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ABSTRACT

Do Parents Work More When Children Start School? Evidence from the Netherlands*

When children start school, parents save time and/or money. In this paper, we empirically examine the impact of these changes to the family's budget constraint on parents' working hours. Labor supply is theoretically expected to increase for parents who used to spend time taking care of their children, but to decrease for fulltime working parents because of an income effect: child care expenses drop. We show that the effect of additional time dominates the income effect in the Netherlands, where children start school (kindergarten) for approximately 20 hours a week in the month that they turn 4. Using detailed administrative data on all parents, we find that the average mother's hours worked increases by 3% when her youngest child starts going to school. For their partners, who experience a much smaller shock in terms of time, the increase in hours worked is also much smaller at 0.4%.

JEL Classification: J13, J22
Keywords: labor supply, starting school, child care

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1 Introduction

The first day a child enters school is a very exciting day in his or her life: it marks the start of many new experiences and the acquisition of many new skills. As economists put it: children formally start investing in their human capital, and this process will continue to influence their lives for many years to come. The benefits of going to school on child development have been studied extensively: compulsory schooling does not only improve test scores, but also causally enhances later life outcomes, such as wages and health (Devereux and Hart, 2010; Machin et al., 2011; Grenet, 2013).

At the same time, compulsory schooling also provides benefits for parents, as they start saving time and/or money – at least in countries where the government subsidizes primary schools more than child care – which may affect their labor supply. On the one hand, parents who used to take care of their children during school hours are expected to increase their labor supply when their youngest child starts school. These parents do not need to take care of their children anymore and hence have free time on their hands. On the other hand, parents whose children attended (paid) childcare before going to school might decrease their labor supply, when their youngest child starts school. These households save on childcare expenses and therefore experience an income effect.

In this paper, we empirically estimate the effect of children starting compulsory schooling in the Netherlands on their parents' labor market position. Using a balanced panel of administrative data on all Dutch parents between 2006 and 2016, we analyze the labor market position of parents when their youngest child is between three and six years old, and we do this for mothers and fathers separately. We apply a difference-in-differences approach to tease out any changes observed due to macro-level shocks, increased working experience over these three years or other changes unrelated to school. The control group consists of parents with a youngest child between one and four years old. They therefore do not experience the 'treatment' because their youngest child does not start school during the observation period. To ensure that our control and treatment group are as similar as possible and to take cohort effects into account, we apply coarsened exact matching.

How compulsory schooling affects the parents' labor market position is of international interest as employment of mothers of young children is relatively low in most countries, and policy makers are hence interested in the drivers of their labor supply. Interestingly, Figure 1 shows that in most European countries the differences in the

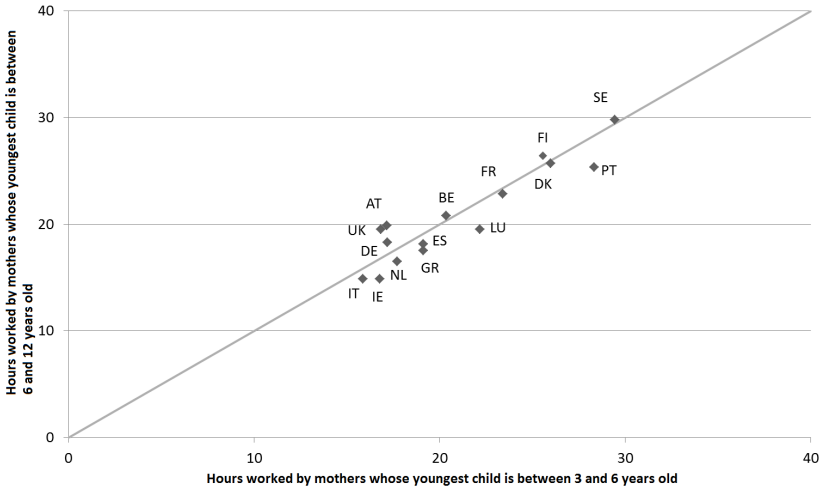
average number of hours worked by mothers with or without all their children in school are small. It is unclear however to what extent this is driven by cohort effects: younger cohorts with smaller children tend to work more in general.

The Netherlands is a particularly interesting country to study labor market effects for parents of compulsory schooling. Primary education is paid for by the government, while child care is not, and child care subsidies are dependent on household income. Moreover, children start school (kindergarten) for approximately 20 hours a week in the month that they turn four, which makes it possible to rule out seasonal employment effects. Furthermore, the participation of Dutch women is relatively high, while their working hours are relatively low compared to that of women in other European countries as the majority of Dutch women work part-time (see Figure 1). This means that there is substantial room for increases in hours worked. A large majority of the men however, works fulltime: in 2016, the employment rate among men was 82.6 percent and more than three quarters works fulltime.

Our findings show economically small labor supply reactions and that mothers adapt their working hours significantly more than fathers when their youngest child starts school. On average, households save approximately 60 to 70 euros per month on child care. Dutch mothers experience an increase in their free time of 13 hours a week when their youngest child goes to school. After two years, we find that the average number of hours Dutch mothers work increases by around 0.5 hours. These changes are driven for about two-thirds by responses at the intensive and one-thirds at the extensive margin. Given that the average mother in our sample works around 15 hours a week, mothers increase their work hours by 3% after their youngest child goes to school. Empirically, the income effect is thus dominated by the effect of additional time on labor supply. Dutch fathers experience an increase in their free time of almost 4 hours a week when their youngest child goes to school. We find that they increase working hours on average by around 0.15 hours, or 0.4% relative to the mean. This is for about two-thirds driven by a response along the extensive margin and one-thirds at the intensive margin.

Heterogeneity analyses suggest that the response is larger among mothers and fathers who are already working longer hours and who already earn higher wages. This is perhaps surprising because they experience smaller time gains and they typically save more money on child care expenses when their youngest child starts school. Theoretically, one would thus expect smaller increases in working hours in these groups.

Figure 1: Hours worked by mothers before and after the youngest child in a household starts going to school



Source: Own calculations based on Eurostat (2014).

Notes: The x-axis indicates how many hours women work when the youngest child in their household is older than three years old, but does not yet go to school and the y-axis denotes the number of hours women work when the youngest child in their household goes to school and is younger than twelve years old. These averages take all mothers in a country into account: mothers who do not work, work zero hours. In addition, this figure is based on cross-sectional data, so that differences may also be affected by cohort effects: overall labor participation of younger generations of women exceeds that of older generations. Finally, the solid line denotes the diagonal: countries in which mothers of children who do not go to school work as much as mothers whose children do go to school, are on the diagonal. In countries above (below) the diagonal, women whose youngest child starts going to school work longer (shorter) hours.

However, differences in initial preferences for labor supply over leisure are probably at the heart of these results: these parents are more likely to have decreased working hours solely to be with their children and hence return to the office once child care activities are less needed. Single mothers show an overall negative employment response to their youngest child attending school. The income effect apparently dominates for this subgroup. One explanation for the relatively large income effect is mental accounting (Thaler, 1985; Abeler and Marklein, 2016). In the Netherlands, child care subsidies depend on household income, are paid by the tax authorities, and parents generally receive them on a different date than when they pay the child care institution. It is therefore possible that parents do not take the net monetary gain they obtain when their youngest child starts going to school into account, but rather consider the gross monetary gain of reduced expenses on child care without taking the corresponding decline in child care subsidies into account. This could lead to much larger perceived income gains. The difference between the gross and the net monetary gain is generally substantial; the gross monetary gain can be up ten times as large as the net monetary gain for low-income households.

Our analysis makes several contributions to the literature on compulsory schooling and the labor supply of parents, which generally uses data on earlier cohorts of parents. The first contribution of this paper is that findings are not confounded by seasonal effects in labor supply. In the Dutch institutional setting, children go to school on the day they turn four years old. This provides us with variation in school entry over the calendar year, unlike other studies from countries where children always start school in September (Gelbach, 2002; Goux and Maurin, 2010; Finseraas et al., 2016). The second contribution is that we can precisely estimate the effects using very similar treatment and control groups. This is because we use a recent administrative dataset, which includes the hours a recent cohort of parents work in each month as well as information on child care subsidies for the universe of Dutch parents. In addition, the data also enable us to determine the heterogeneity in the magnitude of the shock parents experience in terms of money and time depending on their working hours and the number of hours their youngest child attends formal child care. The third contribution is that we symmetrically estimate effects for both mothers and fathers, while most other papers in the literature focus on the employment effects of children going to school for mothers only.

Interestingly, our heterogeneity analyses provide different results than most of the

literature; often older papers find stronger effects for single women and low-income groups, but we draw opposite conclusions. A paper by Gelbach (2002) for example examines the effect of public schooling for five year olds in the US on their mothers' labor supply and finds that single mothers increase the number of hours they work by 6-24 percent, while for married mothers he finds an increase of 6-15 percent. Gelbach uses cross-sectional data from the 1980 US Census, while we use panel data from 2006 to 2016. Goux and Maurin (2010) analyze census data from 1999 in France where all children start school at age 3 or earlier using a cut-off within the year for eligibility and find that pre-elementary school only has a significant effect on the labor supply of single mothers. Similarly, Finseraas et al. (2016) examine a reform in Norway in 1997 where the compulsory school starting age was lowered from six to five. They find a short-term increase of labor supply, with much stronger effects for mothers with low wage potential, who probably did not use childcare. Recent cohorts differ in important dimensions from older cohorts: they are higher educated, employment rates have increased steadily (Blundell et al., 2013) and labor supply elasticities are currently smaller (Blau and Kahn, 2007).

Another related branch of the literature looks at the effect of the availability of – non-compulsory – kindergarten on the labor market position of parents. Cascio (2009) exploits the introduction of subsidies for kindergarten in school districts in the US from the 1960s to the 1980s to examine effects of public schooling on labor supply of mothers. Using cross-section data from the Census for each decade from 1950 to 1990 she only finds significant effects for single mothers. Fitzpatrick (2010) considers pre-kindergarten availability in three states in the US. Using Census data from 2000 in an RD design, she finds no robust impact of pre-kindergarten availability on maternal labor supply. Fitzpatrick (2012) uses the same data, but exploits cutoffs for eligibility for public kindergarten. She finds that eligibility only increases the employment of single mothers without additional children. Related, Shure (2019) considers the effect of the extension of the schoolday in Germany in the 2000s on maternal labor supply. She finds no effect along the intensive margin, but an increase in employment probability.

2 Theoretical Framework

This section formalizes the intuition of how parental labor supply is affected when children start going to school into testable hypotheses. To do this, we analyze the

changes in the budget constraint parents face that occur when their youngest child starts going to school. For simplification, we restrict our focus to three activities parents can spend their working hours on[1]: (1) working on the labor market l_i, (2) taking care of children at home t_i or (3) leisure z_i. The time constraint for each individual i is therefore:

$$l_i + t_i + z_i = 1 \quad \text{where} \quad 0 \geq l_i, t_i, z_i \geq 1 \tag{1}$$

Children always have to be taken care of. This can either be done by the father t_f or the mother t_m, or by child care providers t_y. Older children also spend a number of hours at school, t_s. As long as at least one child in a household does not go to school yet, parents have to arrange child care during school hours. The time constraint of taking care of the children can therefore be characterized by:

$$t_f + t_m + t_y + t_s = 1 \quad \text{where} \quad \begin{array}{ll} t_s = 0 & \text{if at least one child does not go to school} \\ 0 < t_s < 1 & \text{if all children go to school.} \end{array} \tag{2}$$

Households earn income from labor l_i and spend money on child care t_y which costs q and on consumption X which costs p. Households therefore face the following budget constraint:

$$qt_y + pX \leq w_f l_f + w_m l_m \tag{3}$$

In this budget constraint people cannot save any money for future consumption. Substituting the time constraints for fathers and mothers (Equation 1) as well as the time constraint for child care (Equation 2) into this equation yields the following budget constraint:

$$q(1 - t_m - t_f - t_s) + pX \leq w_f(1 - t_f - z_f) + w_m(1 - t_m - z_m) \tag{4}$$

When the youngest child in a household starts going to school, the budget constraint parents face changes. Figure 2 graphically illustrates the changes one parent faces, keeping the time the other parent spends on labor l_f and child care t_f constant. In the Figure, we show the mother's budget constraint, but the budget constraints fathers

[1]The time available during the (work) week is normalized to 1 without loss of generality. Outside of working hours parents can still spend time with their children and enjoy leisure.

face keeping the time mothers spend on labor and child care constant is identical. Mothers decide how to allocate their time between working which enables them to consume X, leisure z_m and taking care of their children t_m. This three-dimensional budget constraint mothers face is shown in three two-dimensional views in Figure 2. The blue solid planes represent the situation when at least one child does not go to school yet and the green dashed planes represent the situation after the youngest child has started going to school and parents no longer have to arrange child care during school hours.

When the youngest child goes to school, parents do not need to pay for child care for the hours during which the children are at school. Parents who pay for child care therefore experience an income effect. This income effect shifts the budget constraint upward and causes mothers to decrease their labor supply. At the same time, the maximum amount of time parents can spend on domestic child care reduces, because children do not need to be taken care of by their parents when they are at school. This 'time effect' causes parents who used to take care of their children during school hours prior to the youngest child going to school, to increase their labor supply. This therefore yields the following hypotheses, which are not mutually exclusive:

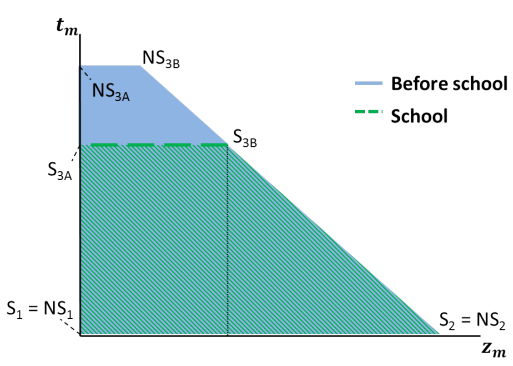
Hypothesis 1 *When the youngest child in the household starts going to school, working mothers experience an income effect, which decreases their labor supply.*

Hypothesis 2 *When the youngest child in the household starts going to school, mothers who do not work fulltime obtain additional time, which increases their labor supply.*

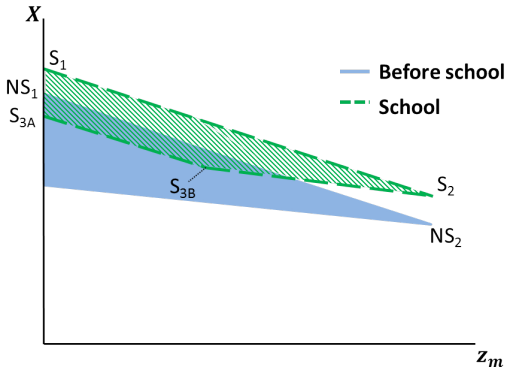
This theoretical framework also allows for the prediction of some heterogeneous effects. If the real wage of the mother increases ceteris paribus, she experiences both a substitution and an income effect. The income effect decreases labor supply, while the substitution effect has an upward effect. Generally, the substitution effect dominates the income effect. For higher real wages of the mother, the negative effect on maternal labor supply is therefore smaller. Additionally, if the price of child care decreases ceteris paribus, the marginal benefit of working increases, making it less attractive to decrease labor supply.

In sum, when the youngest child starts going to school, this may affect maternal labor supply in two ways. On the one hand, parents whose children attend external child care experience an income effect that may reduce labor supply. On the other

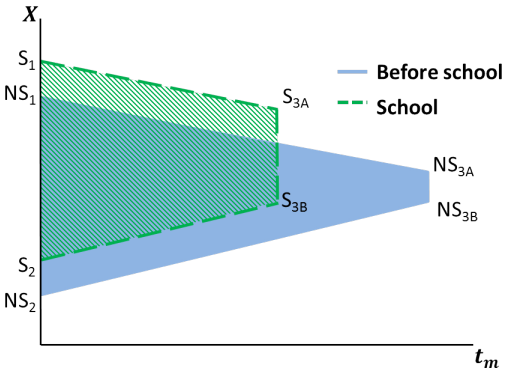
Figure 2: The mother's budget constraint.



(a) Domestic child care t_m vs leisure z_m



(b) Consumption X vs leisure z_m



(c) Consumption X vs child care t_m

Legend

Situation	l_m	z_m	t_m	X
1	1	0	0	$w_f^* l_f + w_m^* - q^*(1 - t_s - t_f)$
2	0	1	0	$w_f^* l_f - q^*(1 - t_s - t_f)$
3A	$t_s + t_f$	0	$1 - t_s - t_f$	$w_f^* l_f + w_m^*(t_s + t_f)$
3B	0	$t_s + t_f$	$1 - t_s - t_f$	$w_f^* l_f$

Notes: This Figure shows three two-dimensional views of the household budget constraint that parents face when deciding on how to allocate their time. The blue solid planes represent the situation before the youngest child goes to school, where $t_s = 0$, while the green dashed planes denote the situation after the youngest child started school, $t_s > 0$. In the figures, situations before the child starts going to school are denoted by NS_i and situations once all children in a household go to school are referred to as S_i. The numbers in the subscript refer to situations shown in the legend. Appendix Section A.1 explains in more detail how this budget constraint changes when the youngest child in a household starts going to school. Although the highest point of the budget constraint before children go to school (the blue solid plane) in Figure 2c is higher than the kink of the budget constraint after children go to school (the green dashed plane), these relative positions could be reversed without affecting the hypotheses.

hand, parents who provide domestic child care spend less time doing so which may increase their labor supply.

3 Magnitude of the treatment

This section discusses the changes parents experience when the youngest child in a household starts going to school. The magnitude of these changes determines the treatment parents experience. This magnitude depends on the number of hours parents work, the number of hours children attend formal child care and on the price of child care. We start this section by explaining the institutional setting in the Netherlands concerning school and child care. Subsequently, we calculate the (counterfactual) magnitude of the change mothers and fathers experience in terms of time when their children start going to school, followed by a calculation of the magnitude of the change households experience in terms of money. To calculate these shocks, we determine how large the change would have been if the parental labor supply and the number of hours children attend external child care had remained the same.

3.1 Institutional setting

In the Netherlands, children generally start school the day they turn four years old. Although schooling is only compulsory from the age of five, more than 99 percent of children starts school when they are four years old (Eurostat, 2012). In the first years of primary school, children attend school for on average 22 hours a week, or on average for 4.4 hours a day.[2]

Formal child care in the Netherlands is privatized and institutions can set their own price.[3] Parents can obtain a child care subsidy from the government for the hours children between the age of 0 and 12 attend formal child care.[4] This subsidy is a percentage of the hourly price child care institutions charge. The subsidy varies with household income: the government pays a lower share of the costs of child care for

[2]The number of hours children go to school varies between schools, because the only requirement set by the government is that in the first four years of primary school, children need to receive education for at least 3,520 hours (Rijksoverheid, 2017). This is 22 hours a week on average.

[3]The government annually sets a threshold price per hour and only for the amount parents pay below this threshold they receive government subsidies.

[4]Formal child care includes day care for children younger than four years old, out-of-school care for children in primary school and childminders for children between 0 and 12 years old.

households with a higher income than for households with a lower income. Primary school on the other hand is paid for by the government, although schools may ask for a 'voluntary parental contribution' which may range from 10 euros a year to 120 euros a year.

3.2 Magnitude of the change in terms of time

This subsection calculates the number of hours parents save when their youngest child starts going to school. Parents only save time when they do not work fulltime and provide domestic child care during working hours. When the youngest child in a family starts going to school, parents no longer need to take care of the children during school hours.

Fulltime employment in the Netherlands takes up forty hours a week. A regular working day therefore consists of eight hours and children go to school for on average 4.4 hours a day in the first years of primary school. The shock parents experience in terms of time therefore consists of 4.4 hours a day for each day that a parent does not work, in other words:

$$\text{Time shock } = (40 - \text{hours worked}) \times \frac{4.4}{8} \tag{5}$$

In these calculations, we assume that working hours are fixed to eight hours a day. This implies that our calculation of the time shock is in fact an upper bound. Parents who have flexible working hours may experience a shock smaller than the one calculated here.

On average mothers save a substantial 13.3 hours per week when their youngest child starts going to school, as illustrated in Column 2 of Panel A in Table 1. Column 2 of Panel B illustrates that the shock fathers experience in terms of time is substantially smaller, only 3.7 hours on average. Fathers generally save less time because a much larger share of them works fulltime, as is illustrated in Column 1 of Table 1. Parents who work fulltime hardly save any time when their youngest child goes to school, as they generally do not take care of the children during working hours before the children start going to school. The time shock is largest for parents who work fewer hours.

Table 1: Magnitude of the shock in terms of money and in terms of time

Panel A: Shock in terms of time and money that mothers experience when their youngest child goes to school	(1) % of mothers	(2) Hours saved per week	(3) Money saved per month (per household)
Does not work	25.6	22.0	8
Works less than 20 hours a week	30.0	14.9	39
Works 20-34 hours a week	39.6	7.9	103
Works more than 34 hours a week	4.7	1.5	135
Total	100.0	13.3	61
Panel B: Shock in terms of time and money that fathers experience when their youngest child goes to school	% of fathers	Hours saved per week	Money saved per month (per household)
Does not work	6.4	22.0	22
Works less than 20 hours a week	4.3	16.1	43
Works 20-34 hours a week	16.6	5.2	83
Works more than 34 hours a week	72.7	1.0	72
Total	100.0	3.7	70

Notes: See main text for calculation of the monetary and time shocks. The percentages listed in Column (1) refer to the share of mothers (fathers) in our sample that works a specific number of hours. The amounts of money households save when their youngest child starts going to school (listed in Column (3)) differs for the mothers (Panel A) and fathers (Panel B) in our sample, because households with single mothers *are* included in the sample for mothers, but not in the sample of fathers.

3.3 Magnitude of the change in terms of money

Parents may also save money when their children start going to school. This only holds true for parents whose children attend child care, as they do not need to pay for child care during the hours the child is at school. When children start school, the number of hours they attend formal child care therefore reduces by approximately fifty percent.[5]

[5]Child care providers generally charge parents for ten hours per day for children who have not yet started going to school yet and for five hours per day for out-of-school care for children who attend

The net income-shock parents experience due to reduced expenditures on formal child care can therefore be approximated using the following formula:

$$\text{Monetary shock } = p_N q_N - p_O q_O = (sP_N)(50\% q_O) - (sP_O)q_O = sq_O\,(0.5P_N - P_O) \tag{6}$$

where subscript O denotes the old situation (day care) and N denotes the new situation (out-of-school care). Additionally, p denotes the price parents pay for an hour of formal child care, which is a share s of the actual hourly price of child care P: $p = sP$.[6] The price of out-of-school care p_N may differ from the price of day care p_O.[7] Finally, q refers to the number of hours a child attends formal child care, where the number of hours in out-of school care q_N is half the number of hours in the day care, $q_N = 0.5q_O$.[8]

On average, households save approximately 60 to 70 euros a month on the costs of formal child care when their youngest child starts going to school, as shown in Column 3 of Table 1. Panel A shows that households where mothers work more hours save more money in absolute terms than households where mothers work fewer hours per week, because household income is generally higher - and childcare subsidies are therefore lower - in households where mothers work more hours.[9] Panel B shows that for fathers

primary school.

[6]For households where both parents work or are enrolled in education, the government subsidizes formal child care, which includes day care, out-of-school care and childminders for children between 0 and 12 years old. The subsidy is a percentage of the price that depends on household income. The share paid by the government varied substantially over the past decade. Formal child care in the Netherlands is privatized and institutions can set their own price. The government annually sets a threshold price per hour set and only for the amount parents pay below this threshold they receive government subsidies.

[7]For these hourly prices of formal child care, we use the average price reported by the sector association of child care providers in the Netherlands in a specific year (Kinderopvang, 2016). The share paid by parents is calculated using a conversion table from the Dutch government that specifies this share for each calendar year for each level of household income.

[8]The hours a child attends formal child care are available per calendar year. We therefore use the number of hours in the calendar year in which the child turns three years old, i.e. the calendar year before the child starts going to school.

[9]To be eligible for child care subsidies in the Netherlands, both parents need to work or be enrolled in education. Nonetheless, Table 1 shows that women who do not work (those working zero hours a week) on average still save some money when their children start going to school. This is likely due to mothers who are enrolled in education or mothers who recently became unemployed and who are therefore still eligible for child care subsidies. Furthermore, before the reform of 2011, the eligibility for subsidies for formal child care did not depend on the number of hours parents worked. Therefore, before 2011 children of women who did not work could also attend formal child care so that these women also experienced a small monetary shock the moment their youngest child started primary school.

this relationship is not linear: households where the fathers work 20-34 hours save more money than households where fathers work more, because on average women work more hours in households where fathers work 20-34 hours.

It is important to note that these average changes in the money parents spend on child care when their children go to school are a lower bound the true magnitude of the monetary shock. Our calculation only takes the costs of *formal* child care into account, as there are no data for all parents on the use of informal child care. If parents use paid informal child care, the true magnitude of the monetary shock exceeds our calculations.

4 Empirical Approach

To determine the effect of children going to school on parental labor supply, we employ a difference-in-differences design. We construct a control group of parents with children aged one to four to control for general business cycle effects, policy changes and other time-changing variables. To ensure comparability of the treatment and control group, we employ coarsened exact matching and we do the analyses separately for mothers and for fathers.

4.1 Defining treatment and control group

Our treatment group consists of parents whose youngest child is between three and six years old. Since children go to school when they are four years old, this means that a parent is in our sample one year before the youngest child goes to school until two years after the child goes to school. To ensure that parents do in fact experience a time shock when their youngest child goes to school, we impose that the child remains the youngest child in the family until they are six years old. We end up with a balanced sample that consists only of parents who took care of this particular child for each of the three years in the sample.

To estimate the effect of the youngest child going to school on parental labor supply, we compare this treatment group to a control group consisting of parents whose youngest child is between one and four years old. In this group the youngest child does not start going to school yet during the observation period, so that parents do not experience the treatment.[10] With this design, we compare parents whose youngest

[10]Older children of parents in the control group may still start going to school in the observation

child turns four years old in a given year (the treatment group) with parents whose youngest child turns two years old in that same year (the control group).

In the robustness checks we also present results where the control group consists of parents whose second-youngest child is between three and six years old. This group does not experience a time shock, since they still have a younger child at home, but they do experience a small monetary shock, since they pay for fewer hours of child care for their second-youngest child when this child starts going to school.[11]

4.2 A difference-in-differences design

We estimate the effect of children going to school on the number of hours worked by the parent in a certain month t (those who do not work, work zero hours). We then check whether this effect is driven by changes along the intensive or the extensive margin by estimating the effect of children going to school on i) a dummy variable that indicates whether the parent works in month t, and ii) the number of hours worked by the parent in month t, excluding those who do not work over the entire observation period. We estimate the following linear model

$$y_{it} = \alpha + \beta \times T_i + \sum_{t=-10}^{24} \gamma_t \times S_t + \sum_{t=-10}^{24} \delta_t \times S_t \times T_i + \eta_i + \theta_t + \varepsilon_{it}, \tag{7}$$

where y_{it} is some measure of labor market participation (hours worked or participation). T_i is a dummy variable that takes value 1 if parent i is in the treatment group and 0 if the parent is in the control group. S_t is a set of dummy variables for each month relative to the treatment period, where $S_t = 0$ when the youngest child is four years old (or two years old in the control group). Hence, γ_t captures the general time trend. The coefficients of interest are δ_t, which capture the average effect of the youngest child

period. This does not cause a time shock for the parents, since they still have a younger child at home. Parents do experience a small monetary shock when older children start going to school, since they pay for fewer hours of child care for these children during school hours. This monetary shock is however substantially smaller than the shock parents experience when the youngest child starts going to school (see footnote 9). As a robustness check, we also restricted our control group to parents whose second-youngest child is at least three years older to make sure no child in the household starts going to school within the observation period. This restriction severely limits the sample, but does not affect our results.

[11] This monetary shock is however substantially smaller than the shock parents experience when the youngest child starts going to school, since own contributions for child care are generally highest for the youngest child. The magnitude of the shock parents experience when their second-youngest child starts going to school is shown in Appendix Table A1.

going to school for the treatment group (ATT) for each month relative to treatment. Our reference category is 11 months before treatment. We include individual fixed effects η_i to control for any individual-specific effects (e.g. the number of children in the household, education level of the parents or ability) that might drive changes in our outcome variable. We also include a full set of calendar year by month fixed effects θ_t to control for any common time shocks (e.g. a recession). Finally, ε_{it} is the error term and standard errors are clustered at the level of the parent to take into account within-parent correlation in labor market behavior.

We also estimate a simpler version of equation 7 to get an average treatment effect over the entire two-year post treatment period

$$y_{it} = \alpha + \beta \times T_i + \gamma_t \times S_t + \delta \times S_t \times T_i + \eta_i + \theta_t + \varepsilon_{it}, \tag{8}$$

where S_t is a dummy equal to one if the youngest child is in school and and zero otherwise and T_i is a dummy equal to one if the parent is in the treatment group and zero otherwise. The average treatment effect on the treated is given by δ. All other terms are defined as before. In the heterogeneity analyses we interact the treatment dummy with indicators for different groups (e.g. marital status or number of children).

To ensure that we compare parents in the treatment and the control groups who are as similar as possible, we apply coarsened exact matching (CEM) (Azoulay et al., 2010; Iacus et al., 2012).[12] Following Azoulay et al. (2010), we match on the pre-treatment outcomes. In particular, we match on hours worked by a parent 11 and 6 months before the treatment and on the calendar year of treatment. The hours a parent worked are divided in bins.[13] In this way, we obtain weights for the control groups that are proportional to the number of treated and controls in each combination of (bins of) hours worked 11 and 6 months before treatment. All treated parents can be matched to at least one parent in the control group. Only 0.0001% of the potential control group is not matched.[14]

This matching procedure alleviates concerns regarding the common trend assump-

[12]In contrast to propensity score matching, CEM is nonparametric. CEM involves selecting covariates on which we want to achieve balance, and then match each treated observation to control observations based on the values of the covariates. The approach is coarse in the sense that we do not match on each value for each covariate, but rather coarsen the distribution for some covariates and achieve balance on the coarsened distribution.

[13]The bins are defined in the following way: 0, 1-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39 and 40 hours and above.

[14]Our results are comparable if we do not apply CEM.

tion, which is required in our difference-in-differences design. That is, conditional on fixed effects and observables, trends in the treatment and control group should follow a similar trend in the absence of treatment. The matching procedure we apply should reduce possible differences in the pre-trend period. We also explicitly test for common trends in outcomes during the pre-treatment period by estimating the 11 months before treatment.

4.3 Data and descriptive statistics

We use administrative data on the universe of employees in the Netherlands.[15] The data consist of monthly employment records collected for the purpose of social security administration and income taxes between 2006 and 2016. The data contain information on actual hours worked and the wage for all jobs of a worker in that month.[16] From these administrative data, we construct a balanced panel of monthly data on parents' average weekly working hours.[17] We add data from the municipal registries (*Gemeentelijke Basisadministratie*) which contains demographic information on all households, including for each household member the month and year of birth and gender.

We construct separate samples for mothers and their partners, who are the biological fathers or the stepfathers to the children, independent of whether they are married or not.[18] We therefore do include single mothers in our sample, but not single fathers.

Subsequently we apply the following sample restrictions. First, we drop mothers who have their first child before the age of fifteen or after the age of 40 (1%) as well as fathers who have their first child before 15 or after 50 (1%), parents who work more than 100 hours per week during at least one month (0.02% of mothers and 0.09% of fathers), parents who belong to two households at the same time (0% of mothers and 0.07% of fathers) and finally mothers for whom the difference between their youngest and second-youngest child is larger than 10 years (2.3%). We also drop observations for fathers where couples divorce or separate during the observation period (7.5%) to ensure that

[15] The data are available to researchers who sign a confidentiality agreement with Statistics Netherlands. While we cannot share the data, all programs to replicate our results are available on request.

[16] We use actual hours worked rather than contractual hours, since actual hours worked also take parental leave into account. Parental leave policies differ substantially between sectors in the Netherlands.

[17] Using the monthly data, we construct average hours worked per week by dividing the number of hours worked in a month by 4.35 (the average number of weeks per month).

[18] Unfortunately same-sex couples cannot easily be identified in our data on household composition, because it is often unclear whether two people of the same gender are a couple or just living together in the same household. Hence we only include couples where the gender differs between the partners.

the partner remains the same. Finally, in the main analyses we exclude people who receive income from self-employment at any point in the observation period, because we do not observe their hours worked outside of hours spent on regular employment (10.6% of the mothers and 19.5% of the fathers).

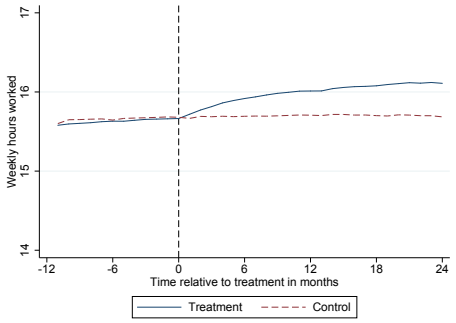
Table 2 shows the summary statistics for mothers (Columns 1 and 2) and fathers (Columns 3 and 4) in the treatment and the control group weighted by matching weights. Mothers in our sample are around 37 years old in the treatment group, and as expected, somewhat younger in the control group. The treatment and the control group have a similar share of highly educated mothers and ethnicity is also similar. They have slightly more than 2 children on average. In the treatment group around 68% is married or in a civil union, while in the younger control group around 65% is married. The age at which they gave birth to their first-born is very similar, as is their hourly wage. Fathers are somewhat older than mothers, close to 40 years in the treatment group and 38 in the control group. Ethnicity and number of children – slightly more than 2 on average – are very similar. Education level is also very similar. Close to 80% in the treatment group is married or is in a civil union, while this holds for around 75% in the control group. The hourly wage is somewhat higher for the older fathers in the treatment group.

Figure 3 reports descriptive statistics on the average number of hours mothers and fathers worked and their employment status, both in the treatment and the control group, weighted by matching weights. On average, mothers work almost 16 hours per week (including those who do not work as zero). In addition, around 68% of the mothers in our sample work in a given month pre-treatment. Finally, employed mothers work around 23 hours on average per week. This suggests that there is substantial room for increases along both the intensive and the extensive margin. It is clear that the matching procedure succeeded in creating very similar groups in the pre-treatment period. This should alleviate some concerns about the common trend assumption.

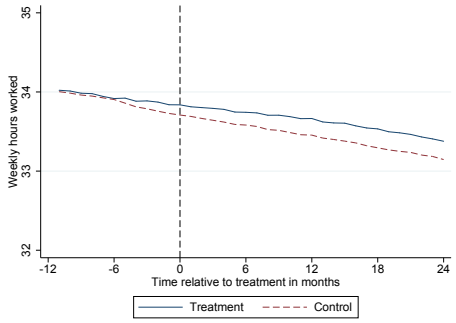
Around 90% of fathers are employed. Those who are employed, work close to 38 hours per week on average. The average number of hours fathers worked declined somewhat during the three years they are in the sample. This decline is similar for the treatment and control group and seems to be driven by a decline in employment status. This could be due to the Great Recession in 2009 – 2010, and the second dip the Netherlands experienced in 2011 – 2013.

Figure 3: Descriptive statistics on employment for mothers and for fathers

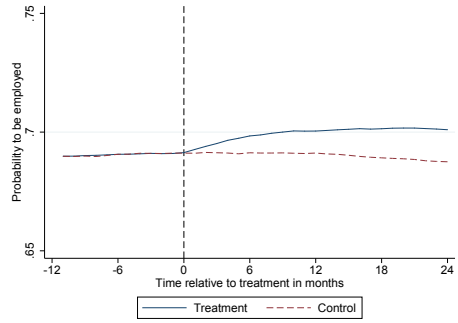
(a) Mothers' weekly working hours (including zeros)



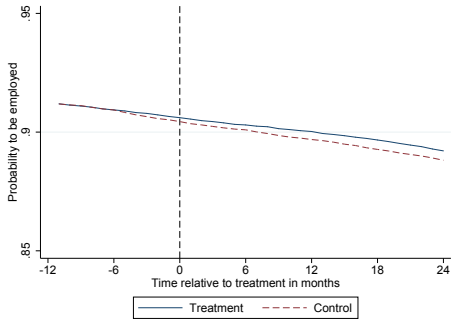
(b) Fathers' weekly working hours (including zeros)



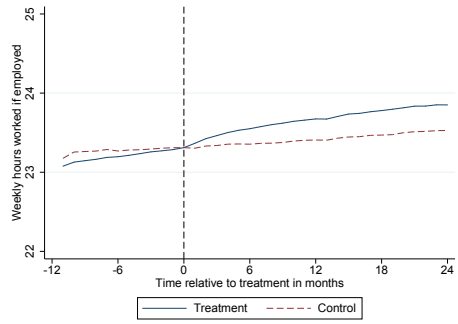
(c) Probability for mothers to be employed



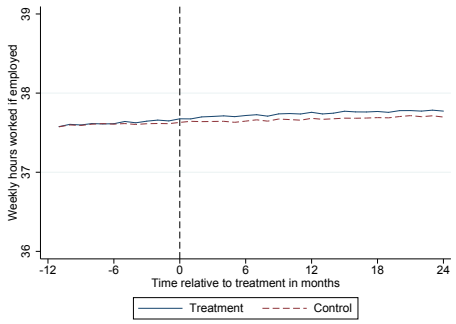
(d) Probability for fathers to be employed



(e) Mothers' weekly working hours if employed



(f) Fathers' weekly working hours if employed



Notes: Own calculations based on register data from Statistics Netherlands. Treatment at $t = 0$. In the treatment group, this is when the youngest child turns four years old and in the control group, this is when the youngest child turns 2 years old.

Table 2: Descriptives of demographics for mothers and fathers in treatment and control group weighted by matching weights.

	Mothers		Fathers	
	(1)	(2)	(3)	(4)
	Treatment group	Control group	Treatment group	Control group
Age	36.80	34.65	39.97	37.90
	(4.49)	(4.58)	(4.90)	(5.06)
High educated	0.41	0.42	0.47	0.47
	(0.49)	(0.49)	(0.50)	(0.50)
Native	0.75	0.74	0.80	0.78
	(0.43)	(0.44)	(0.40)	(0.41)
Foreign born	0.17	0.18	0.14	0.15
	(0.38)	(0.39)	(0.35)	(0.36)
Native born from foreign-born parent	0.07	0.08	0.06	0.07
	(0.26)	(0.27)	(0.24)	(0.25)
Number of children in the household	2.15	2.17	2.18	2.16
	(0.88)	(0.90)	(0.84)	(0.86)
Not married	0.20	0.24	0.20	0.25
	(0.40)	(0.43)	(0.40)	(0.43)
Married	0.68	0.66	0.80	0.75
	(0.47)	(0.47)	(0.40)	(0.43)
Single parent	0.12	0.10		
	(0.33)	(0.30)		
Age at first born	28.98	28.80	32.23	32.21
	(4.73)	(4.76)	(5.11)	(5.20)
Hourly wage pre-treatment	17.01	16.62	21.65	20.66
	(10.97)	(10.39)	(17.29)	(16.59)
Hourly wage year 1 post-treatment	17.13	16.80	21.99	21.08
	(10.77)	(9.79)	(21.41)	(16.45)
Hourly wage year 2 post-treatment	17.30	17.04	22.36	21.48
	(11.73)	(10.44)	(54.72)	(15.80)
Observations	21,473,784	21,809,088	15,364,404	16,056,612
No. of individuals	596,494	605,808	426,789	446,017

Notes: The table reports means and standard deviations in parentheses. We observe all variables for the full sample, except for education, which is only observed for about two-thirds of the sample and is biased towards higher-educated.

5 Results

In Section 3, we calculated that the treatment mothers experience when their youngest child starts going to school is a time shock of on average 13.3 hours per week and a monetary shock to the household of on average 61 euros per month. Similarly, fathers and stepfathers on average experience a time shock of 3.7 hours and a monetary shock to the household of 70 euros. Furthermore, Section 4 showed based on descriptive statistics that employment among mothers seems to increase after treatment has taken

place, while the treatment hardly seems to affect men. In this section, we show the results of the difference-in-differences analyses, which confirm the descriptive results.

5.1 Main results

Figure 4 reports estimates of the effect of the youngest child going to school (at $t = 0$) on maternal and paternal employment. We present estimates for each month from the year before until two years after the child goes to school. The estimates are relative to the situation eleven months before the child goes to school.

Figure 4a reports the estimated differences between individuals in the treatment and the control groups on total working hours, including those who do not work as zero. The precisely estimated average effect is a small increase in weekly working hours after the youngest child goes to school of close to 0.5 hours per week after two years. This is a 3% increase relative to the pre-treatment mean of around 15 hours per week of the mothers in the treatment group. Over the entire post-treatment period the average effect is 0.3 hours, or 1.9% relative to the mean.

About 32% of the mothers in our sample does not work before their child goes to school. It is possible that the time that they no longer need to spend on childcare, induces some of them to enter the labor force. Figure 4c reports effects on the probability to work. We find an increase of about 1.5 percentage points relative to the control group after two years in the chance that a mother works. This is a 2.2% increase relative to the pre-school mean of 69% of mothers who work. The average treatment effect is 0.9 percentage points, or 1.3% relative to the mean.

Finally, Figure 4e reports effects on weekly working hours for those in employment throughout the entire observation period. We find that those in employment work about 0.4 additional hours per week after their child goes to school. The figures provide evidence that our matching procedure succeeded in making our treatment and control groups comparable. We find no evidence of changes in labor supply in the pre-treatment period. This implies that there does not seem to be an anticipation effect.

We can now calculate the contribution of the changes at the intensive and extensive margin to the total effect. The contribution of the effect at the intensive margin is equal to the share who work multiplied by the effect size $0.68 \times 0.3 = 0.2$. The total effect is 0.3, which means that the effect measured in hours worked per week at the extensive margin must be 0.1. This means that changes along the intensive margin contribute about two-thirds to the total effect, while changes along the extensive margin contribute

about one-thirds. Furthermore, given that we find an increase along the extensive of 0.9 percentage point, this means that mothers who start working when their youngest child goes to school on average work around 11 hours (0.1/0.009). This is about half the number of hours worked by those who already work before their child goes to school.

Next, we consider how the youngest child in a household going to school affects the partners of these mothers, if they have one during the observation period. Figure 4 shows that on average fathers and stepfathers respond much less than mothers do to their child going to school. We find that weekly working hours increase by about 0.15 hours on average, or a 0.4% increase relative to the mean of 34 hours before treatment. The probability to work also increases slightly by about 0.5 percentage points, or a 0.6% increase relative to the mean of 91% before treatment. Finally, the effect on hours worked conditional on employment is very close to zero for fathers. For fathers the effect along the intensive margin ($0.91 \times 0.05 = 0.05$) contributes about one-thirds to the total effect, while the effect along the extensive margin contributes about two-thirds. This means that fathers who start working after their youngest child goes to school, work about 20 hours on average ($0.1/0.005 = 20$). However, while statistically significant, the effects are very small. Also note that for fathers we observe a small pre-trend, suggesting that other factors could also play a role here.

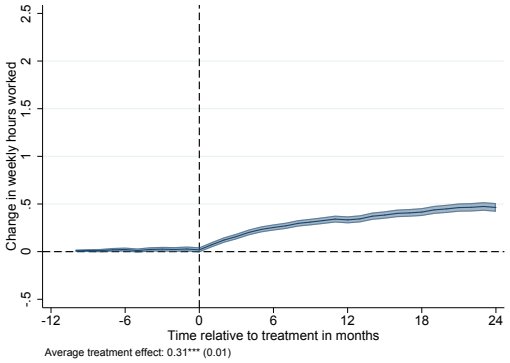
Overall, these results show that the treatment leads to a small increase in time spent at work for mothers and an even smaller increase for fathers. The increase for mothers is both along the intensive and the extensive margin. At the same time, although the effects are statistically significant, they are economically quite small. They are also small compared to the magnitude of the change in time mothers experience when their youngest child starts going to school. Fathers generally experience a substantially smaller shock, particularly in terms of time, when their youngest child starts going to school than mothers do. This may contribute to the finding that mothers respond more than fathers when the youngest child in a household starts going to school. We look into this in the next section.

5.2 Heterogeneity

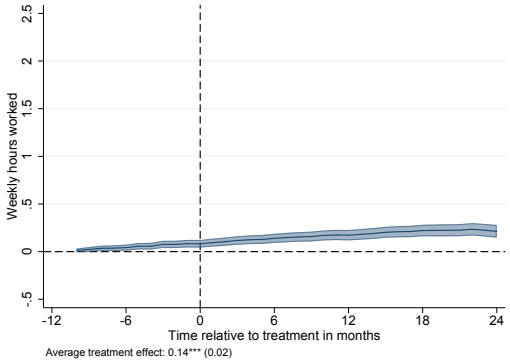
On average the treatment involves an increase of 13.3 hours of additional time and 61 euros of income per month for mothers and an increase of 3.7 hours and 70 euros for fathers. There is however important heterogeneity in the treatment as was shown in Table 1. Parents who work more hours gain less additional time than parents who

Figure 4: Main estimates for mothers and fathers

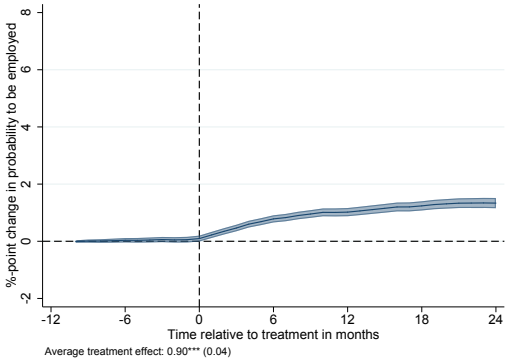
(a) Effect on weekly working hours for mothers (including zeros)



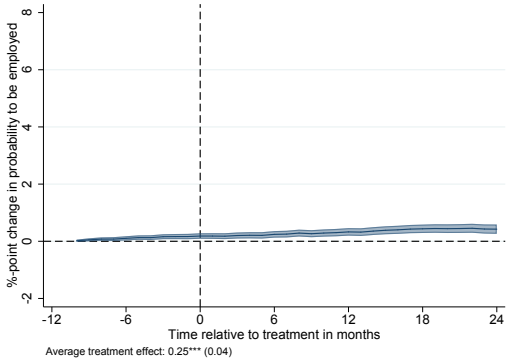
(b) Effect on weekly working hours for fathers (including zeros)



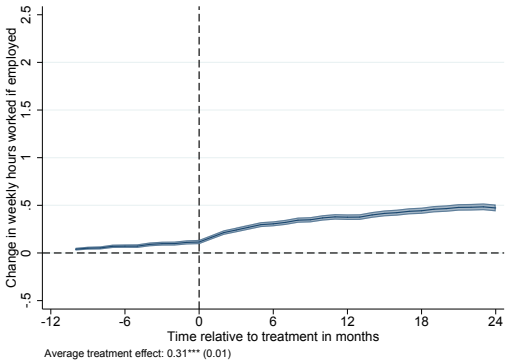
(c) Effect on probability to work for mothers



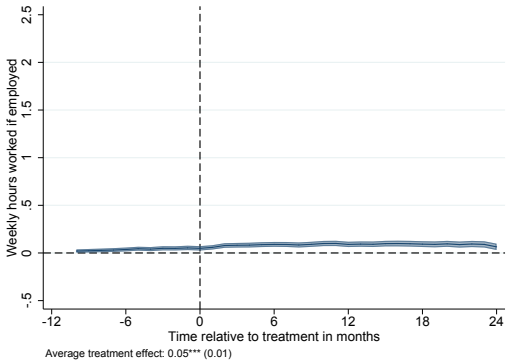
(d) Effect on probability to work for fathers



(e) Effect on weekly working hours if employed for mothers



(f) Effect on weekly working hours if employed for fathers



Notes: Own calculations based on register data from Statistics Netherlands. Treatment at $t = 0$. For the treatment group this is when the youngest child turns four years old. For the control group this is when the youngest child turns 2 years old. The lighter band around the estimate represents the 99% confidence interval. Reported average treatment effect is based on Equation 8. Cluster-robust standard errors clustered by individual in parentheses, *** p<0.001, ** p<0.01, * p<0.05. The coefficients for probability to work are multiplied by 100 so that they can be interpreted as percentage point changes.

work very few hours per week. Additionally, households in which the parents earn more, gain more money when their youngest child goes to school than household with a lower household income because childcare subsidies are income dependent.

Theoretically, we would expect larger positive responses in labor supply for those with the largest time gains and the smallest financial gains. However, our heterogeneity analyses come to different conclusions. Differences in initial preferences for labor supply are probably at the heart of these results.

Table 3 shows the differences in the estimated effects on the hours worked (including those who do not work) for mothers (Column 1) and fathers (Column 3) who work different numbers of hours (Panel A) and who earn different wages per hour (Panel B) in the year before treatment. Column 2 (Column 4) reports the mean number of hours mothers (fathers) in the treatment group worked in the twelve months before their youngest child started going to school. Panel A shows that –surprisingly– the increase in hours worked is largest for mothers who already worked more than 34 hours before treatment. The increase in hours worked is smallest among those who did not work before the treatment. So although the average number of hours mothers worked increases significantly amongst all groups, mothers who obtain more additional time (because they work fewer hours) when their youngest child starts going to school in fact increase their working hours *less* than mothers who only obtain very little additional time (because they already worked (nearly) fulltime before the treatment).

On average, fathers experience a substantially smaller shock in terms of time when their youngest child starts going to school. Column 3 of Table 3 illustrates that fathers who do experience a larger shock in terms of time (because they work few hours prior to the treatment), also do not significantly increase their working hours.These findings suggest that there are reasons other than caring for the youngest child to explain why these fathers do not work, such as disability or study. These results point out that the differences between the estimated average treatment effects between mothers and fathers are not simply entirely due to differences in the magnitude of the shock they experience when their youngest child goes to school. Even within groups in which the number of hours parents work is relatively similar, mothers increase their working hours more or at least as much as fathers do.

Panel B reports the heterogeneity by the hourly wage parents earn. In Section 4, we formulated the hypothesis that for parents who earn higher wages, the effects are larger. Clearly wages are only defined for parents who are working. For mothers, we

Table 3: Heterogeneity by hours worked and wage quartile.

	Mothers		Fathers	
	(1)	(2)	(3)	(4)
	Estimated effect	Avg hours worked	Estimated effect	Avg hours worked
Panel A. Heterogeneity by hours worked				
Not working	0.22***	0.0	−0.01	0.0
	(0.02)		(0.09)	
1-20 hours	0.35***	12.9	0.12	10.8
	(0.02)		(0.14)	
20-33 hours	0.31***	25.5	0.31***	29.9
	(0.01)		(0.05)	
34+ hours	0.50***	37.9	0.13***	38.8
	(0.06)		(0.01)	
Observations	43,282,872		31,421,016	
Panel B. Heterogeneity wage quartile				
Quartile 1	0.22***	19.1	0.06	36.1
	(0.03)		(0.03)	
Quartile 2	0.36***	21.3	0.08***	37.1
	(0.02)		(0.02)	
Quartile 3	0.44***	22.4	0.10***	36.8
	(0.02)		(0.02)	
Quartile 4	0.45***	25.5	0.24***	37.0
	(0.02)		(0.03)	
Observations	29,785,932		28,631,088	
Panel C. Full sample				
Average treatment effect	0.31***	15.6	0.14***	33.9
	(0.01)		(0.02)	
Observations	43,282,872		31,421,016	

Notes: The table reports the total estimated effect for each group from a regression with interactions between the treatment indicator and indicators for each groups. Cluster-robust standard errors clustered by individual in parentheses, *** p<0.001, ** p<0.01, * p<0.05. All regressions include individual fixed effects and calendar year-month fixed effects.

see that women who earn higher wages on average work more hours, while this does not seem to be the case for fathers. We find that all groups increase their hours worked, and that for both mothers and fathers, the increase is indeed largest among those who earn higher hourly wages.

Appendix Table A2 additionally reports how the effects differ by demographic characteristics. Contrary to what is commonly found in the literature, we see in Panel A that single mothers actually decrease the number of hours they work when their youngest child starts going to school. This might be explained by differences in the

examined time periods: most papers on the effect of compulsary schooling on maternal labor supply use data from the 1980s and the 1990s and in those days the composition and preferences of the female labor force were distinctly different. At the same time, the problem might also be that our control group is not suitable for single mothers: perhaps single mothers with very young children are inherently different from single mothers with slightly older children.

Panel C shows that mothers with one child show a small decline in hours worked and the probability to work, while mothers with more children increase both their hours and participation in the labor market. One explanation could be that mothers with more children wait until their youngest is off to school, and only then enter the labor market, while mothers with only one child were already working more. Indeed, the data show that mothers with one child work 17.7 hours on average, while mothers with more than two children work 16.9 hours on average and mothers with three or more children work 11.6 hours on average.

5.3 Robustness analyses

In the main analyses, we did not include self-employed workers in our sample, because we do not observe the number of hours they worked. Because this restriction reduces the sample by a sizable 10.6% for mothers and 19.5% for fathers, it is important to discuss whether this restriction affects our results.

To check this, we estimate the hours self-employed mothers (fathers) worked in a given year by dividing the profits they reported by the average hourly wage of all mothers (or fathers) in our sample in a given calendar year.[19] Clearly using the average hourly wage to calculate the number of hours self-employed parents work yields only a rough estimation of the actual number of hours a self-employed parent works. Still, the estimates for the probability to work are reliable. Other than excluding the self-employed parents, we apply the same sample selections as in the main analysis.[20]

[19] We therefore assume that these self-employed parents are working in each month throughout the calendar year if they have income from self-employment in that year. If self-employed workers are also employed at some point in time, we simply sum the hours worked as self-employed and in their employment.

[20] We again drop people who work more than 100 hours per week in either a job, or as self-employed or as a combination of both. For mothers this is 0.7% of the sample and for fathers it is 1.5%. We then run the same matching procedure as described in the main text. We end up with 1,341,925 matched mothers and 1,127,896 matched fathers. This is 11.6% (29.2%) more than the main sample. 66% (91%) of the mothers (fathers) in this sample work in a given month before treatment, and they work 16.3 (33.7) hours on average.

Descriptives are reported in Table A3 in the Appendix.

Table 4 illustrates that including self-employed in the sample does not change the main conclusions. Panel C reproduces the original estimates from the main analyses and Panel A shows how the effects change when self-employed people are included in the sample. For mothers, we find effects very similar to the main estimates. Including self-employed, mothers work about 1.8% more hours on average in the two years after their youngest child starts going to school, compared to 2% for the main estimates. The estimates for hours worked for those who are employed and for the extensive margin are also remarkably similar. For fathers, we find an average increase in total hours worked of 0.3% relative to the mean, compared to an increase of 0.4% for the main estimates. We find no statistically significant effect for those in work, which means that the full increase is driven by the extensive margin. The results on the extensive margin are very similar to the main estimates. This suggests that the substantial sample selection of self-employed does not bias our results.

5.3.1 An alternative control group

To further check the robustness of our results, we also consider an alternative control group. In our main analyses, our control group consists of parents whose youngest child is between one and four years old. Their youngest child does not go to school in the observation period. An alternative approach is to use parents whose second-youngest child is between three and six years old as a control group.[21] In line with the parents in the control group in our main analyses, parents in this alternative control group do not experience a time shock during the observation period, because they need to take care of their youngest child who does not go to school yet. Parents in this alternative control group, however, do experience a small monetary shock, because they no longer need to pay for child care in the hours during which their second-youngest child now starts going to school. In the Netherlands, government subsidies are substantially higher for the child in the household that uses most hours of child care (generally the youngest child) than for other children. As a result, the monetary shock households experience when their second-youngest child starts going to school are substantially lower. Appendix Table A1 shows the distribution of the magnitude of the shock fathers and mothers in this alternative control group experience.

[21] To ensures that parents in this group do not experience a time shock because their youngest child starts going to school while they are in this control group, the youngest child should be two or three years younger and the child remains the second-youngest child in the observation period.

We apply the same selections as in the baseline estimates. We end up with a sample of 596,494 (426,789) treated mothers (fathers) and 152,947 (122,012) control mothers (fathers). Descriptives are reported in Table A4 in the Appendix.

Panel B in Table 4 reports the estimation results. For mothers we find somewhat smaller effects on average, but larger effects along the intensive margin. We find no effect along the extensive margin. For fathers we actually find small negative effects on hours worked overall. These appear to be driven by the extensive margin. However, while statistically significant, the results are, just as the baseline estimates, economically insignificant: we find a decline in hours worked overall of 0.5% for fathers. Hours worked while employed increases by 0.05 hours, or 0.1%, just as in the baseline estimates. We also find a small decline in probability to work of about 0.6%.

Table 4: Treatment effect estimates on hours per week, hours worked if employed and the probability to work when including self-employed and relative to a control group consisting of parents of children with a second-youngest child aged 3–6.

	Mothers			Fathers		
	(1)	(2)	(3)	(4)	(5)	(6)
	Hours worked	Hours worked if working	Probability to work	Hours worked	Hours worked if working	Probability to work
Panel A. Including self-employed						
Average treatment effect	0.29***	0.28***	0.87***	0.10***	0.02*	0.24***
	(0.01)	(0.01)	(0.04)	(0.02)	(0.01)	(0.04)
Observations	48,309,300	26,732,808	48,309,300	40,604,256	31,022,640	40,604,256
Mean dep. variable	16.2	23.7	0.70	33.7	37.5	0.91
Panel B. Relative to control group with second-youngest child 3-6						
Average treatment effect	0.23***	0.45***	0.09	−0.15***	0.08***	−0.54***
	(0.02)	(0.01)	(0.07)	(0.02)	(0.01)	(0.06)
Observations	26,979,876	15,414,624	26,979,876	19,756,836	15,759,468	19,756,836
Mean dep. variable	15.6	23.2	0.69	33.9	37.6	0.91
Panel C. Main results						
Average treatment effect	0.31***	0.31***	0.90***	0.14***	0.05***	0.25***
	(0.01)	(0.01)	(0.04)	(0.02)	(0.01)	(0.04)
Observations	43,282,872	23,990,148	43,282,872	31,421,016	24,695,748	31,421,016
Mean dep. variable	15.6	23.2	0.69	33.9	37.6	0.91

Notes: Cluster-robust standard errors clustered by individual in parentheses, *** p<0.001, ** p<0.01, * p<0.05. All regressions include individual fixed effects and calendar year-month fixed effects. The treatment group consists of mothers with a youngest child 3–6 years old. The control group in Panels A and C consists of mothers with a youngest child between 1 and 4 years old. In Panel B the control group consists of parents with a second-youngest child 3–6 years old. The coefficients for probability to work are multiplied by 100 so that they can be interpreted as percentage point changes.

6 Conclusion and discussion

This paper shows that when the youngest child in a family starts going to school, mothers in the Netherlands only increase their labor supply marginally. When the youngest child starts attending school, mothers experience an increase in free time of more than thirteen hours a week, which is expected to increase their labor supply. Theoretically, this effect may be mitigated by the income effect that households experience simultaneously: when the youngest child starts attending school, parents save on average sixty to seventy euros on the costs of formal child care. Nonetheless, even though such income effects are expected to decrease parental labor supply, the effects are likely to be small in this case, because the monetary shock is relatively small.

Compared to mothers whose youngest child turned two and who therefore do not experience any shock in the observation period, mothers increase their labor supply by on average approximately 0.5 hours a week after two years. This is around a 3% increase relative to the mean before their child goes to school. For their partners we find an even smaller increase of about 0.15 hours after two years, or 0.4% relative to the mean before their child goes to school. These findings are generally robust to alternative specifications. However, employing an alternative control group of parents with second-youngest children leads to small negative estimates for partners and somewhat smaller positive effects for mothers.

Our heterogeneity analyses shows surprising results: the response is larger among mothers and fathers who are already working longer hours and who already earn higher wages. Theoretically, one would expect smaller increases in working hours in these groups as the relative gain in time and opportunity costs of child care are smaller. However, differences in initial preferences for labor supply over leisure are probably driving these results.

Utility or consumption smoothing can perhaps be an explanation for the relatively limited effects that we find in this paper. Clearly, the moment a child turns four is known in advance. Assuming that parents wish to keep their marginal utility of consumption and leisure as similar as possible over time, only small changes to the number of hours worked can be expected. An alternative explanation is that parents in fact consider the gross monetary gain - the difference in the cost of child care without considering the corresponding decline in child care subsidies - they obtain when their youngest child starts going to school, rather than the net monetary gain that we calculate in this paper. In the Netherlands parents receive child care subsidies

from the tax authorities and often on a different date than when they pay for child care. The gross monetary gain is substantially larger than the net monetary gain, especially for parents with a relatively low household income, and this leads to a larger perceived increase in income than is actually the case. In addition, the literature shows that successive cohorts of parents respond less and less strongly to incentives aimed at increasing their labor participation. Finally, it could be that school times are inconvenient, making it difficult to increase hours worked during school hours.

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A Appendix

A.1 Description of maternal budget constraint

This appendix explains in more detail how the time mothers spend on work, taking care of their children and leisure changes when the youngest child starts going to school, i.e. when $t_s > 0$. Figure 2 shows the budget constraint mothers face when at least one child in a household does not go to school and the budget constraint mothers face when the youngest child in a household starts going to school. In this figure the time fathers spend on labor l_f and child care t_f is held constant. Mothers decide how to allocate their time between leisure z_m, taking care of their children t_m and working from which they earn an income that enables them to consume X. The blue solid planes represent the situation when at least one child does not go to school yet and the green dashed planes represent the situation after the youngest child has started going to school when parents no longer have to arrange child care during school hours.

Figure 2a demonstrates the tradeoff between the time mothers take care of their children t_m and the time they spend on leisure z_m, Figure 2b depicts the tradeoff between the mother's leisure z_m and the household's consumption X and Figure 2c shows the relation between the time mothers spend on domestic child care and household consumption.

In this section we explain the budget constraint by zooming in on four situations that correspond to four points on this budget constraint. A first situation of interest is when mothers work fulltime and therefore do not enjoy any free time and do not provide domestic child care (1: $l_m = 1, z_m = 0, t_m = 0$). A second situation is when mothers spend all their time on leisure ($l_m = 0, z_m = 1, t_m = 0$). At the third and fourth situation we discuss, the mother spends as much time as she can on domestic child care. When a child goes to school or when the father (whose time use is held constant in Figure Figure 2) also provides child care, mothers cannot spend all their time on domestic child care. The third situation therefore entails that women spend as much time as possible on providing domestic child care and spend the remainder of their time working (3A: $l_m = t_s + t_f, z_m = 0, t_m = 1 - t_s - t_f$). Finally in the fourth situation the mother again maximizes the time she spends on providing domestic child care and spends the remainder of her time on leisure (3B: $l_m = 0, z_m = t_s + t_f, t_m = 1 - t_s - t_f$).

First, when mothers work fulltime and do not enjoy any free time and do not provide domestic child care (1: $l_m = 1, z_m = 0, t_m = 0$), the household pays for child

care while the parents work and consumes the earnings of the father and the mother. Household consumption therefore equals $X = w_f^* l_f + w_m^* - q^*(1 - t_s - t_f)$, where the asterisks denote real wages and real prices of child care, $w_i^* = w_i/p$ and $q^* = q/p$. In Figure 2a this point is at the origin: mothers do not provide child care nor do they enjoy leisure. In Figure 2b and in Figure 2c this situation is at the top-left part of the budget constraint. As a result, there is a linear upward shift of the budget constraint from the blue plane to the green dashed plane at this point. When the youngest child in a household starts going to school, household consumption increases by $q^* t_s$ and depending on the shape of the utility function this causes mothers to increase their leisure and thereby decrease their labor supply.

A second situation of interest is when mothers spend all their time on leisure. In this situation, women do not work but children attend external child care outside of possible school hours and when their father does not take care of them. Household consumption at this point is therefore $X = w_f^* l_f - q^*(1 - t_s - t_f)$. In line with the previous situation, there is an upward linear shift of the budget constraint when the youngest child starts going to school and parents only experience an income effect.

Third, when mothers spend as much time as they can on providing domestic child care, they additionally experience a time effect. In situation 3A, mothers maximize the time they spend on child care and work the remainder of the time, $l_m = t_s + t_f, z_m = 0, t_m = 1 - t_s - t_f$. In this situation, children do not attend external child care. Household consumption then equals $X = w_f^* l_f + w_m^*(t_s + t_f)$. When the youngest child starts attending school, the time these mothers spend on domestic child care decreases from $1 - t_f$ to $1 - t_s - t_f$ and her labor supply increases correspondingly.

Finally, in situation 3B mothers spend as much time as possible on providing domestic child care and spend the remainder of the time on leisure, $l_m = 0, z_m = t_s + t_f, t_m = 1 - t_s - t_f$. Household consumption in this situation is equal to $X = w_f^* l_f$ as children do not attend external child care and mothers do not work. When the youngest child starts going to school, these mothers spend less time on domestic child care and enjoy more leisure.

In sum, when the youngest child starts going to school, the budget constraint changes in two ways: on the one hand there is an upward linear shift because mothers whose children attend external child care experience an income effect as their child care expenses decrease. On the other hand, the maximum amount of time mothers can spend on domestic child care decreases. The exact optimal situation in the situation

Table A1: Magnitude of the shock in terms of money and in terms of time

Panel A: Shock in terms of time and money that <u>mothers</u> experience when their second-youngest child goes to school			
	(1) % of mothers	(2) Hours saved per week	(3) Money saved per month (per household)
Does not work	19.2	0	3
Works less than 20 hours a week	27.3	0	11
Works 20-34 hours a week	48.6	0	28
Works more than 34 hours a week	4.9	0	48
Total	100.0	0	19
Panel B: Shock in terms of time and money that <u>fathers</u> experience when their second-youngest child goes to school			
	% of fathers	Hours saved per week	Money saved per month (per household)
Does not work	4.8	0	9
Works less than 20 hours a week	3.4	0	14
Works 20-34 hours a week	18.1	0	23
Works more than 34 hours a week	73.6	0	21
Total	100.0	0	21

Notes: See main text for calculation of the monetary and time shocks. The percentages listed in Column (1) refer to the share of mothers (fathers) in our sample that works a specific number of hours. The amounts of money households save when their second-youngest child starts going to school (listed in Column (3)) differs for the mothers (Panel A) and fathers (Panel B) in our sample, because households with single mothers *are* included in the sample for mothers, but not in the sample of fathers.

before and after the youngest child starts going to school depends on the marginal utility she obtains from those activities, and thereby on the shape of the utility function.

A.2 Additional results

Table A2: Heterogeneity by marital status, ethnicity and number of children.

	Mothers		Fathers	
	(1)	(2)	(3)	(4)
	Estimated effect	Avg hours worked	Estimated effect	Avg hours worked
Panel A. Heterogeneity by marital status				
Dual household	0.37***	15.9		
	(0.01)	(0.01)		
Single household	−0.29***	13.2		
	(0.05)	(0.04)		
Panel B. Heterogeneity by ethnicity				
Native	0.40***	16.8	0.07***	35.1
	(0.01)		(0.02)	
Foreign	0.05*	12.1	0.30***	29.6
	(0.02)		(0.04)	
Panel C. Heterogeneity by number of children				
1 child	−0.17***	17.7	0.18***	33.2
	(0.03)		(0.04)	
2 children	0.45***	16.9	0.14***	34.7
	(0.01)		(0.02)	
3 or more children	0.41***	11.6	0.10***	32.7
	(0.02)		(0.03)	
Panel D. Full sample				
Average treatment effect	0.31***	15.6	0.14***	33.9
	(0.01)		(0.02)	
Observations	43,282,872		31,421,016	

Notes: The table reports the total estimated effect for each group from a regression with interactions between the treatment indicator and indicators for each groups. Cluster-robust standard errors clustered by individual in parentheses, *** p<0.001, ** p<0.01, * p<0.05. All regressions include individual fixed effects and calendar year-month fixed effects.

Table A3: Descriptives of demographics for mothers and fathers in treatment and control group weighted by matching weights for the sample including self-employed.

	Mothers		Fathers	
	(1)	(2)	(3)	(4)
	Treatment group	Control group	Treatment group	Control group
Hours worked per week pre-treatment	16.26	16.20	33.58	33.46
	(13.58)	(13.42)	(14.02)	(13.93)
Fraction working pre-treatment	0.70	0.70	0.91	0.91
	(0.46)	(0.46)	(0.29)	(0.29)
Hourly wage pre-treatment	17.15	16.77	22.43	21.33
	(11.61)	(11.54)	(25.53)	(19.80)
Hourly wage year 1 post-treatment	17.25	16.95	22.69	21.66
	(10.99)	(11.01)	(25.87)	(18.95)
Hourly wage year 2 post-treatment	17.42	17.17	22.98	22.02
	(12.33)	(11.06)	(53.92)	(18.87)
Self-employed at some point	0.11	0.10	0.23	0.22
	(0.31)	(0.30)	(0.42)	(0.41)
Age	36.91	34.77	40.06	38.03
	(4.47)	(4.56)	(4.89)	(5.06)
Fraction high educated	0.43	0.44	0.47	0.47
	(0.49)	(0.50)	(0.50)	(0.50)
Native	0.76	0.74	0.80	0.79
	(0.43)	(0.44)	(0.40)	(0.41)
Foreign born	0.17	0.18	0.13	0.14
	(0.37)	(0.38)	(0.34)	(0.35)
Native born from foreign-born parent	0.07	0.08	0.06	0.07
	(0.26)	(0.27)	(0.24)	(0.25)
Number of children	2.16	2.17	2.21	2.20
	(0.88)	(0.90)	(0.86)	(0.88)
Not married	0.20	0.25	0.21	0.26
	(0.40)	(0.43)	(0.41)	(0.44)
Married	0.68	0.66	0.79	0.74
	(0.46)	(0.47)	(0.41)	(0.44)
Single parent	0.12	0.09		
	(0.32)	(0.29)		
Age at first born	29.08	28.93	32.24	32.25
	(4.71)	(4.76)	(5.15)	(5.25)
Observations	24,117,624	24,191,676	20,004,552	20599704
No. of individuals	669,934	671,991	555,682	572,214

Notes: The table reports means and standard deviations in parentheses. We observe all variables for the full sample, except for education, which is only observed for about two-thirds of the sample and is biased towards higher-educated.

Table A4: Descriptives of demographics for mothers and fathers in treatment and control group weighted by matching weights for the sample using a control group of parents whose second-youngest child is between three and six years old.

	Mothers		Fathers	
	(1)	(2)	(3)	(4)
	Treatment group	Control group	Treatment group	Control group
Hours worked per week pre-treatment	15.67	15.71	33.89	33.90
	(12.65)	(12.57)	(12.29)	(12.11)
Fraction working pre-treatment	0.69	0.69	0.91	0.91
	(0.46)	(0.46)	(0.29)	(0.29)
Hourly wage pre-treatment	17.01	17.52	21.71	21.47
	(10.97)	(11.81)	(17.14)	(16.52)
Hourly wage year 1 post-treatment	17.13	17.73	21.99	21.87
	(10.77)	(10.32)	(21.41)	(18.71)
Hourly wage year 2 post-treatment	17.30	18.00	22.35	22.32
	(11.73)	(12.10)	(56.77)	(15.35)
Age	36.80	34.17	39.97	37.02
	(4.49)	(4.13)	(4.90)	(4.58)
High educated	0.41	0.52	0.47	0.55
	(0.49)	(0.50)	(0.50)	(0.50)
Native	0.75	0.80	0.80	0.84
	(0.43)	(0.40)	(0.40)	(0.37)
Foreign born	0.17	0.13	0.14	0.10
	(0.38)	(0.34)	(0.35)	(0.30)
Native born from foreign-born parent	0.07	0.07	0.06	0.06
	(0.26)	(0.25)	(0.24)	(0.24)
Number of children	2.15	2.38	2.18	2.31
	(0.88)	(0.75)	(0.84)	(0.66)
Not married	0.20	0.24	0.20	0.25
	(0.40)	(0.43)	(0.40)	(0.43)
Married	0.68	0.71	0.80	0.75
	(0.47)	(0.45)	(0.40)	(0.43)
Single parent	0.12	0.05	0.00	0.00
	(0.33)	(0.21)	(0.00)	(0.00)
Age at first born	28.98	28.97	32.23	32.06
	(4.73)	(4.22)	(5.11)	(4.53)
Observations	21,473,784	5,506,092	15,364,404	43,924,32
No. of individuals	596,494	152,947	426,789	122,012

Notes: The table reports means and standard deviations in parentheses. We observe all variables for the full sample, except for education, which is only observed for about two-thirds of the sample and is biased towards higher-educated.