The effect of child care prices on the labour supply of parents

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Abstract

We estimate the effect of day-care fees and child home care allowance to parents’ labour supply. Two cases from Finland provide exogenous variation; a municipal supplement to home care allowance and a day care reform in 1997. The results indicate a statistically significant negative effect to labour force participation of mothers when child home care allowance is increased. The size of the effect is large compared to some earlier estimates. We do not find a significant effect for the day-care fees on labour force participation, but this can be due to small identifying variation in the fees.

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1 Introduction to day care

In Europe there is a problem of falling fertility rates (OECD 2007). The problem many of the OECD countries are facing is that on the other hand they would like to create incentives to increase national fertility rates and on the other increase employment rates of mothers. An official employment strategy in EU has been to increase employment of all groups (EC 2007). An interesting feature is that the Nordic countries have leading figures in both
of these dimensions. It is of policy interest how much various public day care systems create incentives and to which direction. In other European countries there has been ideas to provide public day care and at the same time increase public subsidies to mothers to create opportunities. In this study we have exogenous variation in both of these dimensions.

There is an extensive system for publicly provided child care in Finland. The price for child care is heavily subsidised for parents. The idea of Nordic model of extensive public day care is to provide opportunities for mothers to participate to labour force, which as noted above, seems to work. However, in Finland there is another system working at the opposite direction; parent can take care of the children her-/himself and receive a subsidy called the child home care allowance. This subsidy obviously creates incentives to opposite direction than public day care system. Additional feature of the home care allowance system is that a parent should be able to return to previous job after the allowance period has ended. It may have been partly due to this system that in Finland women’s labour force participation is quite for those who have children under three years old and high for mothers of older children (OECD 2005).

Interesting feature of the home care allowance system is that while most of the family benefits are determined on national level, there is a municipal level supplement to home care allowance; some municipalities pay this supplement and others do not. Municipalities can also themselves make a decision to change the rules according to which they pay the supplement, providing a source of variation over time. There was also a day care reform in 1997 that created variation in public day care fees across municipalities. Both of these features of Finnish day care system, day care reform and the municipal supplement, provide exogenous variation in relative day care price to labour force participation. In this paper we intend to study how these prices affect the labour force participation of parents.

Theoretically, when studying labour supply, the effects of incentives can be divided into two margins, extensive and intensive margin. Increasing a tax to labour supply can in principle either increase or decrease labour supply over intensive margin. In our case increasing home care allowance creates only a disincentive to participate, it affects decisions over extensive margin.

This issue of the effect of taxes on two margins of labour supply has also been addressed in optimal tax theory. When optimal income tax model includes extensive margin of labour supply, it can be optimal to provide more in-work benefits and less benefits such as home care allowance (Saez 2002). It has remained empirical question, though, how large are labour supply elasticities over these margins. There has been literature that has tried to estimate extensive and intensive margins. The most famous systems that
provide in-work benefits are Earned Income Tax Credit (EITC) in USA and Working Families Tax Credit (WFTC) in UK. It has been found that the elasticity over extensive margin is greater than the elasticity over intensive margin (Eissa and Liebman 1996, Blundell and MaCurdy 1999, Blundell et al. 2005). These studies rely on reforms that provide in-work benefits and thus reduce the taxes on extensive margin. Our set up is different, because increasing home care allowance increases the effect of extensive margin.

There has also been empirical research about how much child care prices affect labour supply. Among older papers there has been confounding results, that may partly be a result of various econometric methods (Blau and Robins 1988, Blau 2003). Among more recent research Lefebvre and Merrigan (2008) and Baker et al. (2005) both study a Canadian reform of 1997. They use as identification strategy new policy implemented in Quebec according to which monthly price for day care was 5 Canadian $ per child. They compare work outcomes of mothers eligible to subsidised day care price to mothers living on other provinces. Both articles find positive impact on labour force participation. Interestingly Baker et al. find suggestive evidence of negative impact for child outcomes. According to these studies lower day care price seem to encourage women to participate, but putting the child to earlier to day care is not necessarily better for the child.

The problem with two above mentioned papers is that there was only one treated group, Quebec in 1997. Milligan and Stabile (2007) have variation in the National Child Benefit in many provinces of Canada. The reforms clawed back benefits in some provinces while in some other provinces they did not. This provided a chance to study how child benefits that operate like in-work subsidies provide incentives for labour market participation. Milligan and Stabile simulated incomes and benefits based on observable characteristics and used triple-difference method to study the effect of the reforms. They find that additional 1000 $ in benefits increased labour market participation by around 4 percentage points.

Lundin et al. (2008) use a child care reform in Sweden to identify the effect of child care prices to labour supply of parents. They perform difference-in-differences matching estimator. The confidence intervals of their estimates are tight which shows that there is a zero impact of the child care price on labour supply or income of parents. Their identifying variation comes from Swedish municipal level price differences that changed due to the reform. It seems that since mothers labour force participation is already on so high level in Sweden, the additional incentive in form of reduced day care price did not provide enough incentives for parents to change their labour market behaviour.

There has not been much research in how much home care allowance
provide incentives for labour market outcomes. One obvious reason is that such a system is not in place in many countries. There is, however, one such paper from Norway (Schone 2004). Schone studied cash-for-care subsidy reform that is pretty similar to Finnish child home care allowance. The only difference is that while Finnish allowance is only for mothers that stay at home taking care of the child, Norwegian cash-for-care is provided also for private child care. Schone uses triple-difference method to try to estimate the causal effect of the reform, since it was introduced everywhere in Norway at the same time. His results indicate a modest negative effect for mothers labour force participation due to introduction of the benefit.

In this article, we provide new features at least in two dimensions; we have over time and across municipalities variation in home care allowances, while most of the previous studies had a reform taking place only at one point of time and/or had only one group of people treated. Other interesting feature is that we have variation in relative prices that affect extensive margin of labour supply, since parents do not get the supplement if they participate to labour force. When studying extensive margin of labour supply, we have related case to Milligan and Stabile (2007), who studied the variation in prices over the intensive margin.

The rest of the paper proceeds as follows. We present in the following section 2 the two sources of exogenous variation we have for the child care prices. We will also provide a short description of Finnish public child care system. After describing Finnish special features, we present discuss the identification issues and econometric specification in section 3. After this, in section 4 there will be description of our data set and descriptive statistics. After this we proceed to showing estimation results, in section 5. In the same section there will be some robustness checks as well. Finally there are the conclusion of this study.

2 Forms of child care in Finland

In this section we describe how public child care is provided in Finland. Maternity leave is provided until the newborn child is around 9 months old. There is no regional variation nor a reform in maternity leaves. We thus exclude families where the youngest child is under 9 months old from the estimations. The idea of Finnish system has been to provide financial assistance for a parent regardless of the choice a parent makes. Below this system is described in more detail to provide the background information that is needed to understand the estimations later.

After the maternity leave a parent has a choice whether to take care of
the children him/herself or to put them to day care. There is an extensive public day care system in Finland, but after 1997 also private day care is subsidised partly to family by the government nationwide. Public day care is the predominant choice in Finland for a typical family. There has been a law since 1995 that every child under the age of 7 (when they start primary school) should be entitled to a public day care place if they ask for it. Before 1995 the law stated that every child under the age of 4 are entitled to public day care. There are also laws stating how many children there can be per childminder and other laws controlling the operation of municipality governed public day care, so the quality of public day care should be pretty homogenous across Finland.

The interesting variation to public day care fees comes from a reform in 1997. Before the reform the municipalities could themselves decide how the day care fees depended on family income and family size. After the reform these were set by the government. The effect of the reform was to reduce the payments to highest paying families, but also to reduce the number of families that did not pay anything. After the reform day care fees depended linearly on income for each of three family sizes and there was a cap on the fee per child, the price could not exceed 180 € for one child.

If a family chooses private instead of public day care, they are also entitled to a subsidy: private child care allowance. Private child care allowance has been nationwide in place since 1997. This private day care allowance works by giving allowance directly to care provider. The amounts that family can receive under this system in 2005 were 137 € per child per month and income dependent part was 0 - 135 € per child. Between 1995 and 1997 there was an experiment in 33 municipalities that provided similar allowance. Viitanen (2007) describes this experiment in detail. She finds that the allowance has a significant positive effect to the use of private day care, and little evidence to labour force participation. After the system was adopted nationwide in 1997, municipalities have been able to pay also municipal supplement to private day care allowance.

In this study we do not concern ourselves whether a family chooses private or public day care. Even after the private child care allowance, the public day care should be cheaper than private. Thus, the relative price of day care, that matters for labour force participation comes mainly from comparing the subsidy to take care of the children at home and the public day care price. This should at least give the lower limit for the price. Maybe some families value private day care more and want to purchase more quality by choosing private instead of public day care.

As noted above, after maternity leave the other relevant choice for a parent is to take care of the child him/herself. If the children are taken care
of by a parent, he or she is entitled to a child home care allowance. A parent
do not work, when they receive the child home care allowance, because they
need to spend their time taking care of the children. It can be paid until
youngest child reaches the age of 3 and who are not in public or private
day care. It has two parts; the basic allowance is paid separately for each
eligible child, it was 294 € in 2005, and a supplement that is paid only for one
child and is dependent on family income, maximum was 168 € in 2005. The
income dependent supplement is designed as a low income support. There is
also an extra for each sibling until they reach the age of 7, when they start
primary school in Finland. It is possible for either of two parents to receive
the child home care allowance, although it is dominantly mother who takes
up the allowance and do not participate to labour force. After the youngest
child is three years old or older, it is not possible to receive any home care
allowance.

The interesting variation for this study in the allowance side comes from
the municipal supplement to home care allowance. Some municipalities have
decided to pay supplement to home care allowance while other municipalities
do not pay any municipal supplement. Also the level of municipal supplement
varies over time in municipalities that pay it, and the amount of municipal-
ities that have the policy changes over time. There were 5 municipalities in
1995 and 65 in 2005 that had the supplement policy.

As is suggested by its name, the municipal supplement is paid supple-
mentary to child home care allowance. There is a lot of variation in the
details how each municipality pay the supplement. Typically the municipal
supplement is paid per child. It is possible to receive extra supplement if the
youngest child has older siblings, but this extra amount is substantially less
than the basic supplement, the mean supplement level is 200 € and the mean
sibling extra is 50 €. The municipal supplement, apart from a small number
of municipalities, do not depend on family income. There is also a pre-work
condition in some of smaller municipalities, according to which to be entitled
to the municipal supplement, a parent needed to have a work place prior to
parental leave.

There can be various reasons why a municipality decides to pay the sup-
plement. The first reason must be related to the idea of Finnish day care
system as such, municipalities want to offer chance to make free choices for
parents, and felt that national home care allowance was not enough to sup-
port a parent to stay at home. One reason is historical, since there has been
home care allowance system in Finland since 1980’s in place. Many munic-
ipalities paid supplement to this towards the end of 1980’s and ended the
policy during the recession in the beginning of 1990’s. The 5 municipalities
that paid supplement already in 1995 had this policy for reasons that was
determined prior to our estimation period. Otherwise taking the supplement policy in a given municipality could be for political reasons. Also it clearly became popular policy towards 2005 when already 65 municipalities had adopted the policy, some municipalities clearly mimicking those that already had the policy.

The question why did municipalities choose the supplement policy relates to identification, thus we describe municipalities empirically who did and did not pay the supplement. We use municipal level data from Statistics Finland that shows trends over time in employment of women and migration. These descriptive statistics are shown in figures 2 and 2. Both figures share the same idea: the two lines show the average of those municipalities that paid the supplement to home care allowance in some of the years considered, whereas the "No supplement" line shows average of those municipalities that did not pay the supplement in any of the years. Most of the municipalities that did pay the supplement started the policy around year 2000. The shaded areas and capped bars show plus minus half standard deviation around the mean as sort of confidence interval. The figure 2 shows employed women relative to all women aged between 25 and 39 years in a municipality, because this age group is most likely to have a child. The point of the figure is that although there is a small difference in the means, the trends follow each other pretty well. The small difference between the means is included in the confidence interval.

Figure 2 shows two migrant statistics relative to inhabitants in a municipality. The left panel shows all the migrants to a municipality from somewhere else in Finland and the right panel is corresponding figure for babies aged 0 or 1 year. If some of the families moved in hope of getting the supplement, it does not show up in average statistics. The difference between the trends is larger than with employment rates, but the trends follow each other pretty well. This suggests that although some of the municipalities took the supplement policy around year 2000, this does not show up in migrant trends.

The overall conclusion is that empirically municipalities that have had the municipal supplement policy in place between 1994 and 2005 seem to be bigger on average. There is enough variation in both groups, so that the confidence intervals overlap, though. Also the trends between the two groups follow each other pretty well, so that changes in macroeconomic conditions are similar between the two groups shown.
Employment rates, women 25 to 39 yo

Year
1995 2000 2005
Sd*(+/-0.5) Supplement Sd*(+/-0.5) No Supplement
Mean Supplement Mean No Supplement

Sd*(+/-0.5) Supplement
Sd*(+/-0.5) No Supplement
Mean Supplement
Mean No Supplement
Ratio of migrants to inhabitants

Baby-migrants to inhabitants

<table>
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<th>Year</th>
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<th>Mean Supplement</th>
<th>Sd*(+-0.5) Supplement</th>
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3 Identification and econometric strategy

We consider here on what conditions our model is identified and the potential threats to those conditions not being fulfilled. We use Differences in Differences strategy to estimate the effect child home care allowance or day care fees have on labour supply. We use a linear probability model in our estimations. Our dependent variable is labour supply $Y_i$, that is a dummy variable. The key explanatory variable is $P$ (that can be day care fee or home care allowance). We estimate the effect of price $P_{iym}$ on labour supply $Y_{iym}$ in year $y$, municipality $m$ and of individual $i$. The estimated equation is thus:

$$Y_{iym} = \alpha + \beta_1 P_{iym} + \beta_2 X_{iym} + \beta_4 Mun_m + \beta_5 Year_y + \epsilon_{iym}$$  \hspace{1cm} (1)

The aim is to identify $\beta_1$, the effect price variable has on labour supply of parents. The other variables in equation 1 are municipal $Mun_m$ and year $Year_y$ level dummies and controls $X_{iym}$. The model in equation 1 is estimated for a population of parents. Equation compares the labour supply of parents with different prices $P$ given the control variables. Any change in $P$ given the control variable is allocated to simultaneous change in $Y$. We thus compare the price change for similar people in observable characteristics, like age of children, age of parent and education level. The only difference should be that they live in different municipalities. Thus, the identification relies on municipal and year level factors. That is why we specify the controls to include municipal level variables such as average unemployment rate and share of children in day care relative to the number of children in that municipality. We also include individual level controls to cope with the individual level variation, this should reduce the variation of error term.

3.1 Municipal supplement

To be more precise about the identification of the effect municipal supplement has on labour outcome $Y_{iym}$, let us say that $Y_{iym}^0$ is outcome of the control group. Then the model identifies $\beta_1$ conditional on controls if the following condition holds:

$$E \left[ Y_{iym}^0 | m, y, P_{iym}, X_{iym} \right] = E \left[ Y_{iym}^0 | m, y, X_{iym} \right] = \delta_m + \lambda_y + \beta_2 X_{iym}$$  \hspace{1cm} (2)

The above equation states the difference in differences assumption that selection into treatment should be exogenous to outcome. The assumption that guarantee that this is the case here is that $P_{iym}$ is exogenous to labour
supply. We should be sure that municipalities do not select the supplement based systematically on employment situation. Also the aggregate employment time trends should be parallel between treatment and control groups. Finally the composition of groups should be similar; people should not move from municipality to other based on prices. After the estimation results we present some robustness checks as a defence against some of these potential problems. Against potential differences in macro trends that are not taken care of by control variables, we also estimate following equation:

\[ Y_{icym} = \alpha + \gamma_1 P_{icym} + \gamma_2 X_{icym} + \gamma_3 Mun_m + \gamma_4 Year_y + \epsilon_{icym} \]

This is triple-difference equation, where \( c \) refers to whether the family is entitled to have municipal supplement by the age of the youngest child or not. The third difference is thus between families whose youngest child is either 9 months to three years old or between three and five years old. The families in the older age group should not have any variation in family benefits across control and treatment groups, mothers in these families are not entitled to home care allowance nor the supplement to that. Now in the term \( X_{icym} \) there are also second level interactions between year, municipality and which age group the youngest child in the family belongs. Estimating \( \gamma_1 \) identifies the effect municipal supplement has between different municipalities and between families of different age structure in those municipalities. The third difference should not have any effect, since there is no variation in \( P \) for families with older children between the municipalities. This third difference is then substracted from the other differences clearing out any spurious time trend effects. Thus, this equation deals with the problem of different macro trends across municipalities.

There are empirical reasons to believe that municipalities pay the supplement randomly, and not related to work outcomes of parents. We refer to Finnish child care institutions that were described in section 2. It seems municipalities might have an incentive to offer supplement to keep children out of expensive public day care. This might look especially lucrative from municipality point of view, if there is a baby boom in the municipality. However, there is a state grant system, that provides subsidies for the municipalities according to number of children between 0-6 years old lived in the municipality. These grants are not ear-marked, so municipalities receive the grants independent of how many children participated to public day care, leaving some incentives for the municipality to keep children out of public day care.

However, especially after 1997, if municipality experiences unfavourable economic conditions, it should actually be better idea to provide supplement
for private day care allowance than to home care allowance. If the policy follows these suggested lines, the parents are more likely to work and contribute to tax revenues of the municipality. So, the existence of supplement to private home care allowance is better instrument to reduce the demand of public day care, if that is the only motivation for the supplement.

Our second line of evidence is to describe empirically the macroeconomic conditions. The descriptive statistics are shown in figures 2 and 2. Since our econometric specification allows for municipal level differences and time trends, we are not worried about differences in means as such. More worrying would be differences in time trends between the groups, and such differences are not visible in the figures.

3.2 Day care reform of 1997

We estimate equation 1 for day care fees as well. Although the day care fees have exogenous variation due to reform in 1997, there is a problem with income dependency of day care fees. Namely, people who have higher income (because they work), have also higher day care fees. The day care fees depended on family income both before and after the reform. The reform changed how the fees depend on income. Thus, when estimating the effect of day care fees on labour supply, we need to simulate the incomes to get around the endogeneity problem. This is what Milligan and Stabile (2007) did as well. They used a strategy were a small group of people were selected and then based on rules in different areas, it was simulated how much benefits this group of people would get, based on observable characteristics. These benefits were then imputed to data. This method should clear out any endogeneity resulting from individual characteristics.

We first estimate the incomes based on people who work full time. At the moment the only estimate that was exogenous to individual variation was to use the mean of income of working people in each municipality and year. We then use these incomes and calculate the day care fees according to rules they are determined as if everybody had the income associated with full time working. This sort of method removes individual variation, but also potentially increases standard errors.

Other possible solution to endogeneity problem is to use difference in differences matching framework. That is what Lundin et al. (2008) did. We also perform this type of estimation to be able to compare our estimates with their results. The matching part is done by including a flexible set of family type and income class indicator terms in the regression and interacting them with year and municipal level terms. The equation to be estimated thus looks like:
\[ Y_{iym} = \alpha + \beta_1 P(Z_{iym}) + \beta_2 X_{iym} + \beta_4 Mun_m + \beta_5 Year_y + \epsilon_{iym} \]

where \( P(Z_{iym}) \) is function of day care price according to family type and includes family type indicator terms. \( X_{iym} \) includes family type, year and municipal level interactions. The problem with our data of 10000 households each year and the Finnish case is that since there are about 450 municipalities, it does not leave many observations in some family type times municipality cells. Thus, the common support assumption of matching might not hold very well in our case.

4 Data and Descriptive statistics

We use individual level microdata from years 1994 to 2005. Our data comes from multiple sources. The base data, Income Distribution Statistics, comes from Statistics Finland and is an individual level data, containing over 25000 observations from about 10000 households per year. From these we have for all years about 6000 households that have children between 9 months and 3 years old and about 14000 households that have children under age of 6. In the data we have a rich set of variables describing family characteristics, demographics, incomes and benefits coming from registers and surveys. The data is a panel on municipal level and a repeated cross section on individual level, although there is a rotating panel system. In rotating panel each household is surveyed in two consecutive years and each year half of the sample consists of new households. Thus, there are two consecutive observations for each individual. We do not observe the name of municipality each household lives in due to confidentiality reasons, but we have encoded municipality information, so that we can follow the municipalities over time. The rest of the information is on municipal level and it has been linked to the individual data. It comes from a survey to municipalities conducted by University of Turku and own survey to municipalities, from the Social Insurance Institution of Finland and from Statistics Finland.

The information about the day care prices and allowances were implemented to the data based on family characteristics and family income. The prices and allowances were implemented if the child were eligible to them according to rules described in section 2. For each family two prices are calculated, the other corresponds to a choice to take care of the children at home and the other corresponds to a payment of public day care fee. If there are multiple children only the case that all the children are treated in a similar way is calculated. We do not use actual observed prices, since the choice of
form of child care would already reveal whether the parent supplied labour or not. Below we show tables and figures that describe the relative day care prices as well as other relevant characteristics from the data.

To get some handle on how large the normal level of benefits are compared to mean net income associated with full time work, we present the yearly averages of these variables in table 1. There are some missing cells in the table, because there are no observations from day care fees from years 1994 and 1997. The Family benefits variable shows the average of implemented home care allowances. Similarly, in the Day care fee - column there are the averages of implemented public day care fees. The Supplement - column provides the average of municipal supplement conditional on being eligible to it (zeros not included). Families that live in a municipality that has the supplement policy in place, the average allowance associated with taking care of the children at home is the Family benefits plus Supplement. If a family lives in municipality without the supplement policy, they just would receive family benefits (and some other benefits that do not depend on the choice of day care). Incomes are calculated net of taxes from parents of 0-6 years old children that are in full time work, separately for mothers and fathers. Figures in the table 1 are in nominal terms.

From the table 1 it is evident that the total cost of going to work, forgoing Family benefit plus Supplement and paying Day care fee, is a substantial part of net income. If a mother is eligible to the supplement, the total shadow price is equivalent to quarter of income. Finally it is worth to note that there are other benefits that are not related to children or the decision to participate to labour force as such. We do not consider those potential benefits, because there is no municipal level variation in them and they do not change the relative price of going to work.

One substantial part of the story is employment rate. We construct our dependent variable from variables that show how many months people have been supplying labour either full- or part-time each year. We encode this as being zero or one, having value one when the individual has supplied more than ten months labour in a year. The estimation results shown later were robust to changing the amount of months per year required to be calculated as supplying labour. We note, that this definition produces tighter employment definition than that used by e.g. Statistics Finland in aggregate statistics, thus reducing the employment rate. The work trends over time for mothers by the age of youngest child are shown in Figure 4. The figure shows clearly how the employment rate of mothers increases when their youngest child gets older. There is also a downward trend in the employment of mothers of 2 years old child, that could be caused by expansion of municipal supplement at the same time. These employment rates are somewhat lower, but consistent,
Table 1: Mean level of benefits and incomes. Incomes are calculated from full-time workers that have young children.

with those found in OECD (2005). They also find in OECD (2005) that the employment rate for women increases rapidly with the age of the youngest child. When comparing with figure 2, it is obvious that the employment rate for the whole age group of women is higher ending clearly above 70% in 2005. The difference with aggregate statistics is that it takes in to account all the women in municipality, whereas individual statistic shown here try to describe much more specific and thus smaller group of people.

The descriptive statistics from some of the demographic variables are shown in table 2. It is divided into two panels, in upper panel there are mothers whose youngest child is between 9 months and three years old, but who are not living in municipality where there is a municipal supplement policy in place that year. In lower panel there is the treatment group, otherwise similar mothers to upper panel, but they live in municipality that has the supplement policy in place. The difference in earlier divisions is that here the groups are formed according to what municipality did that year. Thus the composition of groups changes. It can be observed that key characteristics are similar between the panels, but treated mothers have substantially lower participation rate. Income in that table corresponds to average personal income over the year in euros, it is quite low, because participation rate is also low. In the family they have quite often other income from the spouse.

To show precisely how public day care fees relate to incomes of families,
Employment trend by the age of child

![Graph showing employment rates for different ages of children from 1994 to 2005.](image-url)
Descriptive statistics. Mothers of 0-3 yo in control and treatment groups

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<td>1130</td>
</tr>
<tr>
<td></td>
<td>Children</td>
<td>2.0</td>
<td>1.9</td>
<td>1.9</td>
<td>1.9</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Table 2: Descriptive statistics for mothers whose youngest child is between 9 months and three years old. Upper panel for those who live in municipalities that do not have supplement policy in any of the years, lower for those who live in municipalities that have the policy in all or some of the years. Figures show mean level, except the number of observations (upmost statistic).
we show a scatterplot of these from the implemented variables in the data for selected years in Figure 1. Again the data looks similar to later years in the sample. From the figure it is clear that there is severe endogeneity problem with day care fees and income. Especially for years after 1997, the fees can be calculated as a linear function of income and then the price cap of 180 € per child for each family size. For this reason we need to simulate the incomes and calculate the prices based on the simulated (full-time equivalent) income.

The effect of 1997 reform is also captured by scatterplot in Figure 1. Before the reform there was greater variation in day care fees, even within a family size. This corresponds to municipal level variation in how fees depends on income. The other effect of reform was to reduce the number of parents who pay over 400 €, that have two or more children. On the other hand, before the reform there were more people within all family sizes that paid nothing, than after the year 1997.

In Figure 2 there is scatterplot of the municipal supplement and family income.
Figure 2: A scatterplot of municipal supplement and day care fees by the number of children in the family over selected years.

income for those who are eligible to it. First thing to notice is that there is not any apparent income dependency for the supplement. On the other hand having more children can cause the supplement to be higher than with just one child. The amounts received ranges between 420 € and close to zero. There are fewer observations in earlier years, because many municipalities did not pay the supplement then. One interesting point is that the people who receive the supplement in later years do not seem to be significantly richer than people in earlier years. This provides evidence that there is no selection in municipalities that pay the supplement, the municipalities that implemented the policy later had as wealthy people as those municipalities that implemented the policy earlier.
Table 3: Estimation results, mother’s labour supply as a dependent variable.

<table>
<thead>
<tr>
<th></th>
<th>(i)</th>
<th>(ii)</th>
<th>(iii)</th>
<th>(iv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplement</td>
<td>-0.098***</td>
<td>-0.084***</td>
<td>-0.085***</td>
<td>-0.103***</td>
</tr>
<tr>
<td></td>
<td>(0.0097)</td>
<td>(0.0096)</td>
<td>(0.023)</td>
<td>(0.0211)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.03</td>
<td>-0.78**</td>
<td>10.2**</td>
<td>-20.1***</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.34)</td>
<td>(4.26)</td>
<td>(0.581)</td>
</tr>
<tr>
<td>Observations</td>
<td>6023</td>
<td>6023</td>
<td>6023</td>
<td>13863</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.1</td>
<td>0.14</td>
<td>0.14</td>
<td>0.4</td>
</tr>
<tr>
<td>Indiv controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Municipal controls</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd level interactions</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5 Estimation results

The results of estimating equations of type 1 is presented in this section. We first present results concerning the municipal supplement to child home care allowance. Since these, as described in section 4, are generally paid to families who have youngest children between 9 months and under three years old, we exclude rest of the sample from the main analysis. The main results appear in table 3. In each column the dependent variable is mothers labour supply dummy. The measured monetary variables (like the municipal supplement and unearned income) are in 100 euros per month. We performed all the estimates to fathers as well, but did not get any statistically significant results for municipal supplement.

The results in table 3 are organised as follows: in column (i) there is a DiD estimate without any controls besides year and municipality dummies. In column (ii) individual level controls are added, including indicator whether spouse works and interactions with indicators for each child and age of mother. In column (iii) there are also municipal level control variables making this estimate the most flexible difference-in-differences estimator shown. The control variables include individual demographic characteristics like age, age squared, four-step measure of school degree and an indicator for each child. The municipal level controls include average unemployment rate and aggregate income in the municipality, share of children in day care and the municipal income tax rate. Finally in column (iv) there is the triple-difference estimator. The number of observations now increases, since there are also mothers with older children in the estimates. The point estimate of
the supplement is a little bit larger than in column three. Standard errors take into account that unobservables are correlated in municipal level.

Our preferred estimate in column (iii) indicates that increasing the municipal supplement by 100 € a month causes 8.5% less women to participate. Since there is probably variation in how mothers respond to municipal supplement, we interpret this as average treatment effect on the treated. Those who receive municipal supplement are treated in this case. Although there is a little variation in coefficients for municipal supplement across columns (i) to (iv), all the estimates are within 95% confidence interval from each other. We included the triple difference as a check against potential differences in macro trends. It is reassuring that the result was close to difference in differences estimate. We do not consider the estimate in column (iv) as our main estimate, because the result may be driven by the very large number of interactions terms between over 400 municipalities and 11 years, which already makes data a bit thin in some smaller municipality times year cells.

The result in column (iii) seems to be robust with quite flexible set of control variables. Because the point estimate of supplement do not change much, when conditioning on unemployment rates and municipal income tax rates and other municipal level variables, it already suggests that the result does not depend directly on macroeconomic conditions of the municipality. We also performed many robustness checks that did not change the result in a significant way. These checks include excluding municipalities with income dependency in the supplement rules, or excluding those with previous work condition. We tried also to exclude any one of the largest municipalities. In one of the checks we only took years after 1997 into account with no significant effect on the results.

There are various threats to identifying true average treatment on treated effect with our chosen strategy, as discussed in identification section. Thus, we perform some robustness checks in table 4. In columns (i) and (ii) we introduced a pseudo-rule that made mothers whose youngest children was between 3 to 5 years old, eligible to the municipal supplement if they lived in a municipality that pays supplement to mothers of younger children. The estimates are otherwise similar to ones in table 3. Our aim here is to check that we do not get significant results from out of sample estimates. The families that have older children seems to be a natural candidate for out of sample check, since their characteristics should otherwise be close to families that have just 1 or 2 years younger children, as in main estimates. We do not get significant estimates from out of sample rule in column (i), which indicates that there were no specific employment trends in municipalities that paid the municipal supplement.

In column (ii) of table 4 we estimate a robustness check for different group.
Here we utilise the rotating panel feature of the data and take into estimation sample families that will have a child next year aged 9 months or younger, but do not have this year any children that are between 9 months and 3 years old. Thus, they are not entitled to municipal supplement yet, but those who live in municipalities that have the policy, will be in the future. This estimate should tell something about potential anticipation effect. However, the point estimate is not statistically significant. This indicates that there is no serious anticipation effect (although we do notice that the sample size is only 533 in this estimate).

In column (iii) we again use the rotating panel feature, this time to take into account the effect from people who moved. We include this as an indicator to the model and interact it with the Supplement. If people moved in hopes of getting higher municipal supplement, and do not supply labour because of that, the interaction coefficient should be negative. Our estimated coefficient is positive and again not significant indicating that people do not move in search for higher benefits. In column (iv) there is base-line estimation, but with pseudo-rule, since we needed to simplify rules for the implementation of pseudo-supplement. Coefficient for the municipal supplement is similar to main estimates, the simplification of rules do not seem to affect estimates.

In table 5 we present results for how much 100 euros per month of municipal supplement affects incomes of mothers. The idea of estimating the effect of municipal supplement has on incomes is that explanatory variable

<table>
<thead>
<tr>
<th></th>
<th>(i)</th>
<th>(ii)</th>
<th>(iii)</th>
<th>(iv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplement</td>
<td>0.016</td>
<td>-0.025</td>
<td>-0.078***</td>
<td>-0.085***</td>
</tr>
<tr>
<td></td>
<td>(0.0160)</td>
<td>(0.0654)</td>
<td>(0.023)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Spouse works</td>
<td>0.0593***</td>
<td>0.0393</td>
<td>0.0155</td>
<td>0.047***</td>
</tr>
<tr>
<td>Moved *Supplement</td>
<td>(0.0116)</td>
<td>(0.0495)</td>
<td>(0.023)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Constant</td>
<td>-6.976</td>
<td>0.794</td>
<td>17.38***</td>
<td>10.11***</td>
</tr>
<tr>
<td></td>
<td>(5.417)</td>
<td>(24.29)</td>
<td>(6.587)</td>
<td>(3.663)</td>
</tr>
<tr>
<td>Obs.</td>
<td>4479</td>
<td>533</td>
<td>2875</td>
<td>6020</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.179</td>
<td>0.538</td>
<td>0.211</td>
<td>0.143</td>
</tr>
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</table>

Table 4: Some robustness checks to the municipal supplement estimates. All estimates have mother’s labour supply dummy as a dependant variable.
<table>
<thead>
<tr>
<th>COEFF.</th>
<th>(i)</th>
<th>(ii)</th>
<th>(iii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplement</td>
<td>-128.5***</td>
<td>-69.33***</td>
<td>-64.92***</td>
</tr>
<tr>
<td></td>
<td>(24.52)</td>
<td>(20.84)</td>
<td>(24.07)</td>
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<tr>
<td>Age</td>
<td></td>
<td>63.21***</td>
<td>66.69***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(13.86)</td>
<td>(13.41)</td>
</tr>
<tr>
<td>School</td>
<td></td>
<td>433.3***</td>
<td>423.5***</td>
</tr>
<tr>
<td>degree</td>
<td></td>
<td>(28.69)</td>
<td>(25.21)</td>
</tr>
<tr>
<td>Constant</td>
<td>494.6***</td>
<td>-1434***</td>
<td>13633</td>
</tr>
<tr>
<td></td>
<td>(50.78)</td>
<td>(254.4)</td>
<td>(14502)</td>
</tr>
<tr>
<td>Obs.</td>
<td>6038</td>
<td>6038</td>
<td>6038</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.099</td>
<td>0.193</td>
<td>0.206</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Estimation results, mother’s income as a dependent variable.

is now continuous and measures change in income throughout the year. The income used here includes all the personal income the mother gets from work or investments, excluding benefits related to child caring. The estimates are similar to 3, except for the dependent variable. Our preferred estimate, the difference-in-differences in column (iii) indicates that for every 100 euros a mother receives municipal supplement she earns 65 euros less income. Given the large participation elasticity, one could have expected larger income response. But, as noted above, the measured effect is the change in all incomes. If we only include earnings of those mothers who also participate to labour, the estimated coefficient is three times higher.

5.1 Day care fees

In this section we focus on the day care reform in 1997. We proceed with similar estimates than with the municipal supplement. There are some qualifications due to the nature of the reform we are estimating. First, as noted earlier, the incomes need to be simulated first and base the day care fees to simulated incomes. Second, since the reform happened only in one point of time, we only take years 1995-6 as pre-reform years and compare work outcomes after the reform, in years 1998-9. Our estimation results are presented in table 6. Again, the dependent variable is labour supply dummy. First two columns are performed for mothers and second two columns are for fathers. All monetary variables are in units of 100 € per month. The estimation sample consists now parents that have children between 9 months
<table>
<thead>
<tr>
<th>COEFF</th>
<th>Basic</th>
<th>Full mothers</th>
<th>Basic men</th>
<th>Full men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day care fee</td>
<td>-0.0375***</td>
<td>0.0103</td>
<td>-0.00195</td>
<td>-0.0048</td>
</tr>
<tr>
<td>(0.0077)</td>
<td>(0.0075)</td>
<td>(0.0067)</td>
<td>(0.007)</td>
<td></td>
</tr>
<tr>
<td>School degree</td>
<td>0.065***</td>
<td></td>
<td>0.0605***</td>
<td></td>
</tr>
<tr>
<td>(0.0079)</td>
<td>(0.006)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share in day care</td>
<td>-0.006</td>
<td>0.007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.005)</td>
<td>(0.004)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mun tax rate</td>
<td>-0.013</td>
<td>0.004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.008)</td>
<td>(0.007)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.39***</td>
<td>10.71</td>
<td>0.65***</td>
<td>-4.7</td>
</tr>
<tr>
<td>(0.019)</td>
<td>(7.100)</td>
<td>(0.018)</td>
<td>(5.99)</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>5819</td>
<td>5776</td>
<td>5623</td>
<td>5582</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.1</td>
<td>0.21</td>
<td>0.1</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Estimation results of day care fees on labor supply indicator. Population includes a parent whose child is between 9 months and 6 years old, from years 1995, 1996, 1998 and 1999.

and 7 years old.

Our results in table 6 finds a small negative effect for mothers labour force participation when day care fee is increased that disappears immediately when we include any control variables in column "Full mothers". We do not find any significant effect on fathers’ labour supply. The fact that we do not get significant effect may be related to relatively small change in day care prices due to the reform. Also, estimation sample now includes also mothers of older children than 2 years old. These mothers are not entitled to substantive home care allowances reducing the relative price for child care. Also this group has higher labour force participation in any case, leaving less room for incentives to play.

We did also a dd-matching estimator in the spirit of Lundin et al. (2008). The results were in line of those shown in the Table 6.

6 Relevance of estimation results

Some of the estimates we performed were significant and passed some robustness checks. Given that the point estimates can be trusted, they need to be related to previous literature. To this end, we calculate elasticities using the estimated point elasticities.
Our main interest is elasticity of relative day care price for those who are entitled to municipal supplement. This elasticity is based on the mean level of benefits and participation in our estimation sample. We need to make some further assumptions; we only calculate the elasticity for couples whose mother is staying at home and father is working with average income and whose youngest child is between 9 months and 3 years of age. For a mother in this type of family the average benefits excluding municipal supplement were 520 euros per month. The participation rate changed from 25 per cent participation level by 8.5 percentage points associated with increasing supplement by 100 euros per month. These figures imply participation elasticity of:

\[
\frac{dP}{P} = \frac{dY}{Y} = 0.085 \cdot \frac{100}{0.25} \cdot \frac{520}{100} = 1.8
\]

This result is a lot larger than 0.236 that Baker et al. (2005) estimated for child care cost, and still substantially larger than that of Milligan and Stabile (2007) for having earnings as a major source with elasticity of 0.96.

To asses the elasticity estimates in a different way, we used municipal supplement to instrument the change in income associated with participation and regressed this against participation indicator. The results for mothers whose youngest child is between 9 months and 3 years old are shown in table 7. Now the unit is 1 € per month. According to these estimates the amount that mothers gain when they participate to labour leads to increase in participation of .08 % from 1 € per month. The coefficient is now positive because the home care allowance and municipal supplement to it enter the income equation with a negative sign. The other incomes taken into consideration are net of tax full time working income (that was predicted to people) minus day care fees minus home care allowance. This was then instrumented with municipal supplement.

The participation elasticity implied by the coefficient in the table 7 can be calculated as

\[
\epsilon = \frac{d\text{participation}}{d\text{income}} \times \frac{\text{income}}{\text{participation}} = \beta \times \frac{\text{income}}{\text{participation}} = 0.0008 \times \frac{800}{0.25} = 2.6
\]

Where 800 € is the net income of mothers on average in the estimation sample. This elasticity is huge compared to estimates in the literature, but the result seems robust to different estimation specifications. One factor that makes this elasticity so large is the small base line participation rate (0.25) of women to labour force in this group. If the participation rate were closer
Table 7: Labour supply dummy as a dependent variable against change in incomes instrumented with municipal supplement. Estimated for population of mothers with youngest child between 9 months and 3 years old for years 1995-2005.

to levels of women in this age group in general (0.7), we would get elasticities closer to one.

To assess the effect of municipal supplement to municipal economy, we include here a very rough estimate on costs and benefits of the policy. Our point estimate in 3 indicates that increasing municipal supplement decreases the participation rate of mothers by 8.5 percentage points. The average municipal supplement level in 1 is little bit less than 200 €. Thus the overall impact of the policy is to decrease mothers participation rate by 16 percentage points. The monthly gross income of mother who is participating to labour force is on average 2200 €. The effective income tax rate in municipalities is around 16%. These figures make the total cost to municipalities the 200 € from the supplement plus the loss from income taxes that is $0.16 \times 2200 = 352$ € per mother per month. Of course the mothers receive many more benefits when not supplying labour, but these benefits are financed by the central government, so they are not included into the cost-benefit calculation from the municipality point of view.

On the benefit side the municipalities save the cost of providing public day care. We calculate this saved amount by assuming that in the case mother participates to labour force all the children would go to public day care. Then the saved amount per average mother, who has two children as is the case in 2, would be the cost of day care per child 600 € minus

\[
\begin{array}{|c|c|c|}
\hline
\text{COEFF} & \text{Women basic} & \text{Women full} \\
\hline
\text{Supplement} & 0.0007^{***} & 0.0008^{***} \\
 & (0.00012) & (0.00018) \\
\text{Spouse works} & & 0.095^{***} \\
 & & (0.012) \\
\text{School degree} & & -0.011 \\
 & & (0.017) \\
\text{Constant} & -0.59^{***} & -0.8^{**} \\
 & (0.12) & (0.37) \\
\hline
\text{Observations} & 7292 & 6619 \\
\text{R-squared} & 0.04 & 0.11 \\
\text{Standard errors in parentheses} & *** p<0.01, & ** p<0.05, \, * p<0.1 \\
\hline
\end{array}
\]
the amount the mother would pay themselves, 380 €. In all this makes $(600 \times 2 - 380) = 820$ € saved from day care costs. The municipality would need to pay the home care allowance in case of not participating, that is on average 300 € per family. And then there is the municipal supplement of 200 € per family. The total effect per average mother is $820 - 352 - 300 - 200 = -32$. We ended up with a negative number, but not very large. The deciding factor here is clearly the loss in tax income, the calculation would be clearly positive if the behavioural effects were not taken into account. So, perhaps municipalities did not take the participation effect into account when they imposed the supplement policy, or they thought that offering more opportunities for mothers was more important than the loss of tax income. It needs to be pointed out that the total income tax rate is larger than 16% in Finland. The rest of taxes are paid to government. So the loss of tax revenues would be larger if this calculation was made from the point of view of the government (which is not paying the municipal supplement, though).

7 Conclusion

We have estimated the effect home care allowances and day care fees have on mothers labour supply. We analysed two cases that provide exogenous variation to labour supply. These were two reforms from Finland, the municipal supplement to child home care allowance and the reform in day care fees in 1997.

To be entitled to municipal supplement a parent needs to stay at home taking care of children, to have children of certain age and live in municipality that has the policy in place. That is why we could compare parents with similar characteristics and had many treated groups over the years and across municipalities. The municipal supplement to home care allowance seems to have a negative effect on mother’s labour supply. Our estimate from this part indicates that increasing the supplement by 100 € per month causes 8.5% women less to participate to labour. We did not find any significant effect of home care allowance to fathers labour supply, although fathers are also entitled to take up the allowance. The implied labour supply elasticity with respect to day care prices is quite large for mothers according to this estimate.

We did get negative estimate for how much home care allowance affect incomes of a parent as well. The size of the point estimate, -65 € per 100 € change in supplement did not seem large, and the implied elasticity is not small relative to literature, but much smaller than the participation elasticity. Empirically it seems that when mothers decide to participate again, after the
children gets older, they often participate to full time work.

The analysis of day care reform in 1997 did not reveal large point estimates, the only significant estimates for mothers did not stay significant when we added control variables. It is doubtful, whether this is a true effect, or we could not simulate out all the dependency between incomes and day care fees. One reason why day care fee reform did not produce responses we could measure is that day care fees did not change that dramatically for many people in our data. To tackle the endogeneity problem, we needed to simulate incomes, which increases standard errors in estimates. If we had more observations and a panel data, analysis would have created at least smaller confidence intervals.

There are reasons embedded in the Finnish system, why we got so large estimates for mothers’ participation. The benefits are, as has been described above, quite generous to mothers whose youngest child is under three years old. After this age limit for the youngest child, the benefits to stay at home get much lower. Moreover, the mother who had a job prior to maternity leave, can return to the same job after the home care allowance period, provided it still exists. The home care allowance system is in that sense very different from unemployment benefit system, where people do not have any job to take up whenever they feel like it. Also the value of staying at home for a mother of young child is larger than for an unemployed women.

To be able to assess optimality of public day care policy as a total in Finland, we should have some idea of the effect these policies have on children themselves. This remains a question for future research for now.

References


