six year olds to increase their labor force participation* and (2) *The change in the school starting age in Norway induced mothers of six year olds to reduce their labor force participation* the results presented in Table 5 does not seem to be consistent with either one of them.

In relation to the theory described in Section 4 "Labor Supply Theory and Hypotheses", this means that it does not seem like these mothers' utility function include the term Nf(H) presented in Equation (1), where N changes from zero to one as Reform 97 is being introduced. This means that the indifference curves does not change due to the introduction of the reform and, therefore the reservation wage and the employment status (hours worked) stay the same. The results presented here, however, fits better with the results presented in Section 7.1 "Descriptive Results"; it does not seem like Reform 97 had any effect on maternal labor force participation.

As mentioned previously I will also investigate how the reform affected full- or part-time employment and earnings. In the case concerning full- or part-time employment there were significant results in four of the fifteen cells, but none that shows any clear pattern that the reform affected mothers' labor supply, see Appendix Table 1. When looking at earnings the results were consistent with Table 5 and showed significant estimates in all the same cells except in the ones for mothers of five year olds in 1997 and 1998 where the estimates were still positive, but not significantly different from zero, see Appendix Table 2.

## 7.3 Robustness and Specification Analyses

## 7.3.1 Robustness Analysis

One of the identifying assumptions in my difference-in-difference approach is that time trends in full-time employment of mothers of children between the age of three and six would have been similar absent the reform. The fact that I do observe significant difference-in-difference-coefficients on the amount of full-time employed mothers in Table 5 both prior to the introduction of the reform (in 1996) and for mothers of children not affected by the reform (five year olds), do not support this assumption. The positive coefficients concerning mothers of five year olds could come from the fact that they have started adjusting their labor supply towards the school starting of their children in a year, so this could come as a result of the reform. However, mothers of children aged six in 1996 are not affected in any way (they are untreated); their children are to start school at the age of seven in 1997, and therefore the assumption about common time effects across groups are not satisfied here. This means that time trends are not similar for all mothers represented in the table, but vary with the age of their child and the year in question.

As mentioned in Section 6 about empirical strategy, the estimates in the main analysis can be biased; they could either be too high or too low, meaning that there could be systematic composition changes within each group. If the mothers in the different cells in the table are different, for instance, all mothers of children aged five in 1997 have much more education than mothers of children aged five in 1996, they could respond different to changes in the labor market or the introduction of a new reform.

In the analysis above, the main analysis, I included age of the oldest child and the year fixed effects in the regression. To get a more robust analysis I have to include more covariates and see if this changes the difference-in-difference coefficients. In this regression I am going to use the variables specified in Section 5 "Data and Sample Description" under control variables; number of younger children, the mothers' age of birth of the first child and dummy variable for educational level (including one dummy for completed high school and one for having a college degree, leaving the omitted variable to be those who haven't finished high school). In this regression I use the same model as described in Section 6 "Empirical Strategy", but here I include the variables presented above in the regression as covariates.

Table 6: Incremental effect on full-time employment among mothers by age of their oldest child, year, number of younger children, the mothers' age of birth of the first child and dummy variable for educational level

### Year

		1994	1995	1996	1997	1998	1999
	3	-	**	-	_	-	_
age	4		-0.0049	-0.0006	0.0002	0.0077	0.0043
0			(0.006)	(0.006)	(0.006)	(0,006)	(0.006)
	5	-	0.0009	0.0079	0.0134*	0.0161**	0.0246**
ز			(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
	6		0.0052	0.0123*	0.0119*	0.0219**	0.0223**
			(0.006)	(0.006)	(0.006)	(0.006)	(0.006)

Table 6: The table shows the incremental effect on full-time employment among mothers by age of the oldest child, year, number of younger children, the mothers' age at birth of first child and dummy variables for completed high school or college. No. of observations: 613 751. Adjusted  $R^2 = 0.078$ . Mean full-time employed mothers: 0.348. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

In relation to the main analysis, the changes in the difference-in-difference estimates are not big (no more than 0.0035). This means that by including more control variables the effects on full-time employment did not change much and this indicate that it doesn't exist systematic composition changes within each group<sup>55</sup>.

With the exception of the amount of mothers of five year olds in 1996 who were full-time employed there are no differences in which estimates that are significantly different from zero in the main analysis, Table 5, and in the robustness analysis, Table 6. This means that by including more control variables in the main regression the effect of Reform 97 on maternal labor supply does not change; there is still no clear pattern in the regression that indicates that it seems like Reform 97 had any effect on maternal labor force participation. The fact that the results for mothers of five year olds in 1996 are no longer significantly different from zero, but the results for mothers of six year olds this year still are, indicates that the increase in maternal labor supply does not come from the introduction of the reform, but it seems like there are other explanations for this increase.

<sup>55</sup> The same is the case for if mothers are working full- or part-time, i.e. working 4 hours or more each week.

In relation to the theory described in Section 4 "Labor Supply Theory and Hypotheses", the same applies here as in the main analysis in Section 7.2; the mothers' utility function does not seem to include the term Nf(H) described in Equation (1), where N changes from zero to one when Reform 97 is put into action and the school starting age changes from seven to six year olds. This means as described above, that it does not seem like the reservation wage or the hours worked each week changes as a result of the introduction of the reform since the indifference curves does not change due to the term Nf(H). When looking at the hypotheses described in Section 4 "Labor Supply Theory and Hypotheses", the same two applies here as in the main analysis: (1) The change in the school starting age in Norway induced mothers of six year olds to increase their labor force participation and (2) The change in the school starting age in Norway induced mothers of six year olds to reduce their labor force participation, but here, as in the main analysis, the results does not seem to be consistent with either one of them.

## 7.3.2 Specification Analysis

Up until now and for the remainder of this paper, I focus the age of the oldest child as an independent variable<sup>56</sup>. Instead I could be focusing on the age of the *youngest* child like Gelbach (2002) does in his study. When looking at the age of the youngest child the possibility of the mother having older children in school already is bigger and, this older child/these older children can either help the younger child with his or her homework or they could need help from their parents themselves, depending on how old they are and what level they are at in school. This means that by having older children in school the parents could either have more or less to do, depending on the older children. In this section I am going to be looking at the age of the youngest child instead of the oldest, the rest of the regression are the same as in the main analysis.

When looking at the age of the youngest child, there is also a possibility of the mothers of three, four and five year olds having older children at the age of six who are affected by the reform, and therefore the mothers here could be treated through an older child. The sample includes mothers who has a youngest child aged three, four, five and six, the rest of the

<sup>&</sup>lt;sup>56</sup> I explain why in Section 5 "Data and Sample Description".

sample is equal to what was described in Section 5 "Data and Sample Description", and consists of 773 500 mothers<sup>57</sup>.

Table 7: Incremental effect on full-time employment among mothers by age of their youngest child and year

Year

	1994	1995	1996	1997	1998	1999
3	-	-	-		-	_
4		0.0037	0.0029	0.0074	0.0077	0.0194**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
5	-	0.0011	0.0015	0.0043	0.0082	0.0277**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
6		0.0046	-0.0061	-0.0035	0.0025	0.0197**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.005)

Table 7: The table shows the incremental effect on full-time employment among mothers by age of their *youngest* child and year. No. of observations: 773 500. Adjusted  $R^2 = 0.002$ . Mean full-time employed mothers: 0,343. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

When looking at the age of the mothers' *youngest* child, the results are the same as in the main analysis; it does not seem like Reform 97 affected the labor supply of mothers of children between the age of four and six years old relative to those of children aged three, see Table 7. From 1998 to 1999 something happened with the mothers who have a youngest child aged four, five or six; they increased their labor supply, as shown in the estimates in Table 7, relative to mothers of three year olds compared to the same difference in 1994. The estimates "jumped" with between 0.01 and 0.02 for mothers of four, five and six year olds from 1998 to 1999 and all the coefficients in 1999 are significantly different from zero. This could come as a result of the introduction of the Cash-for-Care allowance introduced in 1998 since there might now be more work for mothers with children not affected by this reform (mothers of children aged three or older), they might take over jobs from mothers of children who were affected; mothers of one and two year olds, and therefore they might increase their labor supply. I am not going to investigate this any further since this is a paper focusing on the introduction of Reform 97 and the effect of the Cash-for-Care allowance on mothers of

<sup>&</sup>lt;sup>57</sup> In the regression in Appendix Table 3 the sample includes the mothers who has a youngest child aged six, seven, eight or nine, the rest of the sample is equal to what was described in Section 5 "Data and Sample Description".

children not affected by the introduction of it needs much more attention than I can give it in this paper.

In Appendix Table 3 I have performed the same regression concerning mothers who have a youngest child between the age of six and nine in order to see if this affects maternal labor supply<sup>58</sup>. As mentioned above, mothers of children between the age of three and five could have older children who were affected by the reform. By performing the regression on mothers whose youngest child is between the age of six and nine, the possibility of them having older children who were affected by the reform the year in question disappears and the results show how the youngest child affects their mothers' labor supply. These difference-in-difference coefficients report significant negative estimates for six year olds in 1996, 1997 and 1998 in relation to nine year olds these years compared to the same difference in 1994. Since there are significant negative estimates prior to the introduction of the reform (for mothers if six year olds in 1996), that is for untreated mothers, I must also here conclude that there are no evidence indicating that Reform 97 affected maternal labor supply.

The main findings when looking at the age of the mothers' youngest child is the same as when looking at the age of her oldest child; it does not seem like Reform 97 affected maternal labor supply either in a positive or in a negative way. In relation to the theory described Section 4 "Labor Supply Theory and Hypotheses", the effects are the same as in the main analysis; the utility function does not seem to include the term Nf(H) and therefore there are no changes in the indifference curves, and thereby no changes in the reservation wage or the labor supply of mothers.

<sup>&</sup>lt;sup>58</sup> Here the sample consists of 523 869 mothers.

## 7.4 Subsample Analyses

## 7.4.1 Mothers' Educational Level

Women with different levels of education tend to react different on changes in the labor market or introductions of new reforms<sup>59</sup>, like Reform 97. Because of this I divide the sample into three main groups, divided as follows:

- College degree Mothers with more than 15 years of education (126 901 mothers)
- Completed high school Mothers with 13 to 15 years of education (226 739 mothers)
- Not completed high school Mothers with less than 13 years of education (260 111 mothers)

In the first table below, Table 8, I look at full-time employment among mothers who have a college degree, the second one, Table 9, I focus on full-time employment among those who have a high school degree and the last one, Table 10, I look at full-time employment among those who haven't finished high school.

Table 8: Incremental effect on full-time employment among mothers who have a College Degree by age of their oldest child and year

Υ	ea	11

	1994	1995	1996	1997	1998	1999
3	-	-	<del>-</del>	•••	_	_
4		-0.0028	0.0105	-0.0080 (0.014)	0.0271+	0.0195
5	*	-0.0038	0.0253+	0.0263+	(0.014) 0.0305*	(0.013) 0.0470**
6		(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
		(0.014)	-0.0045 (0.014)	-0.0161 (0.014)	(0.014)	(0.0113)

Table 8: The table shows the incremental effect on full-time employment among mothers who have a college degree by age of their oldest child and year. No. of observations:  $126\,901$ . Adjusted  $R^2=0.001$ . Mean full-time employed mothers: 0.486. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

<sup>&</sup>lt;sup>59</sup> See literature in Section 2 "Existing Literature" and discussion under Section 4 "Labor Supply Theory and Hypotheses".

Table 9: Incremental effect on full-time employment among mothers who have a High School Degree by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
3	-	-	-	_	-	-
4		-0.0058	0.0025	0.0051	0.0045	-0.0044
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
5	erc:	0.0092	0.0114	0.0179+	0.0225*	0.0236*
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
- 6	V.Anagista	0.0171+	0.0266**	0.0268**	0.0298**	0.0321**
		(0.010)	(0.010)	(0,010)	(0.010)	(0.010)

Table 9: The table shows the incremental effect on full-time employment among mothers who have a high school degree by age of their oldest child and year. No. of observations: 226 739. Adjusted  $R^2 = 0.001$ . Mean full-time employed mothers: 0,388. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

Table 10: Incremental effect on full-time employment among mothers who haven't finished High School by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
3	-	-	-	_	-	-
4		0.0000 (800.0)	-0.0053 (0.008)	-0.0001	0.0009	0.0061 (0.009)
5	<b>-</b>	0.0007 (0.008)	0.0041 (0.008)	0.0078 (0.008)	0.0039 (0.008)	0.0161+ (0.009)
6		0.0122 (0.008)	0.0119 (0.008)	0.0157+ (0.008)	0.0134 (0.008)	0.0157+ (0.008)

Table 10: The table shows the incremental effect on full-time employment among mothers who haven't finished high school by age of their oldest child and year. No. of observations:  $260\ 111$ . Adjusted  $R^2 = 0.000$ . Mean full-time employed mothers: 0.246. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

Mothers with a high school degree are where there are most significant estimates and thereby those who seem to be most affected by the age of their children and by the year, see Table 9; here mothers of children aged six work more all the years in question in relation to mothers of three year olds than they did in 1994, and all the results here are significantly different from

zero. When it comes to mothers of five year olds, they also work more compared to mothers of three year olds than they did in 1994, but here only the estimates for 1997, 1998 and 1999 are significant on at least a 10 percent level. For mothers of four year olds the estimates vary in relation to being positive or negative and here none of the estimates are significantly different from zero. As in the main analysis, the result here does not give any clear evidence that Reform 97 affected high school educated mothers' labor force participation; there are also here significant results prior to the introduction of the reform for mothers not affected by the reform (untreated mothers); mothers of six year olds in 1995 and 1996.

When it comes to college educated mothers, see Table 8, the results varies to a greater extent than for high school educated mothers with both negative and positive estimates for mothers of children of all ages. For mothers of five year olds there are positive and significant estimates from 1996 until 1999 indicating that these mothers work more than mothers of three year olds than in 1994. In addition it seem like mothers of all children in 1998 worked more compared to mothers of three year olds than they did in 1994, shown by significant estimates for mothers of children of all ages this year. For mothers of six year olds in 1995 there is also a significant coefficient, but this coefficient indicate that mothers of six year olds worked less than mothers of three year olds in 1995 compared to the same difference measured in 1994, this could come as a result of different things, but I will not devote any more time to figure out what it could be. Since it seems like mothers of five year olds are affected more than mothers of six year olds, this doesn't seem to be a result of Reform 97, since this reform mainly affected children at the age of six from 1997 onwards.

The last group is the mothers who haven't finished high school, see Table 10, i.e. those mothers with less than 13 years of education. The difference-in-difference estimates here are as for the college educated women; both positive and negative, but here not as many as for the college educated women are significantly different from zero. The ones who are significant here are the ones for mothers of five year olds in 1999 and mothers of six year olds in 1997 and 1999. This indicates that the changes for mothers without a high school degree have not affected many mothers, and the estimates do not provide any clear pattern that can be associated with the introduction of Reform 97. In addition when looking at the numbers in Table 10, I can see that the estimates of mothers of six year olds lie a little above 0.01 the entire period and I can't see any clear changes in the estimates in 1997 which indicates that Reform 97 affected maternal labor supply.

The fact that there is not an even increase in full-time employed mothers the years from 1995 until 1999 for college educated women, women without a high school degree or for mothers of four year olds with a high school degree can indicate that there aren't any common time trend here, in other words that the first identifying assumption is not fulfilled. For mothers of five and six year olds with a high school degree however, there is an even increase in labor force participation the years mentioned above, but since I have already mentioned that the possibility of this having to do with the reform is scant, this increase and the fact that it doesn't include mothers of four year olds suggests that this assumption is violated in this regression too.

When dividing the mothers into three groups depending on their educational level, there is no evidence in any of the groups that they are affected by the introduction of Reform 97; there are no clear patterns that could substantiate this in any of the tables presented above. The same applies if I focus on the full- or part-time employed mothers; see Appendix Tables 4, 5 and 6.

According to the theory the effect are the same as in the other regressions; it does not seem like the mothers' utility function include the term Nf(H) described in Equation (1) and therefore the indifference curves does not change for either college educated mothers, high school educated mothers or mothers who haven't finished high school as a result of the introduction of the reform. This means that it seems like the mothers' reservation wage stays the same when their children start school and that this is not affected by their educational level.

The hypothesis that applies here is (3) The change in the school starting age in Norway affected mothers of six year olds labor force participation different according to their educational level. The results shown in this section is not consistent with this hypothesis, since I did not uncover any affect of the reform on any of the mothers, neither on college educated, high school educated nor mothers who had not finished high school.

## 7.4.2 Younger Children

Throughout this paper I am focusing on the mothers' oldest child and its age, because of this, it could be the case that the mothers also have younger children than the one mentioned. This is accounted for in the robustness analysis where I include a variable for younger children. To

figure out if having younger children affect the mothers' labor force participation I divide the main sample into two main groups, as follows:

- Mothers with younger children (388 252 mothers)
- Mothers without younger children (225 499 mothers)

Mothers with younger children are presented in the first table below, Table 11, and mothers without younger children are presented in the second table below, Table 12.

Table 11: Incremental effect on full-time employment among mothers with younger children by age of their oldest child and year

* *			
v	Δ	a	1
1	•	а	1

	1994	1995	1996	1997	1998	1999
3	-	-		***	••	
4		0.0011	-0.0015	0.0101	0.0197*	0.0100
5	-	-0.0079 (0.008)	0.0012 (0.008)	0.0148+ (0.008)	(0.008) 0.0250** (0.008)	0.0220**
6		0.0053	0.0116 (0.008)	0.0254**	0.0363**	(0.008) 0.0293** (0.008)

Table 11: The table shows the incremental effect on full-time employment among mothers with younger children by age of their oldest child and year. No. of observations:  $388\ 252$ . Adjusted  $R^2=0.001$ . Mean full-time employed mothers: 0.313. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

For mothers with younger children, represented in Table 11, something happened with the difference-in-difference estimates in 1997; all of them "jumped" a little above 0.01 from 1996 which indicate that mothers' labor force participation were increased from 1996 to 1997 and this increase lasted throughout the sample period. The fact that the change is occurring to mothers of children of in all age cohorts and not just mothers of six year olds who were affected by the reform, could come from the fact that as a result of Reform 97 there were opened up childcare places in the kindergartens since the six year olds now were enrolled in school and not in kindergarten. These childcare places could either be given to younger children represented by their age in the regressions, for instance children aged four or five or the "new" daycare places could be given to their younger siblings', which meant that the mothers did not have to stay at home with younger children anymore and could instead

increase their labor supply. All estimates from 1997 onwards in Table 11 are 0.01 or higher, but for four year olds in 1997 and 1999 the estimate are not significantly different from zero. In the table below I investigate if something similar happened to mothers without younger children or if this was something that only occurred to mothers with more than one child.

Table 12: Incremental effect on full-time employment among mothers without younger children by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
3	**	_	-	-	_	_
4		-0.0138	-0.0013	-0.0161+	-0.0036	-0.0013
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
5	-	0.0108	0.0153	0.0121	0.0024	0.0315**
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
6		0.0007	0.0039	-0.0143	-0.0007	0.0006
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)

Table 12: The table shows the incremental effect on full-time employment among mothers with only one child by age of their oldest child and year. No. of observations: 225 499. Adjusted  $R^2 = 0.001$ . Mean full-time employed mothers: 0,408. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

When looking at mothers with only one child, represented in Table 12, the effect from Table 11 is no longer present; here all the estimates for four year olds are negative, for five year olds positive and for six year olds it varies with the year I look at. There are no clear pattern associated with these mothers and their labor force participation, and the only estimates that are significantly different from zero are the one for mothers of four year olds in 1997, which is negative, and the one for mothers of five year olds in 1999, which is positive. There is no clear pattern which indicates that Reform 97 had any effect on maternal labor supply for mothers with only one child.

When looking at full- or part-time employment the regressions yields the same results as the analyses here; there are positive estimates for mothers of four, five and six year olds with more than one child from 1997 onwards, but here the estimates associated with mothers of four and five year olds in 1997 are not significantly different from zero, see Appendix Table 7. When it comes to mothers without younger children the results on full- or part-time

employment are the same as presented above in Table 12, the only difference is that there are no longer significant estimates on mothers of four year olds in 1997, see Appendix Table 8.

In relation to the theory described in Section 4 "Labor Supply Theory and Hypotheses", the effect on mothers with only one child are the same as described in the previous sections; the utility function described in Equation (1) does not seem to include the term Nf(H) which changes the indifference curves and thereby the reservation wage and the hours worked when the reform is being introduced, when N=1. This means that the mothers with only one child do not change their labor force participation due to the change in school starting age. However, for mothers with younger children it now seems like they increased their labor supply; their utility function seem to include the term Nf(H) described in Equation (1) in Section 4 "Labor Supply Theory and Hypotheses", which takes the value f(H) when the reform is being put into action, when N=1. This term changes the indifference curves and, thereby their reservation wage and adapting point, which results in a change in the hours spent in the labor market. How these mothers might react is described in Section 4 "Labor Supply Theory and Hypothesis" and, this particular case is also illustrated in Figure 8 below:

Figure 8: Changed indifference curves for one mother with more than one child due to the introduction of Reform 97

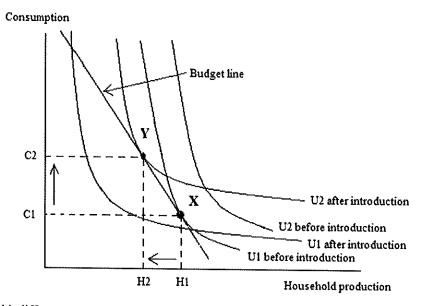


Figure 8: Changed indifference curves due to the introduction of Reform 97 for one mother with more than one child.

Figure 8 present one example of indifference curves and budget line where the mother increased her labor supply as a result of the reform and I am now going to describe how this

particular mother<sup>60</sup> were affected by the reform. Before the introduction of Reform 97 the mother adapted in point X in Figure 8, but when Reform 97 was introduced, the mother's value of her time decreased<sup>61</sup> and as a result, her indifference curves got flatter. This means that she get a new adapting point since the budget line now intersects her new indifference curves (U1/U2 after introduction) at a different point, point Y, in the graph above. As you can see in Figure 8, the time spent on household production decreases as a result of new indifference curves, and thereby the hours spent working in the market increases. The figure presented here is identical to Figure 3 described in Section 4 "Labor Supply Theory and Hypotheses" with the exception of the labels on the indifference curves.

The last hypothesis presented in Section 4 "Labor Supply Theory and Hypotheses" (4) *The change in school starting age in Norway induced mothers with more than one child to increase their labor force participation* is consistent with the results presented in this subsample analysis. This means that it seems like the reform induced mothers with more than one child to increase their labor supply, no matter if their oldest child were four, five or six years old.

<sup>61</sup> How this is possible see discussion around Equation (1) in Section 4 "Labor Supply Theory and Hypotheses".

<sup>&</sup>lt;sup>60</sup> Different mothers have different indifference curves, and therefore the set of indifference curves described here is only one example on how one mother might react to the introduction of the reform.

## 8 Conclusion

In 1997 the Norwegian government implemented a reform that reduced the school starting age of children to six year olds, Reform 97. I use the implementation of this reform to investigate if school starting of children affects maternal labor supply. Children born in 1991 or later were affected through that they had to start school at the age of six instead of seven and attend elementary school for ten years. Using a set of comprehensive administrative data, I estimate a difference-in-difference model which exploits the differences in mothers of these children's labor force participation due to the introduction of this reform. If the reform affected maternal labor supply, I expect this to show in the difference-in-difference estimates for mothers of six year olds from 1997 and beyond.

In my main analysis I found no clear pattern associated with mothers of six year olds from 1997 onwards that could indicate that the reform affected these mothers' labor force participation. In this regression there were significant positive estimates both on mothers of five and mothers of six year olds labor supply from 1996 onwards, which is prior to the introduction of the reform. This means that there were significant positive estimates concerning mothers who were not affected by the reform, untreated mothers (mothers of six year olds in 1996). The same is the case in my robustness and specification analyses and my subsample analysis concerning mothers' educational level; no clear pattern associated with the estimates that could indicate that the reform affected maternal labor force participation.

When dividing the sample into mothers with only one child and mothers with more than one child, however, I found a pattern associated with mothers of children aged four, five and six with more than one child that could indicate that the amount of these mothers working full-time increased from 1997 and beyond, and the pattern was still visible when including part-time employment as well in the regression. This means that mothers of children in all age cohorts with more than one child worked more compared to mothers of three year olds in 1997 onwards than they did in 1994. This pattern did not exist in the estimates for mothers with only one child, neither for mothers working full-time nor for mothers working either full-or part-time.

In relation to the four hypotheses described in Section 4 "Labor Supply Theory and Hypotheses";

Hypothesis 1: The change in the school starting age in Norway induced mothers of six

year olds to increase their labor force participation

Hypothesis 2: The change in the school starting age in Norway induced mothers of six

year olds to reduce their labor force participation

Hypothesis 3: The change in the school starting age in Norway affected mothers of six

year olds labor force participation different according to their

educational level

Hypothesis 4: The change in school starting age in Norway induced mothers with

more than one child to increase their labor force participation

the only one who is consistent with the findings in the regressions are hypothesis 4 (*The change in school starting age in Norway induced mothers with more than one child to increase their labor force participation*). Compared to labor supply theory this means that it seems like only the mothers with more than one child have a utility function like the one described in Equation (1) in Section 4 "Labor Supply Theory and Hypotheses";

$$U = u(C, H; N) = C^{a}H^{(1-a)} + Nf(H)$$

where N=1 when Reform 97 is put into action and thereby changes the indifference curves due to the term f(H). With the changed indifference curves, the mothers' reservation wage changes and as a result their labor supply also change. In this particular case the reservation wage decreases, making the mothers with more than one child increase their labor force participation.

## References

Angrist, Joshua D. and Evans, William N. (1998), "Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size", *The American Economic Review*, Vol. 88, No. 3 (Jun., 1998), pp. 450-477

Averett, Susan L.; Peters, Elisabeth H. and Waldman, Donald M. (1997), "Tax Credit, Labor Supply, and Child Care", *The Review of Economics and Statistics*, Vol. 79, No. 1 (Feb., 1997), pp 125-135

Becker, Gary S. (1981), "A Treatise on the Family", Cambridge, Mass.: Harvard University Press.

Becker, Gary S. (1985), "Human Capital, Effort, and the Sexual Division of Labor", *The Journal of Labor Economics*, Vol. 3, No. 1 (Jan., 1985), pp. 33-58

Becker, Gary S. and Tomes, Nigel (1986), "Human Capital and the Rise and Fall of Families", *The Journal of Labor Economics*, Vol. 4, No. 3 (Jul., 1986), pp 1 - 39

Bettinger, Eric, Hægeland, Torbjørn and Rege, Mari (2011), "Home with Mom: The Effects of Stay-at-Home Parents on Children's Long-Run Educational Outcomes"

Blau, David M. and Robins, Philip K. (1988), "Child-Care Costs and Family Labor Supply", *The Review of Economics and Statistics*, Vol. 70, No. 3 (Aug., 1988), pp. 374-381

Blau, David M. and Robins, Philip K. (1989), "Fertility, Employment, and Child-Care Costs", *Demography*, Vol. 26, No. 2 (May, 1989), pp. 287-299

Blau, David M. (1999), "The Effect of Income on Child Development", *The Review of Economics and Statistics*, Vol. 81, No. 2, pp 261-276

Blau, David M. and Currie, Janet (2004), "Preschool, Day Care, and After School Care: Who's minding the Kids?", Handbook of the Economics of Education, Elsevier

Blundell, Richard and Costa Dias, Monica (2009), "Alternative approaches to evaluation in empirical microeconomics", *Journal of Human Resources*, Vol. 44, No. 3, pp 565 – 640

Borjas, George J. (2010), "Labor Economics", *Harvard University*, Fifth Edition, McGraw-Hill International Edition

Brooks, Jennifer L., Hair, Elizabeth C. and Zaslow, Martha J. (2001), "Welfare reform's impact on adolescents: Early warning signs", Washington DC: Child Trends

Carneiro, Pedro; Løken, Katrine and Salvanes, Kjell G. (2009), "A flying start or no effect? Long-term outcomes for mother and child", working paper

Cascio, Elizabeth U. (2007), "Maternal Labor Supply and the Introduction of Kindergartens into American Public Schools", *The Journal of Human Resources*, Forthcoming Winter 2009

Conelly, Rachel (1992), "The effect of child care costs on married women's labor force participation", *The Review of Economics and Statistics*, Vol. 74, No. 1 (Feb., 1992), pp 83-90

Dahl, Gordon and Lochner, Lance (2009), "The Impact of Family Income on Child Achievement: Evidence from the Earned Income Tax Credit"

Heckman, James (1974), "Shadow Prices, Market Wage, and Labor Supply", *Econometrica*, Vol. 42, Issue 4 (Jul. 1974), pp. 679-694

Gelbach, Jonah B. (2002), "Public Schooling for Young Children and Maternal Labor Supply", *The Journal of Political Economy*, 81(2). 168-199

Gronau, Reuben (1973), "The Effect of Children on the Housewife's Value of Time", *The Journal of Political Economy*", Vol. 81, No. 2, Part 2: New Economic Approaches to Fertility, (Mar. – Apr., 1973), pp. 168-199

Kimmel, Jean (1998), "Child Care Costs as a Barrier to Employment for Single and Married Mothers", *The Review of Economics and Statistics*, Vol. 80, No. 2 (May, 1998), pp 287-299

Kornstad, Tom and Thoresen, Thor O. (2007), "A Discrete Choice Model for Labor Supply and Child Care"

Pissarides, Christopher; Garibaldi, Pietro; Olivetti, Claudia; Petrongolo, Barbera and Wasmer, Etienne (2005), "Women in the Labor Force: How Well is Europe Doing?"

Rege, Mari and Solli, Ingeborg F. (2010), "The impact of Paternity Leave on Father Involvement",

Ribar, David C. (1992), "Child Care and Labor Supply of Married Women: Reduced From Evidence", *The Journal of Human Resources*, 27:1, pp 134-165

Appendix Table 1: Incremental effect on working 4 hours or more each week among mothers by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
3	l	l	l	1	1	1
7		-0.0042	0.0027	-0.0025	0.0020	0.0095
		(0.006)	(900.0)	(0.006)	(0.006)	(0.006)
M	ı	-0.0012	0.0063	0.0113+	0.0084	0.0202**
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
9		-0.0034	0.0051	0.0061	0.0143*	0.0112+
		(0.006)	(0.006)	(0.006)	(0.006)	(0.006)

single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust No. of observations: 613 751. Adjusted R<sup>2</sup> = 0,002. Mean mothers working 4 hours or more each week: 0,597. Estimates reflect results from standard errors in parentheses.

# Appendix Table 2: Incremental effect on total pension income among mothers by age of their oldest child and year

Year

1998 1999	1	7.5633 15.1945	(12.277) (12.250)	14.5823 58.5642**	(12.288) (12.278)	- 43.4885** 61.9277**	(12.272) (12.294)
1997	I	-17.6655	(12.282)	16.0201	(12.260)	23.0600+	(12.235)
1996	1	1.4995	(12.228)	22.5010+	(12.199)	41.4628**	(12, 226)
1995	ş	-3.1220	(12.131)	13.4686	(12.154)	18.0652	(12.209)
1994	ı			ı			
	8	4		v		9	

No. of observations: 613 751. Adjusted R<sup>2</sup> = 0,017. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

Appendix Table 3: Incremental effect on full-time employment among mothers by age of their youngest child and year

Year

	1994	1995	1996	1997	1998	1999
9	ı	0.0028	-0.0125+	-0.0180**	-0.0212**	-0.0105
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
۲		0.0088	0.0063	-0.0043	-0.0110	0.0027
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
<b>∞</b>	ı	0.0028	0.0092	0.0081	-0.0044	0.0032
		(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
6						

No. of observations: 523 869. Adjusted R<sup>2</sup> = 0,003. Mean full-time employed mothers: 0,360. Estimates reflect results from single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust standard errors in parentheses.

Appendix Table 4: Incremental effect on working 4 hours or more each week among mothers who have a College Degree by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
3	ı	I	ı	I	ı	l
4		0,0065	0.0105	0.0061	0.0267*	0.0326**
		(0.013)	(0.013)	(0.012)	(0.012)	(0.012)
5	1	-0.0042	0.0220+	0.0256*	0.0385**	0.0449**
_		(0.013)	(0.013)	(0.012)	(0.012)	(0.012)
9		-0.0151	0.0087	0.0041	0.0465**	0.0373**
		(0.013)	(0.013)	(0.012)	(0.012)	(0.012)

single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust No. of observations: 126 901. Adjusted R<sup>2</sup> = 0,004. Mean mothers working 4 hours or more each week: 0.733. Estimates reflect results from standard errors in parentheses.

Appendix Table 5: Incremental effect on working 4 hours or more each week among mothers who have a High School Degree by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
60	1	1	ŧ	I	ľ	1
4		-0.0021	0.0028	0.0062	0.0087	-0.0016 (0.010)
S	•	0.0024	-0.0005	0.0161	0.0187+	0.0144
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
9		0.0077	-0.0007	0.0169+	0.0206*	0.0161 (0.010)

single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust No. of observations: 226 739. Adjusted R<sup>2</sup> = 0,002. Mean mothers working 4 hours or more each week: 0.630. Estimates reflect results from standard errors in parentheses.

## Appendix Table 6: Incremental effect on working 4 hours or more each week among mothers who haven't finished High School by age of their oldest child and year

Vear

	1994	1995	1996	1997	1998	1999
60	l		I I	l	1	ı
4		-0.0114	-0.0011	-0.0112	-0.0165+	0.0101
		(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
N	***	-0.0002	0.0075	0.0058	-0.0102	0.0193+
		(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
9		-0.0095	0.0091	0.0002	9800.0-	-0.0009
		(0.00)	(0.009)	(0.000)	(0.010)	(0.010)

single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust No. of observations: 260 111. Adjusted R<sup>2</sup> = 0,002. Mean mothers working 4 hours or more each week: 0.501. Estimates reflect results from standard errors in parentheses.

# Appendix Table 7: Incremental effect on working 4 hours or more each week among mothers with younger children by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
60	ı	1		1	The state of the s	1
4		-0.0047	-0.0031	0.0044	0.0144+	0.0205*
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
S	ı	-0.0105	-0.0011	0.0132	0.0232**	0.0292**
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
9		-0.0061	0.0005	0.0138+	0.0311**	0.0275**
		(0.008)	(0.008)	(0.008)	(0.008)	(0.008)

single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust No. of observations: 388 252. Adjusted  $R^2 = 0,005$ . Mean mothers working 4 hours or more each week: 0.572. Estimates reflect results from standard errors in parentheses.

Appendix Table 8: Incremental effect on working 4 hours or more each week among mothers without younger children by age of their oldest child and year

Year

	1994	1995	1996	1997	1998	1999
****	ŧ	ı	ı	I	Į.	l
		-0.0092	0.0055	-0.0123	-0.0082	0.0015
	1	0.0104	0.0109	0.0104	-0.0053	0.0201*
		(0.009)	(0.010)	(0.010)	(0.010)	(0.010)
		-0.0074	0.0029	-0.0085	-0.0039	-0.0043
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)

single OLS models, adjusted for year and age fixed effects. +, \* and \*\* denote significance at 10 percent, 5 percent and 1 percent level. Robust No. of observations: 225 499. Adjusted R<sup>2</sup> = 0,002. Mean mothers working 4 hours or more each week: 0.639 Estimates reflect results from standard errors in parentheses.