The effect of child care subsidies on the labour supply of parents*

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Abstract

This paper studies the effect of child care subsidies on maternal labour supply. In the Finnish child care system, parents taking care of their children at home receive a relatively generous home care allowance. I use variation arising from changes in municipality specific supplement to this allowance to identify the causal effect of subsidies on the labour force participation of mothers. A municipal supplement creates plausibly exogenous variation since being eligible to it depends on municipal level rules but not on changes in individual labour supply decisions. Moreover, a supplement policy affects labour supply in a transparent way since the amount of a supplement one is eligible to do not depend on income. Robustness checks indicate that policy endogeneity or residential sorting is not driving the results. I find a large negative effect on the labour force participation and income of mothers. 100 euros more supplement per month reduces maternal labour supply by 4 per cent. The estimated effect is larger for higher educated than for lower educated mothers.

1 Introduction

A key question faced by most industrialized countries concerns policy measures aimed at increasing labour supply. With ageing population, a smaller workforce will have to provide for a larger retired share of the population. At the same time

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it has proved difficult to extend working lives through changes in retirement policies (Lindbeck and Persson (2003) and OECD (2009)). This has led to increased attention towards the study of labour supply decisions in different phases of working age. One important gap in working lives occurs when parents have children. Mothers in particular may not participate to the labour force for many years after they give birth.

This paper studies the impact of child care subsidies on maternal labour supply. In the Finnish day care system a relatively generous home-care allowance is given to parents who stay at home to take care of their children. This subsidy clearly increases incentives to stay outside of the labour force for prolonged periods. Changes in a municipal supplement provide exogenous variation in the labour supply of mothers. The variation is exogenous to the labour supply since being eligible to a supplement does not depend on current labour supply decision or income prior to the maternity leave. A mother is eligible to a supplement based on municipality she lives in and the age of her youngest child.

A municipal supplement to the home-care allowance provides a good case for using regional experimental set-up. There are no other regionally varying policies that affect mothers of young children in Finland. Moreover, a municipality might offer a supplement simply because it is a popular policy among voters. The decision to do so is not likely to depend on municipal employment situation. There is, however, a worry that a supplement policy could be endogenous to labour supply. After presenting the estimation approach, I discuss institutional reasons and empirical evidence showing that the policy endogeneity do not cause a threat to identification.

The main results show a significant negative labour supply and earned income effects from a supplement. The estimated effect indicates that 4 per cent fewer mothers participate when a supplement is increased by 100 euros per month. Surprisingly, I find larger response for higher educated than for lower educated mothers. To put these reduced-form estimates into a policy context, I estimate a participation elasticity using the exogenous variation as an instrument. The results indicate participation elasticity of 0.9 for all mothers. These findings survive a battery of sensitivity and robustness checks. I perform all estimates for fathers as well, but do not find any effect on their labour supply.

In comparison to previous studies, a municipal supplement provides several attractive features to study labour supply effects of a policy. Municipalities have changed their supplement policies on several occasions. This allows me to compare very similar people with each other. For example, Eissa and Liebman (1996) compared mothers women without children and Blundell et al (1988) compared women across education levels and cohorts, although it is reasonable to assume that these two groups behave in different ways. The multiple reforms introduced

at different points of time also help to clean out macro shocks for treatment or control group. This would not be the case if the reforms happened simultaneously or there was only one treated group (Schone (2004) and Baker et al. (2008)).

The variation in the data is in subsidies rather than in marginal tax rates. Most previous studies (e.g. Baker et al. (2008), Milligan and Stabile (2007) and Lundin et al. (2008)) use exogenous variation in the day care prices or means tested benefits. Taxes can be determined as everything that affects the difference between gross income and disposable income. Thus, the day care fees affect the same margin as taxes. On the other hand, a municipal supplement affects different margin: subsidies. An attractive feature about the variation in a subsidy is that in absolute terms it affects equally individuals from any part of income distribution when they do not participate. By analyzing a municipal supplement, I contribute by showing how maternal labour supply responds to changes in subsidies rather than taxes mostly used in earlier studies.

Combined with the subsidy side variation the fact that the take-up rate is high across education levels of mothers brings out more interesting aspects of a supplement policy. It is possible to estimate how the labour supply effect varies by education. This is interesting since many earlier papers analyzed policies where most of the variation to labour supply incentives affected the low-end of income distribution (e.g. Eissa and Liebman (1996) and Milligan and Stabile (2007)). With variation in labour supply incentives over all education levels, I consequently have a proxy that affects all income levels. Thus, the set up allows me to study the effects across whole income distribution, in contrast to earlier literature.

A municipal supplement allows to estimate the participation elasticity. It is important to differentiate between extensive and intensive margins of labour supply (Saez (2002)), from which the former has been found to be larger (Eissa and Hoynes (2004) and Blundell (2005)). To estimate the participation elasticity, the change in income associated with entry need to be simulated to everybody in the sample. The amount of a supplement one is eligible for does not depend on family income. Consequently, a municipal supplement is a good instrument for how this imputed variable affects the participation status. These parameters can be used in tax simulations analyzing the optimality of tax systems (Saez (2001), Saez (2002) and Immervoll et al. (2007)). To improve these policy relevant simulations, it is important to know more about labour supply responses of subgroups. This study contributes by showing that the participation elasticity of mothers is high. In contrast to earlier results the divided sample results by education show increasing response profile (Eissa and Liebman (1996)).

This study also adds to the literature estimating the labour supply effects of child care policies. The policies range from lowered day care prices (Lundin et al. (2008), Baker et al. (2008) and Lefebvre and Merrigan (2008)) to employment

responses of maternity leave (Baker et al. (2008b)) to child care related benefits (Milligan and Stabile (2007)[1]. A typical finding is that policies have some effect, however not in all cases[2].

The rest of the paper proceeds as follows. In section 2, I present the source of the variation in child care subsidies. I also provide a short description of the Finnish child care system. The identification issues and the econometric specification are discussed in section 3. In section 4, there is a description of the data-set and descriptive statistics. The estimation results are in section 5. In the same section there are some robustness checks. A discussion of the economic interpretation of the results and an estimation of participation elasticity is presented in section 6. Section 7 discusses the economic policy implications of a supplement. The last section concludes the study. Appendices show tables and figures referred to in the text.

2 Forms of childcare

Child care can be structured in many ways. To understand the particular features of the Finnish institutions, I first compare these to the arrangements in other countries. I then describe Finnish day care in more detail and discuss how the institutions result in exogenous variation to the labour supply of parents.

2.1 How is Finland doing compared to other countries?

The Nordic countries provide extensive public day care and parental leave policies. Children are entitled to a place in a public day care center. The price for day care is heavily subsidized by the government. In Anglo-Saxon and central European countries day care relies more on private providers. The price a household ends up paying for day care can be much higher than in the Nordic countries. Parental leave policies are provided in the Nordic countries for parents whose youngest child is under one year old (with national variation). This is much more than in the other OECD countries in general. In Finland the home-care allowance continues for as long as two years after the maternity leave. The home-care allowance works

[1]Milligan and Stabile (2007) studied the National Child Benefit reform in Canada. With province level reforms, the variation that they observed does not arise from a single treated group, a problem in many of the articles cited above. Their results indicate an elasticity of 0.96 from having earnings as a major source of income, which is comparable to what I find.

[2]Lundin et al (2008) do not find any employment effect from Swedish reform that put a cap on child care prices. Similarly, Havnes and Mogstad (2009) do not find any effect on maternal labour supply from Norwegian day care reform. This is interesting, since the Swedish and Norwegian child care institutions are similar to Finland, except only Finland has significant home care allowance system.

in similar way as parental leave: one has the right to return to previous work place after the leave and there is a subsidy from the government to the mother.

A key feature that countries try to influence through their child care institutions is the employment rate of mothers. FigureA1 presents maternal employment rates by the age of youngest child in selected countries in 2005. It is evident that the Nordic countries have higher employment rates than the OECD countries on average.

The first column in figure A1 shows the employment rate of mothers whose youngest child is under 3 years old. This column stands out for Finland even compared to the other Nordic countries. The home-care allowance is provided for this group in Finland in contrast to Sweden and Denmark. I hypothesize that there is an effect from the Finnish home-care allowance system on the labour supply of mothers. When mothers are no longer eligible for this allowance, their employment rate shoots back to a high level seen in other columns in figure A1.

2.2 Finnish day care

In this section I describe the provision of child care and the home-care allowance in Finland. The idea of the Finnish system has been to provide financial assistance to parents regardless of the choice a parent makes. After a maternity leave (when the newborn child is 10 months old), parents can choose essentially between three child care alternatives, all of which are financially subsidized by the government: home care, public day care or private day care.

Public day care is the predominant choice in Finland for a typical family. Every child under the age of 7 (when they start primary school) is entitled to a public day care place if requested[3]. Day-care fees are regulated by the government - a typical family with two children in public day care paid 380 euros per month in 2005. Private day care is also subsidized[4]. Furthermore, municipalities are able to pay a municipal supplement on top of the private day care allowance if they choose to.

This study focuses on the employment effect of the home-care allowance and a supplement to it. Thus, the point of interest is not whether a family chooses the private or the public day care. These two choices are similar in terms of the employment decision.

When a child under three years of age is cared for by a parent, he or she is

[3]This is stated in legislation. Before 1995 the law stated that every child under the age of 4 is entitled to public day care.

[4]This system has been in place nationwide since 1997. Between 1995 and 1997 there was an experiment in 33 municipalities that provided a similar allowance. Viitanen (2007) describes this experiment in detail. She found a positive effect on the use of private day care, but little effect on labour force participation.

entitled to the child home-care allowance. This national allowance can be paid until the youngest child not in public or private day care reaches the age of 3. The amount depends on the family's characteristics and is from 300 to 500 euros per month. The child home-care allowance may be paid to either parent, although it is predominantly the mother who takes up the allowance.

A municipal supplement to the home-care allowance constitutes an interesting variation in this study. Some municipalities have decided to pay a supplement on top of the national home-care allowance while other municipalities have no supplement policy. The municipal supplement has been part of the Finnish child care system since the 1980's. The observation period reaches from 1995 to 2005. Over this period, there were around 450 municipalities of which 5 had adopted a supplement policy in the beginning, rising to 65 at the end. Figure A2 shows how municipal supplement has spread over time. There is also a map showing the population in each municipality. By comparing it is evident that there are bigger cities in a group that offers supplement and in a group that does not.

Although there are strict national rules about how municipalities have to provide child care, municipalities may choose relatively freely their supplement policies. Thus, there is a lot of variation in the details as how each municipality pays its supplement. Typically a municipal supplement is paid per child. It is possible to receive an extra supplement if the youngest child has older siblings. The mean monthly supplement level in the data is 200 euros and the mean sibling extra is 50 euros per family. With the exception of a few municipalities, the municipal supplement does not depend on family income. There is also a Prior-work condition in some smaller municipalities, according to which to be entitled to the municipal supplement the parent must have been in work prior to going on parental leave.

For what reasons do municipalities pay supplements to the home-care allowance? Literature does not document much about the motivation for a municipality to provide a supplement. Potential reasons include political considerations; for example, right-wing and center parties in Finland have supported the idea that any choice a parent makes regarding child care must be supported by the public sector, not just day care facilities. Some municipality councils may appreciate the idea of a parent taking care of the young children themselves instead of a paid nurse.

3 Identification and econometric strategy

To estimate the effect of a municipal supplement on maternal outcomes, I apply a differences-in-differences (DD) and a triple difference approaches. In DD strategy I compare an outcome of a mothers living in different municipalities before and after there was a change in a supplement policy. Mothers living in a municipality that did not change its supplement policy comprise the control group. A supplement

policy is measured as the actual supplement a mother is eligible to based on her observable characteristics. Thus, it is not a dummy variable as in the basic DD approach. The model is estimated for mothers who have children between 9 months and 3 years old. In the triple-difference estimation the third difference is between mothers who have older or younger children than three years old. This distinction is meaningful, since the upper age limit of the youngest child to receive a supplement is 3 years old. I estimate the OLS equation:

$$Y_{iym} = \alpha + \beta_1 P_{iym} + \beta_2 X_{iym} + \beta_3 Mun_m + \beta_4 Year_y + \varepsilon_{iym} \quad (1)$$

The dependent variable is labour supply or earned income, Y. In the labour supply case it is a dummy variable having value 1 when a parent participates and zero otherwise and in earned income case a continuous variable. The key explanatory variable is P (municipal supplement). The model identifies β_1, the effect of a subsidy P_{iym} on labour supply Y_{iym} in year y, municipality m and individual i. In the case of labour supply, β_1 shows the change in probability a parent supplies labour when P is increased by one unit. The other variables in equation (1) are municipal Mun_m and year $Year_y$ dummies and a control vector X_{iym}. When estimating the triple difference, the control vector includes interaction terms of the dummies used in DD approach. Any change in P is allocated to a simultaneous change in Y. The only reason for a change in Y should be that there is a change in P, conditional on covariates. Since P has variation on municipality and year dimensions, the identification relies on municipal and year level changes. That is why the controls include municipal level variables such as average unemployment rate and share of children in day care relative to the number of children in a municipality. The control vector includes also individual level variables to cope with the individual level variation. This should reduce the variation of the error term.

Changes in a municipal supplement rules depends on the age of the youngest child. Simultaneously mother's decision to return to work is correlated with the age of youngest child. Consequently, β_1 would be biased away from zero without taking this correlation into account. Municipal supplement rules vary extensively by the youngest child's age. In some cases the upper age limit to eligibility is raised gradually from 1 year and 2 months to 2 years. Thus, to be able to control this variation in a flexible way, I needed to include dummies according to the age of youngest child. A dummy for each three months of age for the youngest child controls away all the variation in the policy rules. Other specifications for the length of the age interval in the dummy produce similar results as in the main estimates.

3.1 Identification issues

The DD approach identifies a causal effect of a municipal supplement on outcome Y provided that certain assumptions hold. I use the standard DD assumption that selection into treatment should be exogenous to outcome. In particular, the model identifies β_1 conditional on controls if the following condition holds:

$$E[Y_{iym}|m, y, P_{iym}, X_{iym}] = E[Y_{iym}|m, y, X_{iym}] = \delta_m + \lambda_y + \beta_1 X_{iym} \quad (2)$$

Where I note the outcome of the control group by Y^0_{iym}. The assumption that guarantees the identification here is that P_{iym} is exogenous to labour supply. Also, the aggregate employment time trends should be parallel between treatment and control groups. It seems credible that mothers within a municipality do not select into treatment, since municipal supplement is offered to everyone living in a municipality having children of correct age. There would be a problem if changes in a supplement would induce mothers to be more fertile. Finally the composition of groups should be similar; people should not move from municipality to other based on changes in a supplement policy. After the estimation results I present some robustness checks as a defense against these potential problems.

"How Much Should We Trust Differences-in-Differences Estimates" is a question raised by Bertrand et al. (2004). Their simulations show that potential problems are less severe if there are many treated and control groups and the reforms are implemented at different points of time. One virtue of analyzing the Finnish home-care allowance system is that there are over 400 municipalities of which 65 offered supplement policies in 2005. The reforms were implemented at different points of time.

3.2 Policy endogeneity

One potential problem here is a policy endogeneity as discussed by Card and Levine (2000) and Lalive and Zweimuller (2004). The main worry is that there is a negative shock to the municipal employment and a supplement is offered in response to that. In this case it would seem there is an effect from the supplement on employment, whereas there actually is none. I argue below based on the Finnish child care institutions why this story is not plausible in this case.

There could be many ways how a change in a supplement policy would be systematically related to a change in municipal employment rates. I describe the most likely one and argue why it does not cause a problem in the municipal supplement setting. In case of a positive employment shock for mothers in a municipality, mothers would demand more public day care. There is a subjective right to receive a place from public day care if a family asks for it, so the municipality needs

to provide more places when the demand increases. Since the public day care is expensive for municipalities, a municipal council could try to offset the increased demand by offering a supplement. However, I just established a positive relationship between a supplement and maternal employment. For this reason, in this unlikely case, the introduced bias would rather weaken the results than make them more negative. A similar but opposite logic works when there is a negative shock to maternal employment.

One can invent other stories establishing policy endogeneity, such as a baby boom in a municipality. It is not possible to go through all of them due to space limitations. On the other hand there is no evidence supporting the view that a supplement policy is endogenous.

The second reason to believe there is no policy endogeneity problem emerges from a municipal level data. Employment trends of women aged from 25 to 39 years old between two groups of municipalities is shown in figure A4. Group "Supplement" had a municipal supplement in place for some or all of the years 1994 - 2005. The other group, "No Supplement", did not have a policy in any of the years. The shaded areas and capped bars show confidence intervals around the means. It is apparent from the figure that although there is a small level difference in the means, the trends follow each other fairly well. Since the econometric specification allows for municipal level differences and overall time trend, the level differences in means is not a major concern here. More worrying would be differing time trends between the groups, and such differences are not visible in figure A4. Thus, there does not seem to be a problem as regards policy endogeneity. Many municipalities adopted a supplement policy around 2000, but employment rate for women does not show any significant deviation from the trend before that year.

Two more figures show some further evidence against the policy endogeneity. Figure A5 shows two migrant statistics relative to the inhabitants in a municipality. The left panel shows total domestic migration to a municipality and the right panel the corresponding figure for babies aged 0 or 1 year who moved. The difference between the means is larger than for employment rates, but the trends follow each other fairly well. This result indicates that changes in municipal level migration are not driving a supplement policy. If this was true, it would mean that the policy was a response to a situation that also affects employment. Similarly, figure A6 compares fertility rates between treatment and control groups. Again, no clear difference between the two trends is found. More rigorous robustness tests are performed with micro data after the main estimation results.

4 Data and Descriptive statistics

The main data set in this study is an individual level micro data from years 1994 to 2005. The data comes from multiple sources. The base data, Income Distribution Statistics (IDS), comes from Statistics Finland and is an individual level data, containing over 25000 observations from about 10000 households per year from a population of about 5 million Finns. The main estimation sample includes families whose youngest child is between 9 months and three years old. Pooled for all years, there are about 6000 households in this group and about 14000 households that have children under the age of 6. In the data there is a rich set of variables describing family characteristics, demographics, incomes and benefits coming from registers and surveys. The rest of the information is on municipal level and it has been linked to the IDS data. It comes from a survey to municipalities conducted by University of Turku, a survey to municipalities conducted by the author, from the Social Insurance Institution of Finland and from Statistics Finland. The data is a repeated cross section on individual level, although there is a rotating panel system[5]. Aggregated to municipal level, the data is a panel where each municipality can be followed over the years.

Table A1 shows descriptive statistics from the data. It categorizes the mothers according to the age of their youngest child. Mothers in the main estimation sample, shown in the first column, are on average 32 years old and have at least high school education almost 50 per cent of the time. The most typical families are those with one or two children, but there are also larger families in the data.

The outcome variables in this study are employment rate and earned income. I construct the employment rate using earned income statistics. The data for these variables come originally from tax records and are on yearly basis. I define mothers as employed when their yearly income is higher than half the mean income of women who are between 22 and 55 years old and not disabled to work or retired[6]. The employment trend of mothers according to this variable by the age of youngest child is shown in figure A7. It shows clearly how the employment rate of mothers increases with the age of youngest child. From this figure it is clear that mother's employment rate is correlated with the age of youngest child. The share who receive municipal supplement to all mothers in the sample by the age of youngest child is also shown. It is noticeable how the two lines have opposite slopes.

The explanatory variable used in the main estimations is a supplement to the home-care allowance. When estimating the participation elasticity, also the home-

[5]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. The data is a panel on municipal level.

[6]This specification ensures I calculate the mean income from a population that is mainly in labour force.

care allowance, the day care fee and the family income are used as a dependent variable to measure the change in incomes associated with entry. These variables are implemented to everyone in the sample using their observable characteristics (family size, age of children and municipality they live in) and eligibility rules. These rules are described in section 2. To make income uncorrelated with actual working status, it is imputed for people based on observable characteristics and incomes from those who are working. For each family two prices are calculated, other corresponds to taking care of the children at home and other to children being in public day care. If there are multiple children only the case that all the children are treated in a similar way is calculated.

The mean values, standard deviations and number of observations of supplement and employment rate are shown in table A2. The share that receive supplement describes how large share of the sample is eligible to a supplement in the table. It describes these variables for mothers whose youngest child is between 9 months and 3 years old and for selected years. Table A2 is divided to two parts; the left panel contains everybody in the sample for the year in question, and the right panel contains only those who live in a municipality that has the supplement policy in the year in question. From the table it is evident that it has become more common to be entitled to receiving supplement. At the same time there has been variation in the supplement conditional to receiving it. It is evident that monthly supplement is around 200 euros on average at least towards the end of the observation period. The group of mothers in the table do not have very high participation rate on average and this is reflected also on gross income being low on average. In the right panel there are only those who receive supplement that year. It is interesting to note that the employment rate and mean gross income have fallen relative to whole sample of mothers in the left panel.

5 Estimation results

Table B1 shows the main estimation results. In each column the dependent variable is mother's labour supply dummy. The monetary variables (like the municipal supplement and earned income) are in 100 euros per month. I perform all the estimations to fathers as well and find zero effect on their labour supply.

The results in table B1 are organized as follows: There are two panels, top and bottom, which are divided according to dependent variable. The top panel presents the results for employment dummy, which is coded as one if earned income is more than half the average income of working age women. In the bottom panel the dependent variable is earned income. In column (i) there is a plain regression of municipal supplement on dependent variable. Column (ii) presents a difference-in-differences (DD) estimate, where year and municipal level dummies,

dummies for youngest child's age for every three months as well as many control variables are included. By controlling away municipal level differences, the results become more significant and negative. Column (iii) presents the triple difference results. The third difference is between having youngest child in age group 9 months to 2 years or 3 to 5 years old since the latter age group is never entitled to supplement. An advantage of the triple-difference estimate is that it allows controlling for municipality specific time trends.

The main result for work-dummy indicates that increasing the municipal supplement by 100 euros per month causes 4% fewer mothers to participate. The main result for income indicates that increasing the municipal supplement by 100 euros per month decreases the yearly income by 1190 euros[7]. Since there is probably variation in how mothers respond to municipal supplement, we interpret this as the average treatment effect on the treated effect.

The result in column (iii) seems to be robust with quite a flexible set of control variables. As a sensitivity check I tried to include a linear time trend for every municipality, use other definition to define work dummy[8] and exclude some individual municipalities or years. Tables C2 and C3 show some of the results. Since the point estimate do not change much, when conditioning on municipal level variables, the result does not depend directly on macroeconomic conditions of the municipality. The coefficient on a supplement is in general quite robust to controlling for many individual and municipal level effects. However, one variable deserves special attention; age of the youngest child. Since this variable is closely correlated with the employment of mothers and the treatment is not constant within youngest child's age, it turns out to be important to include this covariate.

There are various threats to identifying true average treatment on treated effect with the chosen strategy, as discussed in identification section. I perform robustness checks in table B2 to check if there is a problem with identification. Column (i) introduces a pseudo-rule that made mothers whose youngest child was between 3 to 5 years old eligible to the municipal supplement if they lived in a supplement municipality. The estimates are otherwise similar to ones in table B1, column (ii) for the work dummy outcome. The families that have older children seem natural candidates for a robustness check, since their characteristics should otherwise be close to families that have just a little younger child. The zero result here indicates that there is no delayed effect on mothers employment of the supplement policy. The result is in line with OECD (2007) statistics that indicate that the employment of mothers with children of this age is much higher than the employment of

[7]The average net income per month for a woman working full time is around 1410 € (own calculations).

[8]The other definition is number of months worked that is based on a survey question. The results for this are shown in table C1. There is measurement error in this variable, thus I did not use it in main estimates.

mothers with younger children.

Column (ii) of table B2 presents a robustness check for a different group: women who are going to have a children in the next year. Here I utilize the rotating panel feature of the data. The model is estimated for families that will have a child the following year aged 9 months or younger, but do not currently have any children that are between 9 months and 3 years old. Thus, they are not entitled to municipal supplement yet, but live in municipalities that have the policy. This estimate should tell something about potential anticipation effect. However, the coefficient on a supplement is zero. This indicates that there is no serious anticipation effect (although we do notice that the sample size is only 533 in this estimate).

Column (iii) checks if there is a higher probability of ending up in the estimation sample associated with changes in a supplement policy. The outcome is a dummy indicating whether or not a person is a child under three years old (who are usually the ones entitled to a supplement). This model is estimated to everyone in the data. The result shows no effect of a supplement on children ending up in estimation sample. Thus, families with small children do not seem to move to municipalities offering supplement[9]. Moreover, mothers in supplement municipalities do not seem to be more fertile because of supplement. Column (iv) presents a base-line estimation, but with simplified rules needed in the implementation of a supplement used in other robustness checks. The coefficient on a municipal supplement is similar to main estimates, the simplification of rules do not seem to affect the estimates.

The treatment effect may also be heterogeneous. To check for this, I divided the sample according to two dimensions: number of children in the family and mother's education. The results are shown in table B3. The dependent variable is mother's labour supply dummy and supplement is measured in 100 € per month.

Interesting about these results is that for families with 1 or 2 children the result is much stronger (coefficient is more significantly different from zero) and the coefficient for larger families, although non-significant, is actually positive. It is surprising that for the higher education group, where a mother has some education degree attained higher than high school, the coefficient is larger than for lower education group. Eissa and Liebman (1996) found larger estimate for lower education group. However, the reform analyzed by Eissa and Liebman was Earned Income Tax Credit (EITC) reform targeted to working poor. It is therefore not surprising if they found small effect for higher educated mothers. The municipal supplement is instead provided based on the municipality a mother lives in. Consequently, the amount one is eligible to do not depend on education one has. The supplement thus provides a good case to analyze participation responses across

[9]Typical area size of a municipality is large in Finland. Thus, moving to another municipality usually means moving to a completely different city or town.

education levels.

The result that those with higher education respond more is surprising, since in the literature the opposite is assumed (Saez 2002 and Eissa et al. 2008). Education is usually taken as proxy for income or at least capability to earn higher income. The result in table B3 can be interpreted as mothers with higher earnings respond on average more than those with lower earnings. In the literature of optimal income taxes with extensive margin of labour supply it is usually assumed that poor people have higher participation elasticity than rich people (see e.g. Saez 2002 and Immervoll et al. 2007). This assumption is usually made when simulating the welfare effects of a tax reform across income distribution. If at the same time participation tax rate is high in the bottom of the income distribution, the assumption about declining participation elasticity profile makes an EITC type tax profile more attractive.

6 Participation elasticity

This section presents the participation elasticity results. It is interesting to put the effect of a supplement on labour supply to a policy relevant context. The participation elasticity is a parameter that can be used for this. For instance, in optimal income tax models taking extensive margin into account there is an inverse elasticity rule that basically uses inverse of participation elasticity analyzed here (Saez 2002).

To estimate the participation elasticity, I need two income numbers for every mother. One measures the disposable income when staying at home and taking care of children and the other measures the disposable income when working and putting children to public day care. I need to make assumptions here, and one of them is that the two choices just described are the only ones available to a mother.

One of the two prices is always non observable for a person. A typical solution to this is to simulate the two income measures for everybody. I use information in the data set about incomes for those who work to predict income according to observable characteristics. When working the predicted income minus the day care fee is disposable income. When staying at home, the disposable income consist of the home care allowance and a municipal supplement to it, provided one is eligible.

The difference of these would itself suffer from endogeneity problem. Therefore, I use municipal supplement as an instrument for the change in incomes associated with participation. The various robustness checks presented in the previous section contribute to validating the use of this instrument. To be a good instrument, the municipal supplement should be exogenous to labour supply of an individual. On the other hand, it should affect directly the income one gets when the change in participation status is made. The coefficient should have positive sign because the

subsidies enter the income equation with a negative sign. The incomes taken into consideration are net of tax full-time working income minus day care fees minus the home-care allowance (and the supplement when entitled to it). This was then instrumented with municipal supplement.

The results are shown in table B4. The explanatory variable is again a dummy for participation status. Now the unit is 1 euro per year. The first stage, shown in the first line, is very strong. There is almost one-to-one relationship between change in incomes and being eligible to a supplement. The second stage results from 2SLS suggests that the amount mothers gain when they participate leads to increase in participation probability of .0028 % from 1 euro per year.

The participation elasticity implied by the coefficient in the table B4 can be calculated as

$$\eta = \frac{dparticipation}{dincome} * \frac{income}{participation} =$$

$$\beta * \frac{income}{participation} = 0.0000277 * ((11600)/(0.355)) = 0.91$$

The above elasticity is calculated on a year basis. The 11600 euros is the average change in net income associated with labour market entry for a typical mother. The 0.355 is the average participation rate in the population for which the estimation was made. Table B5 shows the participation effect by education level. The result is significant only for mothers with university degree or higher. The participation elasticity implied by that estimate is 1.48 with mean yearly income of about 16000 euros and participation rate of 0.61. The results for other education groups imply lower participation elasticity than in the main estimate for the whole population.

The estimate is done here more structurally than in other studies analyzing child care benefits and prices (Baker et al. (2008) Milligan and Stabile (2007)). Here the change in income associated with entry is taken explicitly into account. This is possible since a supplement does not depend on income directly and since To report some estimates, Baker et al. (2008) estimated participation elasticity of 0.236 from decreasing child care cost, and Milligan and Stabile (2007) reported elasticity of 0.96 for having earnings as a major source of income from the Canadian benefit reform. Eissa and Liebman (1996) estimated a participation elasticity of 0.6 to single mothers.

7 Policy implications

This section presents crude calculations on the economic implications of supplement policies. Based on the estimates in this paper and aggregate municipal level

statistics, it is possible to look at how desirable a supplement policy is from the municipal point of view and the total economy point of view. To be able to fully assess the optimality of the policy, I would need estimate on the welfare of individuals and the effects to other groups, most notably children.

To make the calculations certain assumptions need to be made. I present only results for mothers. I find that fathers do not often take up a supplement and that the estimated labour supply effect for them is zero. I assume that the children are put to public day care in case she goes to working, which is the prevalent choice in Finland. I need to calculate the effect on average mother. To this end based on own calculations from data I assume that she has: 1,4 children, a spouse that is working, earns 1600 euros per month when working and faces municipal and national income tax rates of 16 per cent and 25 per cent, respectively.

I describe the economics effects of a mother staying at home from this period point of view. If she went to work she would pay on average 500 euros taxes per month, would pay 280 euros per 1.4 children per month day care fees. The day care costs to the economy are 1300 euros per month. I she chose to stay at home she would receive 300 euros home care allowance per month. Summing these rough estimates from the data together (500+280-1300 = - 522 euros compared to -300 euros), it seems that without a municipal supplement, it is less costly if a mother stays at home taking care of children. This result is driven mainly by expensive public day care to the economy. These calculations would look different taking longer-term effects into account. Then pension savings lost, and the effects of deteriorating working skills should be taken into account.

If looking from the municipality point of view, it might seem lucrative to keep mother home taking care of their children. Municipalities receive less tax revenues than the economy as a whole, but need to pay for the public day care. However, it is not necessary optimal to provide municipal supplement. Even with pretty large participation elasticity estimate, the costs of a supplement are larger than gains. This can be seen from a simple example. Assume there are 1000 mothers in a municipality, of which 355 are working and the rest taking care of their children. Increasing home care allowance by 100 euros per month via a supplement would induce on average 40 mothers more to stay at home. The saved amount of public funds from day care costs is 40*(1300-280)=40800 euros. At the same time municipality would need to pay the supplement to every mother already staying at home. The cost of the new policy is then 685*100=68500 euros. Thus, even this rough calculation shows quite clearly that a municipality loses in a reform introducing a supplement to the home-care allowance.

8 Conclusion

This paper presents evidence to what extent child care benefits affect the maternal labour supply. An important component of this study is the feature of the Finnish child care system: a municipal supplement to the child home-care allowance. It provides plausibly exogenous variation to the labour supply of mothers.

To be entitled to a municipal supplement a parent needs to stay at home taking care of children, to have children of a certain age and live in a municipality that has the policy in place. Because of regional policy reforms, the control group and the treatment group consist of very similar mothers. The municipalities changed their policies many times during the observation period.

I find that a municipal supplement to the home-care allowance has a negative effect on the labour supply decision of mothers. The main estimate indicates that increasing a municipal supplement by 100 euros per month causes 4 per cent fewer women to participate. I do not find any effect on the labour supply of fathers.

To put the results into a policy relevant context, I estimate the participation elasticity. It is calculated using an instrumental variables strategy using a municipal supplement as an instrument to changes in income associated with entry. It is a good instrument, since it clearly affects the income difference. At the same time the prior analysis has established that a supplement is exogenous to labour supply. The result implies a participation elasticity of around 0.9. This estimate is towards the high end of elasticities found in other studies for the population as a whole. It thus confirms the idea that the participation response is larger for single mothers and secondary earners than for the rest of the population (Blundell and Macurdy 1999).

The effect estimated describes to what extent certain monetary amount affects participation. It is therefore surprising to find that I obtained a larger effect for those with higher education, contrasting what Eissa and Liebman (1996) found. This is interesting by itself. Also, when education is taken as a proxy for income, one would expect that those with higher potential earnings would be less responsive to the same monetary incentives than those with lower potential earnings. In studies where the effects of a tax reform are simulated to people, declining participation elasticity profile in income is assumed (e.g. Saez 2002 and Immervoll et al. 2007). The result obtained in this study implies that the participation response may be high towards the middle and top of the income distribution, not just on the bottom of the distribution. Since for example the Earned Income Tax Credit (EITC) is targeted towards the working poor, this finding may have implications regarding the optimality of an EITC type reform.

The results also show that when the home-care allowance period ends, mothers return to employment. Thus, the policy does not seem to have a delayed effect.

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A Appendix Tables and Figures

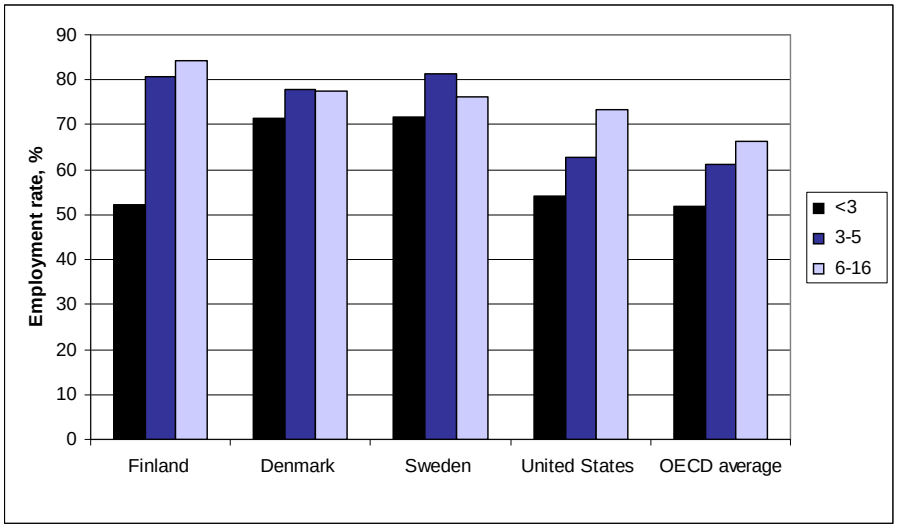

Figure A1: The employment rate of mother by the age of youngest child. Source: OECD (2007).

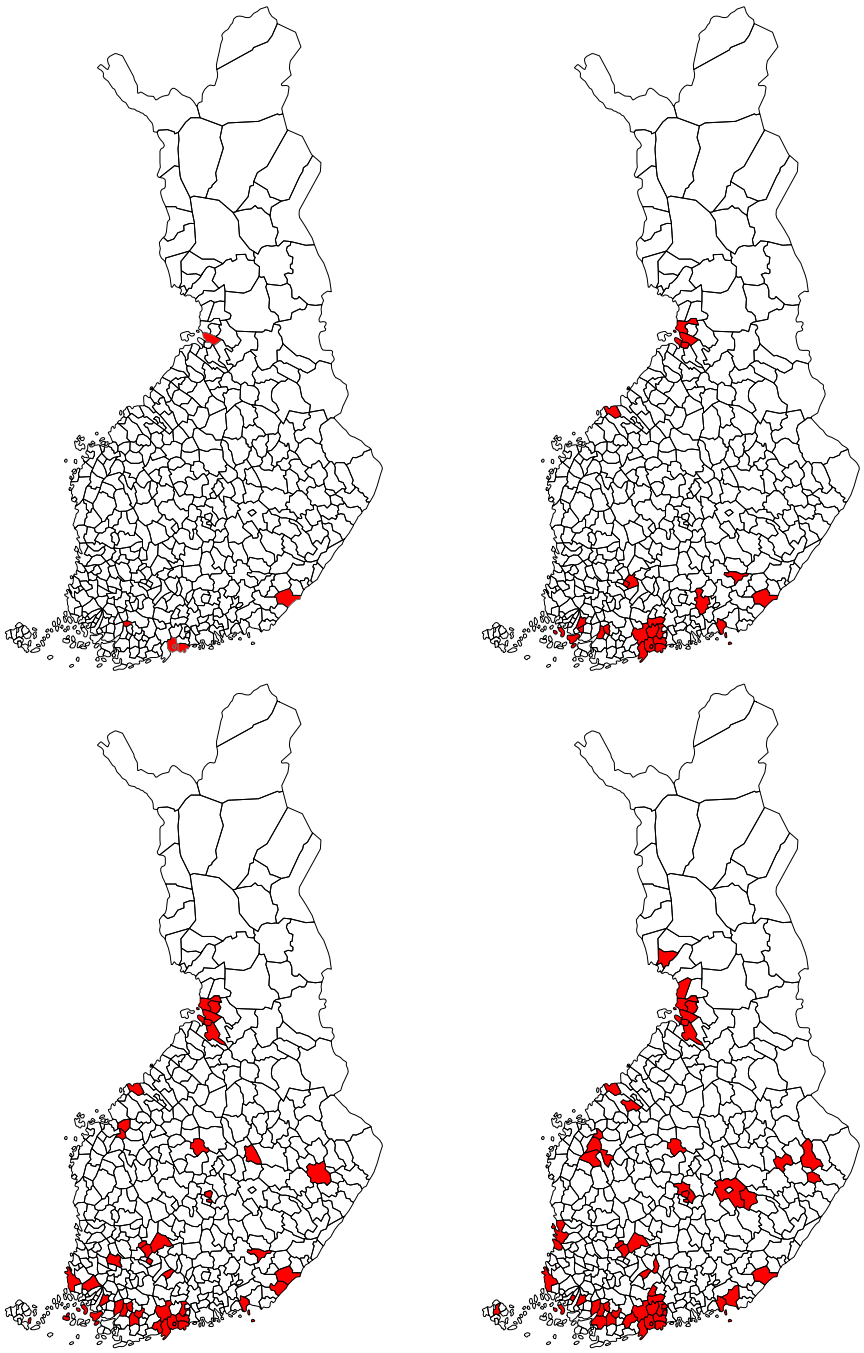

Figure A2: Maps of Finland showing municipalities having a supplement policy in selected years

Note: Maps of Finland show the municipalities that have a supplement policy marked as red. The maps correspond to situations in 1995, 1998, 2001 and 2005, respectively.

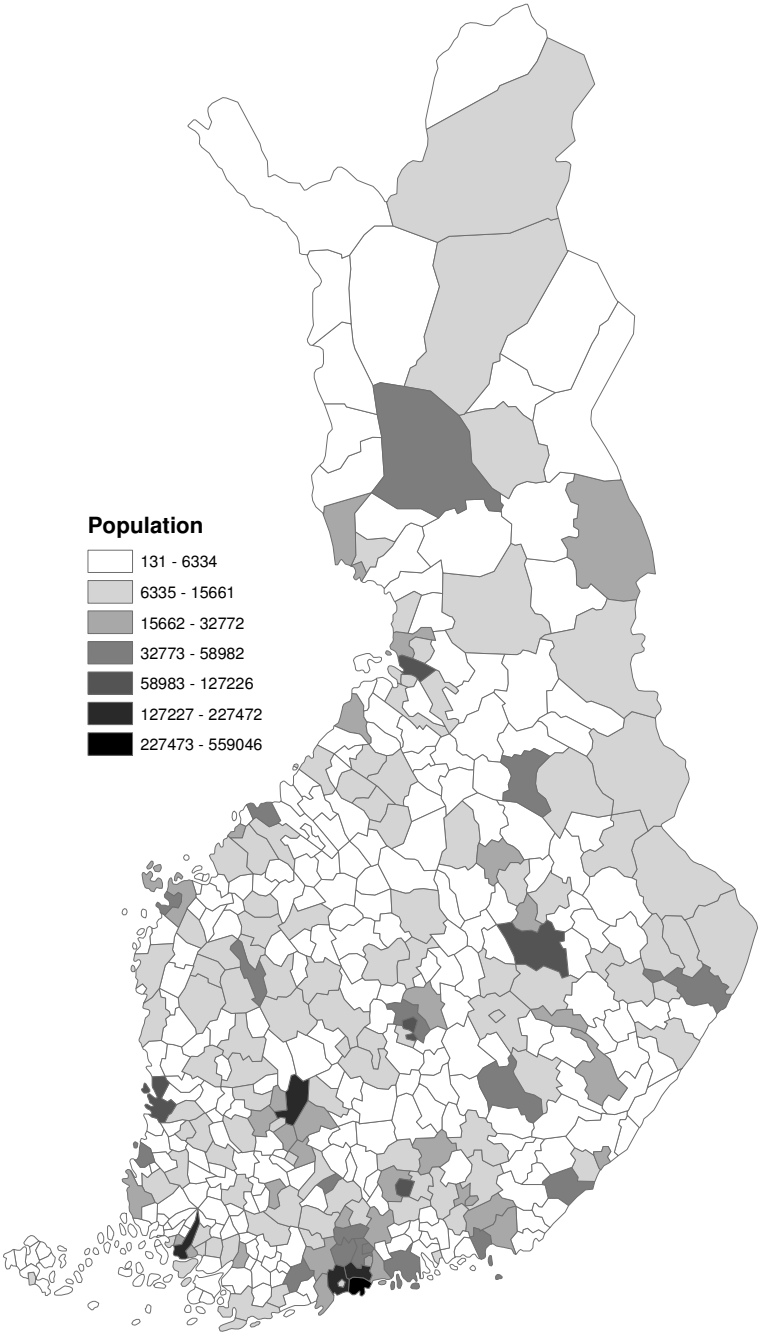

Figure A3: A map showing the population of each municipality in 2005

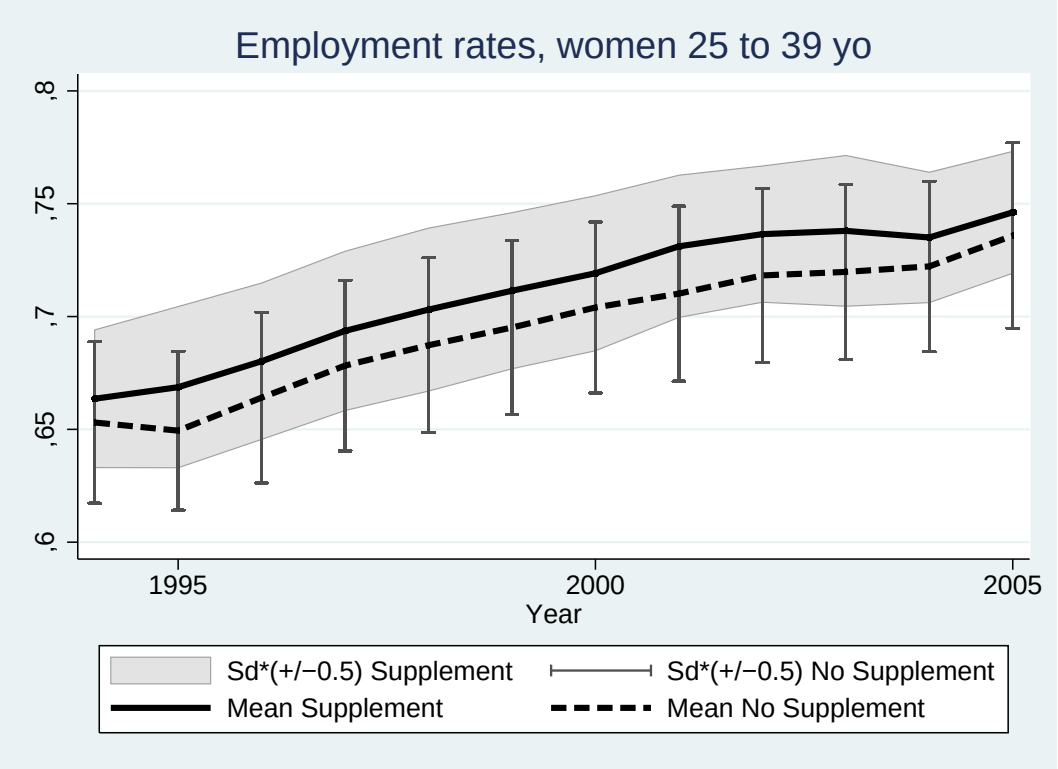

Figure A4: The employment trends of mothers in two groups of municipalities

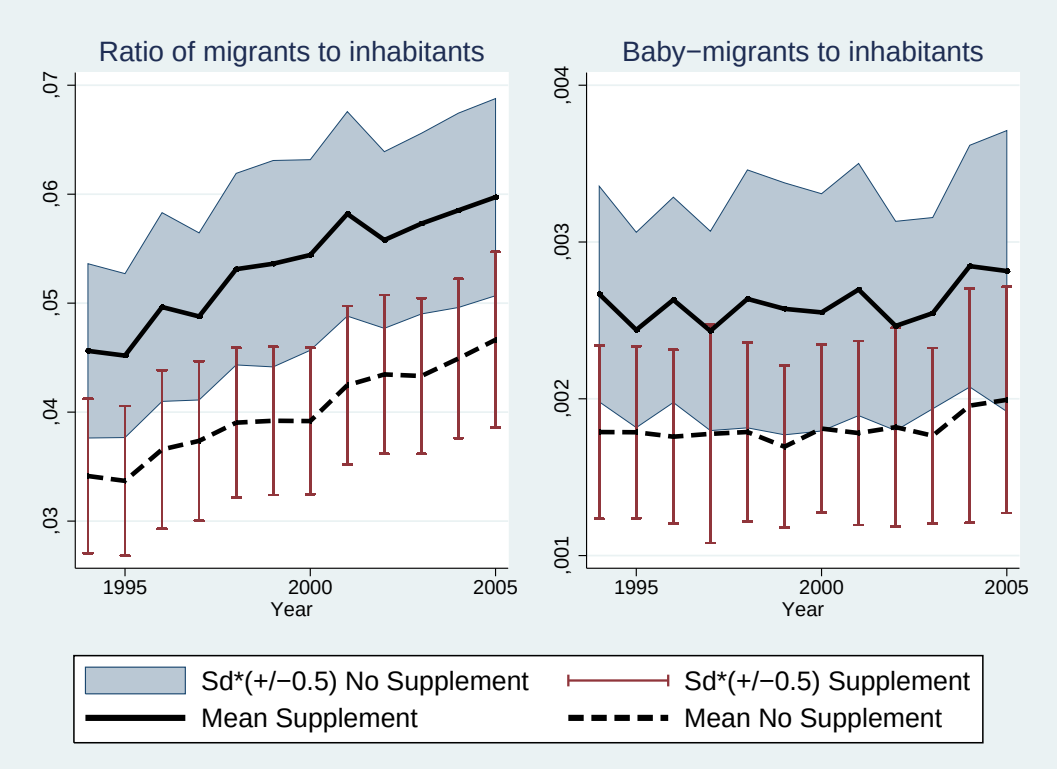

Figure A5: Municipal level migrant statistics

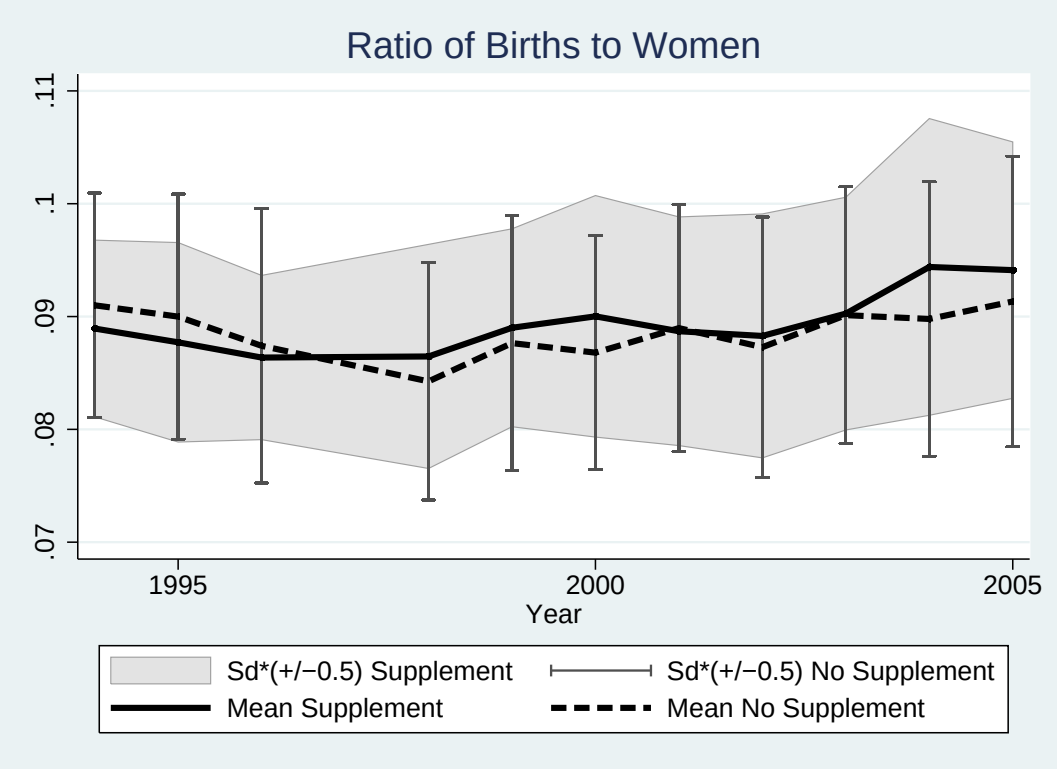

Figure A6: Fertility rates over time in two groups of municipalities

	Children between 9 months and 3 years		Youngest child between 3 and 7 years of age	
	Mean	Sd	Mean	Sd
Number of obs.	5709		8411	
Age	32.09	(5.26)	36.24	(5.40)
Earned income	7726	(10510)	14983	(12979)
Employment rate	0.35	(0.48)	0.65	(0.48)
Education missing	0.11		0.12	
Basic education	0.42		0.43	
Some higher education	0.26		0.26	
Bachelor or higher	0.21		0.18	
Number of children under age of 7	1.65	(0.70)	1.24	(0.45)

Table A1: Descriptive statistics

Note: Mean level of descriptive statistics. Standard deviation of means are in the second column, when applicable. In the left panel there are group of families where youngest child is between 10 months and three years of age and in the right panel there are families with youngest child between 3 and 7 years of age.

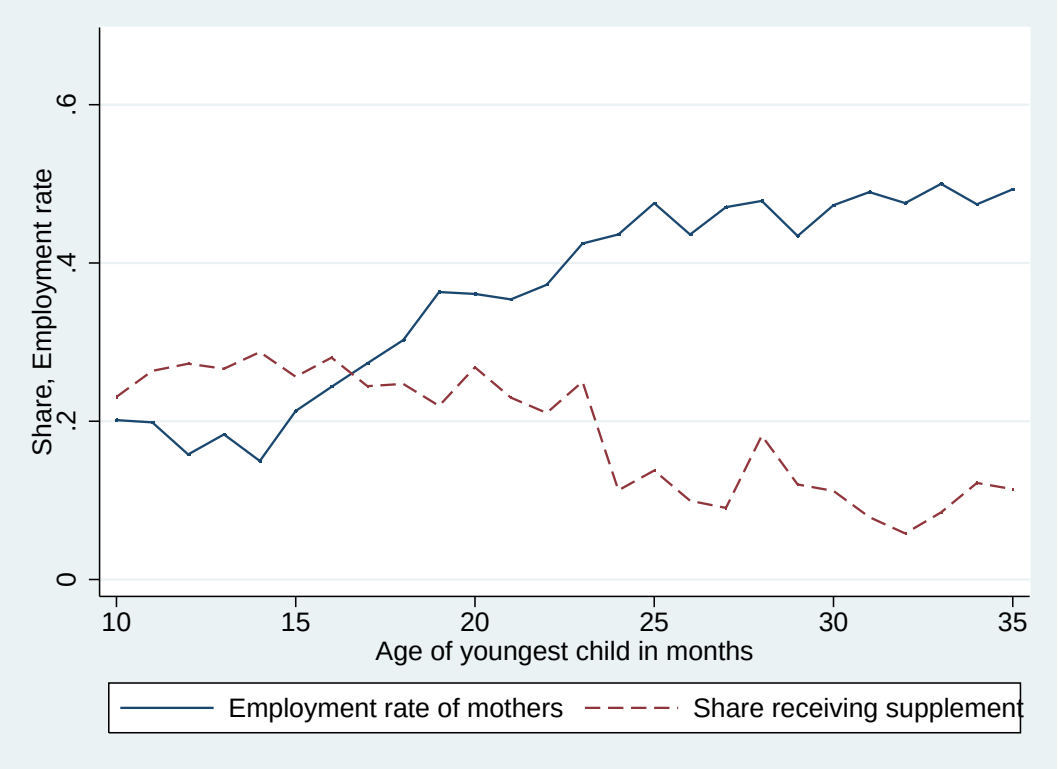

Figure A7: Employment rate of mothers by the age of youngest child and proportion receiving a supplement.

	All				Conditional on receiving supplement			
Year	Share receives supplement	Employ-ment rate	Earned income	N	Supple-ment	Employ-ment rate	Earned income	N
1995	0.06	0.36	6305	761	120	0.46	7881	46
	0.24	*0.48*	*8294*		*30*	*0.50*	*9754*	
1997	0.12	0.42	8244	761	185	0.40	7448	91
	0.32	*0.49*	*10016*		*71*	*0.49*	*8102*	
1999	0.17	0.37	7941	693	206	0.39	8491	116
	0.37	*0.48*	*10306*		*83*	*0.49*	*9997*	
2001	0.20	0.39	8932	713	212	0.35	7216	145
	0.40	*0.49*	*10554*		*76*	*0.48*	*8906*	
2003	0.20	0.37	9452	667	204	0.30	9029	132
	0.40	*0.48*	*12735*		*67*	*0.46*	*14672*	
2005	0.23	0.36	9466	638	190	0.32	7453	144
	0.42	*0.48*	*11989*		*75*	*0.47*	*9374*	

Table A2: Outcome and treatment variables

Note: In the left panel there are all observations for selected years and in the right panel only those who are eligible to a supplement in that year. Below mean values the standard deviations are in italics.

B Estimation Results

Outcome	Coefficient	(i)	(ii)	(iii)
Work	Supplement	-0.00622	-0.0327***	-0.0400***
		(0.00727)	(0.0107)	(0.0137)
	Obs	5709	5709	11209
	R-sq	0.000	0.246	0.397
Income	Supplement	274.5*	-960.2***	-1194***
		(159.9)	(263.1)	(379.4)
	Obs	5725	5725	11287
	R-sq	0.001	0.311	0.450
Years		No	Yes	Yes
Municipalities		No	Yes	Yes
2nd level interactions		No	No	Yes
Standard errors in parentheses (clustered on municipal level)				
*** p<0.01, ** p<0.05, * p<0.1				

Table B1: The main estimation results

Note: OLS estimates for a population of mothers. In the top panel, the dependent variable is labour supply dummy of mothers. In the bottom panel, the dependent variable is earned income of mothers. Supplement is measured in 100 euros per month. Column (i) is plain regression of a supplement on dependent variables. Column (ii) shows the DD results. Column (iii) presents the triple difference results. The third difference is between whether or not the youngest child is older than 3 years of age. Individual covariates used: age, education, number of children, the size of household. Municipal level covariates used: municipal income tax rate, municipal unemployment rate, average income in municipality, average share of places in public child day care to the number of children in municipality.

	(i)	(ii)	(iii)	(iv)
Supple-	0.0129	0.0149	-2.83e-06	-0.0316***
ment	(0.0136)	(0.0509)	(1.41e-05)	(0.0101)
Constant	-1.055	-20.46	0.366	9.070**
	(5.005)	(18.09)	(0.266)	(4.569)
Obs.	4722	541	217837	5877
R-sq.	0.219	0.548	0.057	0.259
Years	Yes	Yes	Yes	Yes
Municipalities	Yes	Yes	Yes	Yes
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

Table B2: Robustness checks

Note: Columns (i), (ii) and (iv) have mother's labour supply dummy and column (iii) has an indicator having value 1 for children under the age of 3 as a dependent variable . Column (i) is done for a population of mothers whose youngest child is between 3 and 5 years old. The Supplement is implemented based on municipality rules and number of children in the family. In column (ii) the estimation is done for women who will have a child next year and currently do not have a child that is under 3 years old. Column (iii) shows the effect of a supplement on ending up in estimation sample. Column (iv) shows a similar estimate to main results, but with simplified supplement rules.

	Basic educ	Lower educ	Higher educ	1 child	2 children	3 or more children
Supplement	-0.0433	-0.0149	-0.0769***	-0.0432***	-0.0498***	0.0196
	(0.0314)	(0.0124)	(0.0277)	(0.0131)	(0.0115)	(0.0452)
Observations	647	3873	1189	2633	2535	541
R-squared	0.459	0.226	0.343	0.295	0.307	0.503
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Table B3: Divided sample results

Note: All results have mothers labour supply dummy as a dependent variable. The sample of mothers whose youngest child is between 10 months and 3 years is divided by family size and mother's education. All estimates have been controlled with same control vector as main results.

	(i)
First	-1.006***
stage	(.032)
F-value	983.88
Change in	-.0000277***
incomes	(9.25e-06)
Constant	-0.541
	(0.397)
Observations	5879
R-squared	0.225
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table B4: Change in mothers participation in response to change in incomes

Note: 2SLS results on the participation dummy of mothers. The first stage regresses municipal supplement on change in incomes associated with entry. The second stage explains the participation dummy with the first stage predicted value.

	(i)	(ii)	(iii)
First	-1.04***	-1.02***	-1.09***
stage	.098	.024	.051
F-value	113	1825	462
Change in	-1.69e-05	-1.42e-05	-5.65e-05***
incomes	(2.15e-05)	(9.74e-06)	(2.02e-05)
Observations	699	3977	1203
R-squared	0.42	0.21	0.28
Standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Table B5: Participation response by mothers education

Note: 2SLS results on the participation dummy of mothers divided by their education level. Column (i) shows results for those having basic education or missing education information, in column (ii) highest degree attained is high school or equivalent and in column (iii) bachelor level or higher. Change in incomes and other monetary values measured in euros per year.

C Robustness and sensitivity checks

	(i)	(ii)	(iii)
Supplement	-0.0548***	-0.0843***	-0.0140*
	(0.00616)	(0.00958)	(0.00827)
Years	No	Yes	Yes
Municipalities	No	Yes	Yes
Child age		No	Yes
Observations	6023	6023	6023
R-squared	0.013	0.139	0.273
Standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Table C1: Estimations with work dummy based on survey question

Note: OLS estimates for mother's labour supply dummy having value 1 when reported working 10 or more months per year in a survey. Supplement measured in 100 € per month. The last column reports a DD estimate equivalent to main estimates. Although the coefficient is smaller, it implies similar participation elasticity, since the participation elasticity measured in this way is smaller than in normal estimates.

Outcome	Coefficient	(i)	(ii)
Work	Supplement	0.00255	0.00433
		(0.00933)	(0.00947)
	Obs	5527	5527
	R-sq	0.197	0.224
Income	Supplement	244.3	-91.42
		(279.2)	(262.0)
	Obs	5560	5560
	R-sq	0.366	0.387
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1			

Table C3: Sensitivity check: results for fathers

Note: OLS estimates for father's labour supply dummy and earned income. Supplement measured in 100 € per month. Column (i) is similar to main DD estimates for mothers. Column (ii) adds to this linear municipality trends.

Outcome	Coefficient	(i)	(ii)	(iii)	(iv)	(v)	(vi)
Work	Supplement	-0.0261*	-0.0340*	-0.0226	-0.0243**	-0.0291***	-0.0196*
		(0.0139)	(0.0198)	(0.0151)	(0.0108)	(0.00915)	(0.0115)
	Obs	5709	3572	4493	5273	5709	5709
	R-sq	0.267	0.288	0.262	0.243	0.262	0.234
Income	Supplement	-978.8***	-1131***	-866.1**	-687.1***		
		(339.9)	(418.1)	(360.8)	(227.6)		
	Obs	5725	3581	4506	5289		
	R-sq	0.322	0.346	0.318	0.308		
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1							

Table C2: Sensitivity checks

Note: OLS estimates for mother's labour supply dummy and earned income. Supplement measured in 100 € per month. Column (i) includes linear municipal trends where some smaller municipalities were grouped together. Column (ii) presents estimates for years from 1995 to 2001. Column (iii) includes years from 1998 to 2005. Column (iv) takes out the largest municipality in the sample. Column (v) reports results for labour supply dummy having value 1 when yearly earned income is over 80 per cent of the mean and column (vi) presents result of similar exercise with mothers categorized as working when they earn over 30 per cent of the yearly mean.