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The joint decision of labour supply and childcare in Italy under costs and availability constraints

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Abstract

It is widely recognized that childcare has important pedagogical, economic and social effects on both children and parents. This paper is the first attempt to estimate a joint structural model of labour supply and childcare decision applied to Italy. Such an approach is particularly informative given that it allows one to estimate the changes in family choices under different policy simulation scenarios, evaluating the effects on labour supply and childcare usage and the potential consequences for household income.

We analyse how maternal labour supply and childcare usage can be affected by relaxing the existing constraints in terms of childcare availability and costs by considering public, private and informal childcare, with related imputed availability and costs and their interaction with the whole tax-benefit system.

Due to the regional differences, costs and effects are highly differentiated among different areas of the country. Results suggest that Italian households might alter their childcare and labour supply decisions substantially if the coverage rate of formal childcare increases, in particular if the increase would correspond to the increase needed to reach the European target in the Southern regions. Overall, increasing child care coverage is estimated to be more effective in enhancing labour incentives than decreasing existing child care costs, at the same budgetary cost. However, the potential effects on the disposable income are larger in the latter scenario because decreasing the childcare costs is beneficial also for women who do not change their labour supply behaviour.

Keywords: childcare, female labour market participation, labour supply, Italy

JEL codes: H53, J13, J22, I38

1. Introduction

It is widely recognized that childcare has important pedagogical, economic and social effects on both children and parents. Preschool investments may have important effects on cognitive and non-cognitive capabilities of children (Cunha and Heckman, 2008; Carneiro and Heckman, 2003) and childcare availability plays a key role in the reconciliation between family and work for mothers (Del Boca and Wetzels, 2008). Both aspects are crucial for Italy where the share of children with a disadvantage background (i.e. lone parent families, immigrants, …) or in a poverty status in the early stage of their life is increasing and the female labour market participation is persistently below the European average. Previous studies, related to the Italian situation, show the positive effect of child care availability on children's cognitive ability (Brilli, Del Boca and Pronzato, 2013) and on the labour market participation of mothers (Del Boca 2002; Del Boca and Vuri 2007; Del Boca, Locatelli and Vuri 2005; Del Boca, Pasqua and Pronzato, 2009). However, a structural approach that, considering the whole tax-benefit system, combines individual preferences for labour supply and childcare decisions under availability and cost constraints is still missing. This paper aims at filling this gap by providing the first attempt to estimate a joint structural model of labour supply and childcare decisions applied to Italy. Such an approach is particularly informative given that it allows one to estimate the changes in family choices under different policy simulation scenarios.

An enhancement of the labour supply incentives is a particularly urgent matter in the Mediterranean countries where, although the labour market has performed relatively well before the economic crisis, the employment rate is far below the EU2020 employment target of 75% (European Commission, 2010). In 2008, before the onset of the current economic downturn, the female employment rate was about 51% in Italy, 52% in Greece and 58% in Spain. Moreover, the Italian context is characterised by a strong dualism between North and South: in the southern regions employment, in particular among low educated women, is particularly low, to a large degree due to a lack of demand as well as a lack of services. As in the other Mediterranean countries, in Italy the attainment of the EU target requires increasing labour force participation and encouraging a stronger family-work reconciliation rather than simply absorbing unemployment. Nearly 30 percent of the mothers leave their jobs after the birth of their first child, and the probability of leaving the labour market after childbirth is higher for low educated mothers and in areas with limited childcare (Brilli, Del Boca and Pronzato, 2013). In such a context, demand constraints, caring responsibilities and other arrangements within the family should be considered as a priority by the policy makers.

Despite the important policy initiatives aiming at increasing the childcare availability, many Italian households are still confronted with availability and cost constraints. The Barcelona childcare targets of 2002 set by the European Council stated that each country should provide a childcare slot for at least 33% of children under three years of age. Italy clearly missed the target, with a current national average coverage rate of around 15% but highly differentiated across regions ranging from over 25% of children attending public preschool in Emilia Romagna, Toscana and Umbria to less than 5% in some Southern regions (ISTAT, 2011). As a consequence, the demand for public childcare is higher than the supply in all Italian regions. Those who get an available slot in the child care services are still confronted with high costs: in 2009, the average monthly cost of public childcare for a family with one child is € 300. This cost varies across regions: € 221 in the Southern regions and € 364 in the North.

This paper adopts a modelling framework for analysing labour supply developed by Aaberge, Colombino and Strøm (1999). To account for the possible interaction between labour supply and childcare choices, the model treats childcare as an endogenous variable. Kornstad and Thoresen (2007) assume that each household faces a household specific choice set from which they can choose. Hence, labour supply and childcare choices are outcomes of discrete choices from finite sets of jobs and childcare arrangements, where each job is assumed to have fixed working hours, a wage rate and a number of non-pecuniary attributes and each care alternative has fixed opening hours, a specific care price and different quality attributes. Excess demand of childcare is reflected in these opportunity sets where households that face a higher degree of rationing in childcare have fewer childcare options to choose from. The approach presented in this paper is different from Kornstad and Thoresen (2007) and more closely related to Aaberge, Colombino and Strøm (1999), who focus only on the labour supply decisions of couples. In their framework, each spouse faces an individual-specific opportunity set where each market alternative is characterized by a fixed quantity of hours, a wage rate and other non-pecuniary attributes. The amount of opportunites might differ between individuals due to differences in age, education and skills. In our approach; the opportunities refer not only to the labour supply choices but also to the childcare options.

The empirical part of this paper analyses how maternal labour supply and childcare usage can be affected by relaxing the existing constraints in terms of childcare availability and costs. We do consider public, private and informal childcare, with related imputed availability and costs. In order to derive the budget set taking into account the whole tax-benefit system, we use the Italian component of EUROMOD, the multi-country European wide tax-benefit model. Considering the gross hourly wage of the woman and any other source of income of the family and its characteristics, EUROMOD derives the net disposable income of the family corresponding to each possible labour market alternative the woman can opt for, taking into account the whole tax-benefit system. In the first scenario, the coverage rate is increased in steps of 5% in each region up to 30%. In the second scenario, the childcare costs are decreased in steps of 5% in each region and the results in terms of labour supply and potential disposable income are compared considering the same total net cost for the government budget.

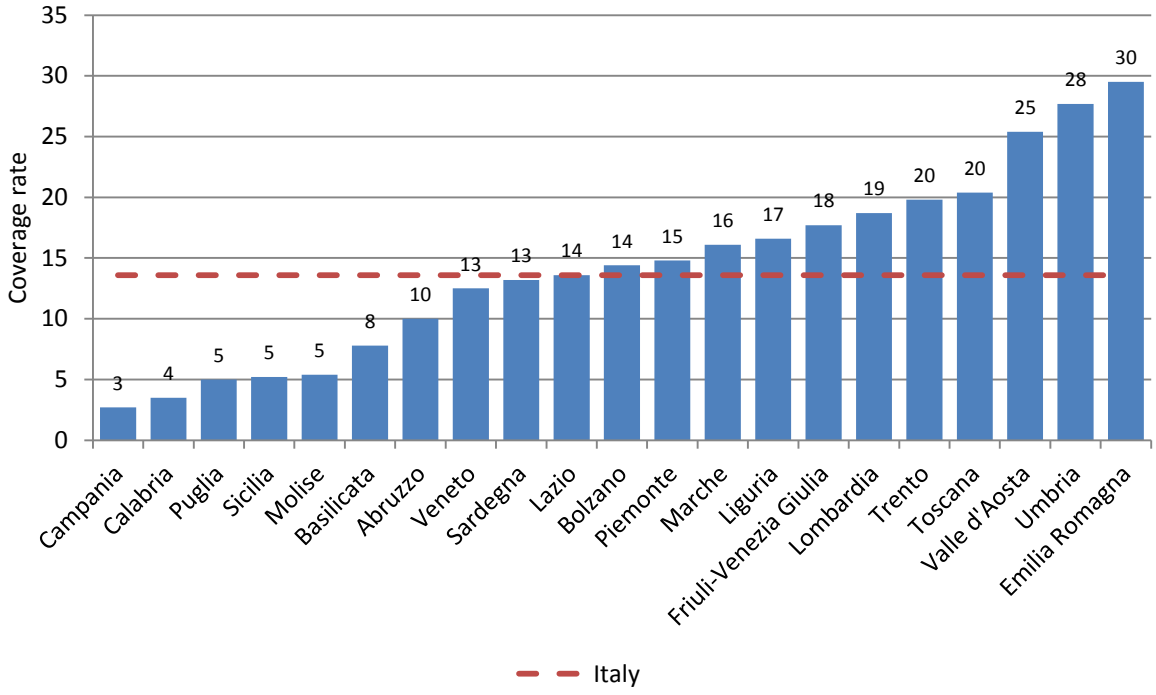
Due to the regional differences, costs and effects are highly differentiated among different areas of the country. The estimation and simulation results suggest that Italian households alter their childcare and labour supply decision when the coverage rate of formal childcare increases, in particular if the increase would correspond to the increase needed to reach the European target in the Southern regions. Positive labour supply effects at the intensive and extensive margin of the labour market are observed. Many households that used to be rationed in their childcare choice have now the opportunity to start working. Overall, increasing child care coverage is more effective in enhancing labour incentives than decreasing existing child care costs, at the same budgetary cost. However, the potential effects on the disposable income are larger in the second policy scenario because decreasing the childcare costs is beneficial also for women who do not change their labour supply behaviour.

2. Institutional framework

Compared to other countries, the Italian case is characterized by a low availability of public child care slots and relatively high fees to be paid by the families, with a potential direct impact on mothers

labour market participation given that childcare costs increase her reservation wage. Despite the important policy initiatives implemented since the end of the 1990s aiming at increasing the childcare availability, many Italian households are still confronted with availability and cost constraints. The 2002 European target of a childcare slot for at least 33% of the children under three years of age has been clearly missed, although the share of children who attend childcare is highly differentiated across regions. According to the administrative data provided by ISTAT (2011), the national coverage rate in 2009 was about 13.4%, ranging from more than 25% of children aged 0-2 attending public preschool in Emilia Romagna, Umbria and Valle d'Aosta to less than 5% in some Southern regions such as Calabria and Campania (Figure 1).

Figure 1. Coverage rate of public childcare services for children aged 0-2, by regions, in 2009



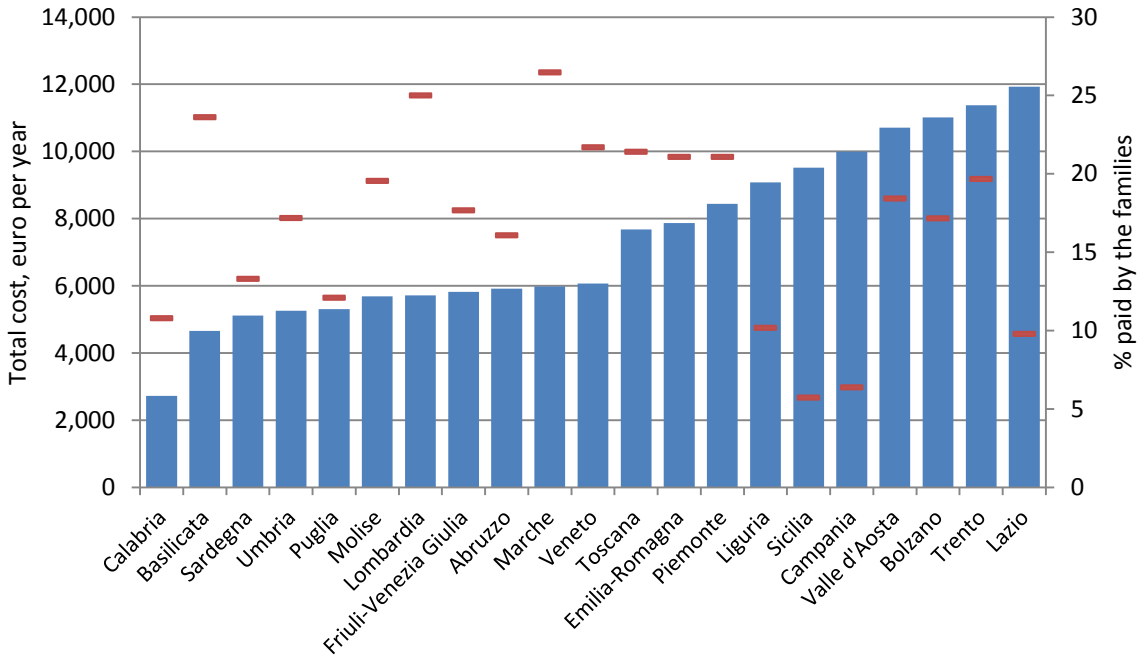
Source: ISTAT (2011)

Such a coverage rate considers childcare slots in both public centers and private centers subsidized by the public (i.e. childcare services run by private institutions but receiving substantial subsidies form the public and, above all, required to respect regulations set by the public in terms of opening hours, service quality and educational standards), while non-subsidized private centers are not considered even if they contribute to reach the European target. Survey data (ISTAT (2011) based on Multiscopo 2010) report that overall 16.3% of the children aged 0-2 attend childcare so it is possible to derive that, on average, private childcare covers around 3% of the children. Such an estimate is confirmed by administrative data (Istituto degli Innocenti, 2011). However, the private provision does not help in compensating the variations across regions because it tends to be larger where there is already higher public provision (Brilli, Del Boca, and Pronzato, 2013). In order to meet the European target one has to consider also that almost 5% of the children already attend primary school by the end of the year when they are two years old. Overall, it is reasonable to assume that around 21% of the children aged 0-2 attended a childcare service in 2009.

As a consequence of the low coverage rate, the demand for public childcare is higher than the supply in all Italian regions, as shown by the waiting lists that report shares of children who made the application but were not given a slot ranging from than 12% in Lombardia to more than 40% in Sicilia (Cittadinanza Attiva, 2011). The probability of being rationed is determined by the different criteria applied at municipal level. The importance given to the socio-demographic characteristics of children (e.g. disability) and their families (e.g. presence of siblings, living with a lone parent) and the employment status of the parents differs greatly among municipalities. Del Boca, Pronzato and Sorrenti (2015) show the extent to which the different selection criteria have an impact either on mothers work and children outcomes, supporting the view of child care as a way to support either early education and social exclusion of children or family and work reconciliation.

In 2009 the average cost for each child enrolled in public child care was about 7500 euro per year, with huge disparities across regions showing costs ranging from less than 3000 euro per year in Calabria to more than 11000 euro per year in Lazio and Trentino. On average 18% of the overall cost has been covered by the families but again with differences across regions, reflecting the different selection and financial criteria (Figure 2).

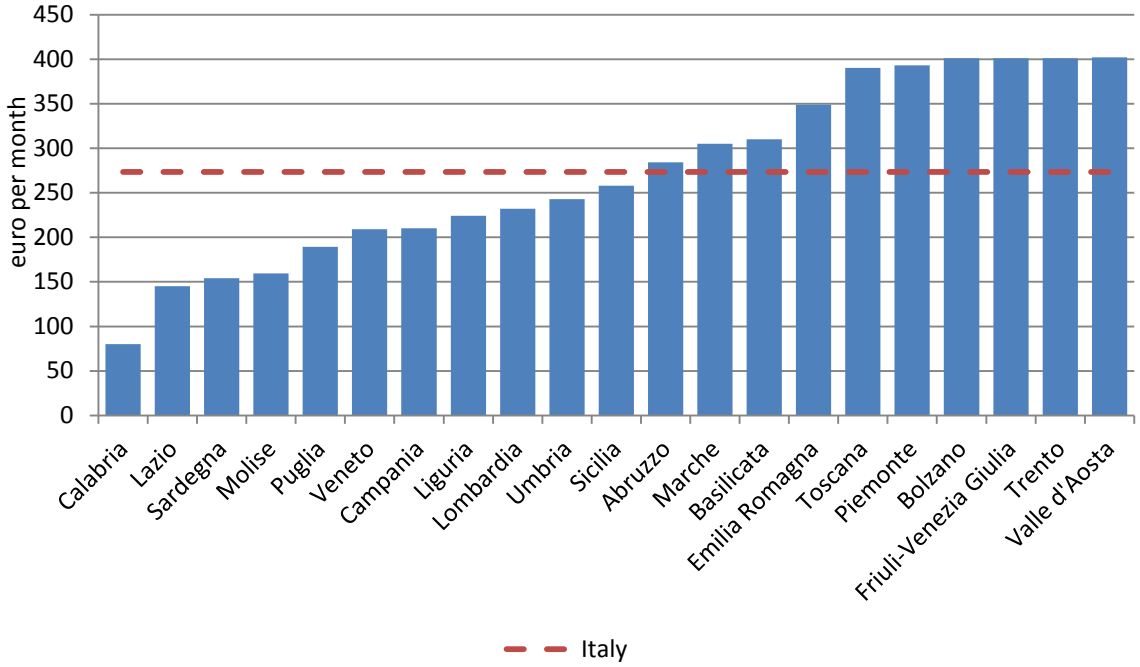
Figure 2. Cost of public childcare services and % covered by families for children aged 0-2, by regions, in 2009



Source: ISTAT (2011)

Those who get a slot in the public child care contribute to the costs according to their family situation measured by the equivalent financial situation index (ISEE) which takes into account income, wealth and family composition and the rules determined by each municipality (Cittadinanza Attiva, 2011). The average out-of-pocket monthly fee, for a family with an ISEE of around 20.000 euro per year, in 2009 was 270€ (Figure 3), with huge differences across regions determined by fees ranging from 80€ in Calabria to around 400€ in most of the Northern regions (Toscana, Piemonte, Bolzano, Friuli, Trento and Valle d'Aosta).

Figure 3. Monthly fee for a public child care slot by regions, 2009.



Notes: Authors' calculations based on the rules in place in the main city of each region for a hypothetical family with an equivalent financial situation index (ISEE) of 20.000 euro per year.

The latest years witnessed an increasing coverage rate of childcare services (estimated to be around 24.4% in 2012) although the European target is still far from being reached. At the same time an increase in the fees sustained by the Italian families in particular in the north of the country.

In a country like Italy informal childcare is of great importance and the low coverage of public childcare is somehow compensated by the caring help provided by the grandparents. They offer a support usually more flexible in duration and schedule than the one provided by formal childcare services, and this is facilitated by a greater geographical proximity between grandparents and grandchildren than in other countries (Aasve, Meroni and Pronzato, 2012).

3. Empirical methodology

In order to simulate the behavioural responses of women to the changes in the childcare constraints they face in terms of costs and availability, we follow the growing literature of static structural discrete choice models of labour supply initiated by Aaberge et al. (1995) and Van Soest (1995).[1] The models are *structural* because they provide direct estimations of preferences over income and hours of work, through the specification of the functional form of the utility function and the individuals face a limited – and *discrete* – set of possible alternatives. Discrete choice models belong to the family of random utility maximisation models (McFadden, 1974), which allow the utility function to be random. A convenient specification of the random component (usually the extreme value distribution) is used to determine the optimal alternative in terms of utility level associated to each choice.

[1] See Creedy and Kalb (2005) for an extensive review of discrete choice modelling in the analysis of labour supply.

The assumption behind the discrete choice models is that utility-maximising individuals and couples choose from a relatively small number of working hours. Indeed the choice of working hours is also restricted in practice due to demand side constraints, labour market institutions and limited flexibility, in particular in Italy. The discrete choice models work with the nonlinear and nonconvex budget sets determined by complex tax-benefit system rules, which are simulated by means of a fiscal microsimulation model.

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3.1 Structural labour supply and child care model

We assume that mothers make simultaneously a choice regarding the hours of work and the type of child care that maximizes the utility of her household.[2] They choose a job *j* from a finite set of feasible jobs *B* and a child care arrangement *s* from a finite set of feasible child care arrangement *S*. Under a given choice from the job opportunities set and child care arrangement set, the household maximizes the utility function subject to budget constraint as follows:

$$\underset{(w,h,k,s)\in BxS}{U}(C,h,k,s)$$

$$s.t. \qquad C = f(wh, I)$$

where

h = hours of work
w = hourly wage
C = consumption or disposable income
k = job characteristics[3]
s = child care arrangement
f(.) = tax-benefit rule that transforms pre-tax (wh,I) income into disposable income C

[2] For sake of simplicity, we only model the labour supply and child care decisions of mothers living with a partner working full-time and being the main earner of the couple.
[3] As such these characteristics are not observed by the researcher.

I = Non-labour income
B = the set of labour supply alternatives (i.e. "Labour supply set")
S = the set of child care arrangements (i.e. "Child care set")

Labour supply set B is made of 4 choices: j=1 if not working, j=2 if working short part-time, j=3 if working long part-time, j=4 if working full-time. The child care set S is made of 3 choices: s=1 if choosing no child care, s=2 if choosing formal child care, s=3 if choosing informal child care.

We further assume that the utility function can be expressed as:

$$U(f(wh,I),h,k,s) = v(f(wh,I),h,k,s)\varepsilon(j)$$

where v(.) is the systematic part of the utility function and $\varepsilon(j)$ is the stochastic component of the utility function assumed to be independently and identically distributed across alternatives and households according to the Extreme Value distribution.

The probability distribution function is the following

$$Pr(\varepsilon<x)=exp(-1/x) \qquad \text{for any number x>0.}$$

and with the assumed distribution for the random term, the probability that a mother chooses a job *j* and a childcare arrangement *s* with observed characteristics (h,k,s) can be written as:

$$\varphi(h,w,k,s) \equiv \Pr(U((f(wh,I),h,k,s) = \max(U(f(xy,I),y,z) = \frac{v(w,h,s)\,p(w,h,s)}{\iiint_{BxS} v(w,h,s)\,p(w,h,s)dxdydz} \qquad 1)$$

where $p(w,h,s)$ denotes the density function (or the proportion) of opportunities with wage *w*, working hours *h* and child care *s* in the choice set *B*x*S*.

In this way, the probability of a given choice can be expressed as the preference for this choice weighted by its availability in the choice set. We specify the density of opportunities of choosing job *j* with wage *w*, working hours *h* and child care *s* as:

$$p(h,w,s) = \begin{cases} p_{1s}g_{1s}(h)g_2(s) & \text{if h > 0} \\ p_{0s}g_2(s) & \text{if h = 0 \& formal/informal child care} \\ p_0 & \text{if h = 0 and no care} \end{cases}$$

where

p_0 is the proportion of non-market opportunities without child care option in the opportunity set

p_{1s} is the proportion of market opportunities with child care type *s*

p_{0s} is the proportion of non-market opportunities with child care type *s*

$g_{1s}(h)$ is the density of hours for child care type *s*

$g_2(s)$ is the density of child care opportunities

For estimation purposes, we divide both the nominator and the denominator of the choice probability function (eq. 1) by p_0 and rewrite the choice density specific to each choice as:

$$\varphi(0,0,1) = \frac{v(0,0,1)\frac{p_0}{p_0}}{D_1} = \frac{v(0,0,1)}{D_1} \qquad 2)$$

for the non-market alternative without child care,

$$\varphi(0,0,\ j) = \frac{v(0,0,s)\,p(0,0,s)}{D_1} = \frac{v(0,0,s)\frac{p_{0s}}{p_0}}{D_1} \qquad 3)$$

for the non-market alternatives with child care s,

$$\varphi(h,w,s) = \frac{v(h,w,s)\frac{p_{1s}}{p_0}g_{1s}(h)g_2(s)}{D_1} \qquad 4)$$

for the market alternatives with child care s, where

$$D_1 = v(0,0,1) + \sum_{s=2}^{3} v(0,0,s)\frac{p_{0s}}{p_0} + \sum_{s=2}^{3}\iint v(h,w,s)\frac{p_{1s}}{p_0}g_{1s}(h)g_2(s)dxdy$$

3.2 Preferences specification

The equations 2, 3, and 4 are jointly estimated through a Maximum Likelihood procedure. The systematic part of the utility function is specified as a generalized Box-Cox functional form that allows for a particular interaction term in order to accommodate non-separability features.[4] The main arguments of the utility function are household disposable income, individual leisure of the mother and their interaction:

$$\log v(C,h,s) = \alpha\frac{C^{\lambda}-1}{\lambda} + \beta\frac{L^{\delta}-1}{\delta} + \rho\frac{(C^{\lambda}-1)(L^{\delta}-1)}{\lambda\delta}$$

where

$$\alpha = \alpha_0 + \alpha_1 Age + \alpha_2 Children + \alpha_3 Formal\_Care$$
$$\beta = \beta_0 + \beta_1 Age + \beta_2 Children + \beta_3 Formal\_Care$$

[4] See Dagsvik and Strøm (2006) and Dagsvik and Røine Hoff (2011) and Dagsvik and Jia (2012) for details.

and:

- *C* is the household disposable income net of the expected child care costs faced in each alternative as described below.
- *L* is the mothers leisure time defined as the difference between 60 hours per week[5] and the working hours *h* associated to each alternative.
- *Age* is the logarithmic transformation of age of woman divided by 10.
- *Children* refers the total number of children of each woman.
- *Formal_Care* refers to the formal care simulated choice.

The systematic part of the utility function is quasi concave if the exponential coefficients γ and δ are less than 1. It is linear in C and L if γ and δ are equal to 1, and log-linear if they are 0.

The distribution of working hours is assumed to be uniformly distributed except for the possible peaks capturing part time and full time jobs.

$$g_1(h) = \begin{cases} \gamma & \text{if} \quad h < 20 \\ \gamma \exp(\pi_1) & \text{if} \quad \text{part time} \\ \gamma \exp(\pi_2) & \text{if} \quad \text{full time} \\ \gamma & \text{if} \quad h > 34 \end{cases}$$

For the purpose of empirical specification of equations 2, 3, and 4, we introduce the following transformations of the proportion of market opportunities in the choice set:

$$\theta_s = \log\left(\frac{p_{0s}}{p_0}\right)$$

and

$$\mu_s = \log\left(\frac{p_{1s}}{p_0}\right)$$

and specify the density of child care opportunities as:

$$g_2(s) = \log(\mu_{js}\Theta_j(s))$$

where

$\Theta_j(s)$ denotes the characteristics of child care type *s*

On the one hand, variables capturing the preference for formal child care are the regional coverage rate of formal child care, a dummy if a parent is foreign born, and the existence of more than one child per mother. On the other hand, variables capturing the preference for informal child care are a

[5] Maximum observed in our data.

dummy if living in the Southern part of the country, the proximity of grandparents, and a dummy if the mother is foreign born.

4 Microsimulation model and data description

In order to derive the budget constraint faced by the woman (and her family) at each alternative of the choice set, we use the Italian component of EUROMOD, the multi-country European wide tax-benefit model. Using the information available in the underlying datasets, EUROMOD simulates cash benefit entitlements, direct tax, social insurance contribution on the basis of the tax-benefit rules in place. Non simulated benefits (mainly contributory pensions, due to data constraints), as well as market incomes, are taken directly from the input datasets. For further information on EUROMOD, see Sutherland and Figari (2013).

One of the main features of a static microsimulation model is that it can compute the disposable income of individuals and their families under different scenarios, taking into account the tax-benefit policies and the way they depend on the level of individual market income and personal/household characteristics (Figari, Paulus and Sutherland, 2015). Considering the gross hourly wage of the woman and any other source of income of the family and its characteristics, EUROMOD derives the net disposable income of the family corresponding to each possible labour market and child care alternative the woman can opt for, taking into account the whole tax-benefit system. See the EUROMOD Country Report for details (Ceriani et al. 2013).

The tax systems simulated in this paper refer to 2009, the same reference period as monetary variables included in the underlying data which comes from the Italian SILC 2010. The survey is representative for the national population at regional level and is the national component of the European Union Statistics on Income and Living Conditions carried out yearly to collect comparable information on income, poverty, social exclusion and living conditions across European countries.

The EUROMOD input dataset for Italy contains information on 19.147 households and 47.420 individuals. We start selecting 1278 children aged from 3 to 36 months at September 1st, 2009 by assuming that children are born at the beginning of the semester on which we have information on. Second, we retrieve only children belonging to mothers living with a partner working full-time and being the main earner of the couple, in order to model only female labour decision which is the most flexible in couples with pre-school children. Moreover, couples where one of the partners receive a self-employment income, pension or disability benefits are excluded. This is a common restriction in the literature on behavioural evaluation of tax reforms and is motivated by the aim to exclude individuals whose labour choices are affected by factors such as disability status, educational choices, early retirement, self-employment and professional activities that are not or cannot be controlled for in the labour supply model. In addition, the very few cases where child mindering is used have been dropped. After these restrictions, we have 827 children belonging to 774 mothers. Whenever a mother has more than one child aged 3-36 months, only the child care characteristics of the youngest child are considered. Therefore, the final sample used for estimation and simulation purposes is composed of 774 observations.

In the discrete choice setting, outlined in the previous section, each woman faces a discrete number of alternative options characterized by different working hours which form the personal choice set. At each choice, the total amount of gross earnings is given by the number of working hours multiplied by the gross hourly wage. Considering the gross earnings of the woman and any other

source of income of the family and its characteristics, EUROMOD derives the budget set of each family computing the net disposable income at each alternative of the choice set.

The choice of alternatives to be included in the choice set and their availability to individuals are two important issues in the discrete choice setting. Aaberge et al. (2009) show that choosing the alternatives sampled from the observed distribution, rather than imposed by the researcher, reduces the prediction errors. It is a way to account for different opportunities and constraints a woman might face when deciding her working choices. We group the possible working hours for women into four intervals (0, 1–20, 21–34, 35+) and the labour choice set of each woman is made up of four alternatives: the actual choice (i.e. observed number of worked hours) plus other three potential alternatives.

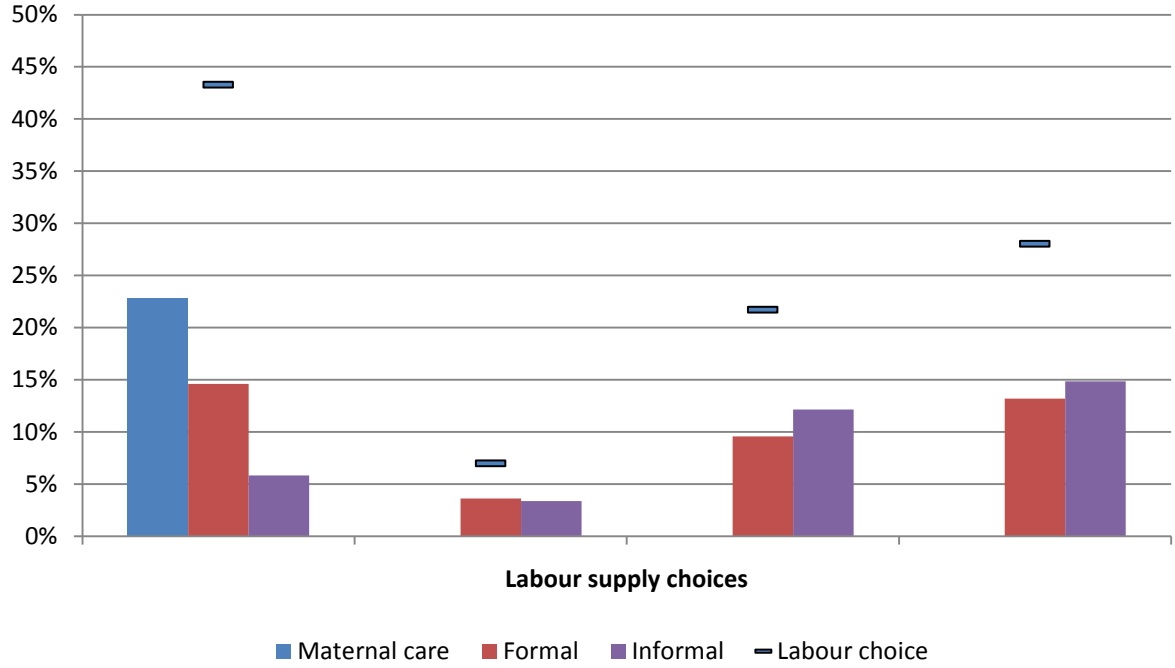
Within each interval, the potential alternative is sampled from the empirical density function of the observed hours of work. The distribution of the potential alternatives respects the proportion of women observed to work a specific number of hours within each interval.

In order to construct the child care choice set we exploit information on the number of hours spent at formal (i.e. centre-based services or day-care centre) or informal childcare (child minders, grand-parents, others household members, friends, etc…) during an usual week. Over the three child care alternatives (i.e. maternal care, formal and informal care), priority is given to the formal child care whenever the hours are equal across child care types. The child care choice set of each woman is made of three alternatives: the actual choice (i.e. observed child care arrangement) plus the other two potential alternatives.

The construction of the whole choice set is given by the combination of four labour supply choices and three child care choices, resulting in twelve choices. Moreover, we assume a «fixed link» between labour supply and child care (Ilmakunnas, 1997) in the sense that a mother needs child caring whenever she works, excluding in this way three labour supply-child care choices from the choice set (short part-time job/maternal care, long part-time job/ maternal care and full-time job/ maternal care) and classifying such observations from no care to informal care. We don't make any distinction between part-time or full time child care. As such mothers working full time but using part-time care are simply classified by the type of child care. Figure 4 illustrates for the children and their mothers included in our sample the relative frequency of the final nine child care and labour supply choices.

Women who are not working represent 43% of the sample and most of them do not require a child care service: however, 34% of them make use of formal childcare and the remaining 13% receive caring help form grandparents or relatives. The high use of child care among those not working can be the outcome of a deliberate educational choice or the consequence of the rationing rules that determine easier access conditions to public child care when at least one parent is not working. Among women working, the majority of them makes use of informal childcare that overall results to be more widespread than formal care, confirming that in countries characterized by traditional values informal care is still preferred (El-Attar, 2013).

Figure 4 Mother labour supply and childcare arrangements



Notes: authors' calculation on IT-SILC 2010 data

In order to assign to each woman, despite her observed working status, a gross hourly wage we estimate a Heckman selection model on all women in the survey (i.e. 11.235) aged 18-59 years old but excluding those in education, receiving self-employment or pension incomes. The dependent variable is the logarithm of the gross hourly wage. In the outcome equation we include two dummies for education (higher secondary and tertiary), age and its square, and the regional unemployment rate for women. In the selection equation the identification comes through additional characteristics, namely whether a woman is in a couple, the number of children she has (grouped into two age categories), and household non labour income. See Table 1 for the estimates which are in line with the expectations. The likelihood ratio test of independent equations (i.e. rho = 0) indicates that the selection bias is statistically significant, justifying the Heckman procedure.

Table 1. Wage equation - Heckman selection model

	Coef.		Std. Err.
Hourly wage (ln)			
Age	-0.058	***	0.009
Age square	-0.000	***	0.000
Higher Secondary education	0.068	**	0.027
Tertiary education and more	0.291	***	0.035
Female regional unemployment rate	-4.420	***	0.846
Constant	3.882	***	0.248
Selection equation			
Age	0.278	***	0.009
Age square	-0.003	***	0.000
Higher Secondary education	0.516	***	0.029
Tertiary education and more	0.667	***	0.409
Female regional unemployment rate	16.704	***	0.968
Couple	-0.325	***	0.033
Number of children < 3 years	-0.237	***	0.037
Number of children >= 3	-0.073	***	0.026
Household non labour income	-0.000	***	0.000
Constant	-6.740	***	0.181
Number of observations	11,235		
Censored observations	5,855		
Uncensored observations	5,380		
Log likelihood			
Wald chi2(5)	390.64		
Prob > chi2	0.000		
rho	-0.961		
LR test of indep. Eqns (rho = 0): chi2(1)			
Prob > chi2	0.000		

Notes: * p<0.10, ** p<0.05, *** p<0.01. Estimates are based on all women aged between 18 and 59 years, excluding those in education, receiving self-employment or pension incomes. Excluded category is up to lower secondary education. "Household non labour income" are monthly amounts equivalised using the modified OECD equivalence scale. Source: authors' analysis based on EUROMOD.

In the four alternatives where a mother can choose the formal childcare arrangement, we have to impute the child care fees paid by the family without knowing whether the mother opts for a slot in the public or private childcare services. We need to consider that such a choice can be restricted by the public child care rationing due to the limited coverage in each region. First, we estimate the fee to be paid to get access to a full-time public slot according to the rules in place in the main city of each region and the relevant family characteristics, summarized by the equivalent financial situation index (ISEE) that takes into account labour and non-labour income, assets and the composition of the

family. Second, we estimate the fees to be paid for a full-time slot in the private sector using the available information at macro regional level, showing that the private childcare costs are around 10% higher than the maximum public fee in the North, 35% higher in the Center and 21% higher in the South (Cittadinanza Attiva, 2011).

Finally, following Haan and Wrohlich (2011), we compute the expected child care cost that takes into account the rationing in the public sector:

$$E(xcc) = C_{public} \times P_{public} / \text{Formal rate} + C_{private} \times (1 - P_{public} / \text{Formal rate})$$

and is given by the fee to be paid in the public child care sector according to the family circumstances (i.e. C_{public}) weighted by the probability that the family gets a slot in public child care plus the fee to be paid in private child care (i.e. $C_{private}$) weighted by the probability not to get access to the public child care sector. The probability of getting a slot in public childcare is assumed to be equal to the public child care coverage rate over the attendance rate in formal childcare in each region. In such a way the expected child care cost reflects the constraints faced by each mother due to limited availability of a slot in the public sector and the fee to be paid accordingly.

The expected child care fee is taken into account in the simulation of the tax-benefit system in order to allow a family to receive the tax credit (i.e. 19% of the childcare costs up to 632€ per year) granted to parents with children attending a formal childcare service.

As mentioned above, grandparents play a key role in providing informal childcare. However, the data used in this analysis do not contain information on grandparents' availability and willingness in providing caring help. To overcome this limitation, grandparents' availability is proxied by grandparents proximity, defined as having at least one grandmother in good health living within (Del Boca, Locatelli and Vuri, 2005), as predicted from the Multiscopo Survey.

5 Estimation results

5.1 Utility parameters estimates

The estimates of the utility function are presented in Table 2. The exponent associated with disposable income is significantly different from zero but not lower than 1, which indicates that the systematic part of the utility function is only increasing but not concave in income. In contrast, the exponent associated with leisure is significantly different from zero and lower than 1, which implies that marginal utility is increasing and concave in leisure. Additionally, age is negatively associated with womens' preference for income and leisure; nevertheless only the former has a significant coefficient. In contrast, the number of children has a significant and positive effect on the marginal utility of leisure, indicating that leisure time is proportionally conditioned by the number of children, a finding well-proven in the pertinent literature of female labour supply.

When it comes to the parameters of job and child care opportunities, Table 2 shows that full-time and part-time peaks in the opportunity density of hours are associated with negative signs. This suggests that mother have less preferences for full-time and part-time jobs than for non-employment. Additionally, the ratio of non-market opportunities with either formal or informal child care to the amount of non-market opportunities with maternal child care is negative but significant

only in the case of informal child care. In effect, the statistical significance and sign of these estimates reflect the distribution of child care alternatives in the non-market opportunities set: there are significantly more non-market opportunities with maternal child care than informal child care (23% versus 6%), while the difference is relatively small when compared to formal care (23% versus 16%). Furthermore, the estimates show that foreign women use less child care services when compared to natives. The presence of another child makes it easier to access formal child care services. This is not surprising as it composes one the main access criteria applied in many Italian municipalities. Women who live in regions with a higher coverage rate of formal childcare are more likely to use formal child care services.

Grandparental proximity has a positive sign and a strong statistical significance, showing that having grandparents in good health relatively close to the children increases the probability of making use of informal childcare. Finally living in the southern part of the country is significantly and negatively associated with informal child care opportunities reflecting the lower labour market participation and hence lower request for child care services in this area.

Table 2: Estimates of the parameters of the utility function

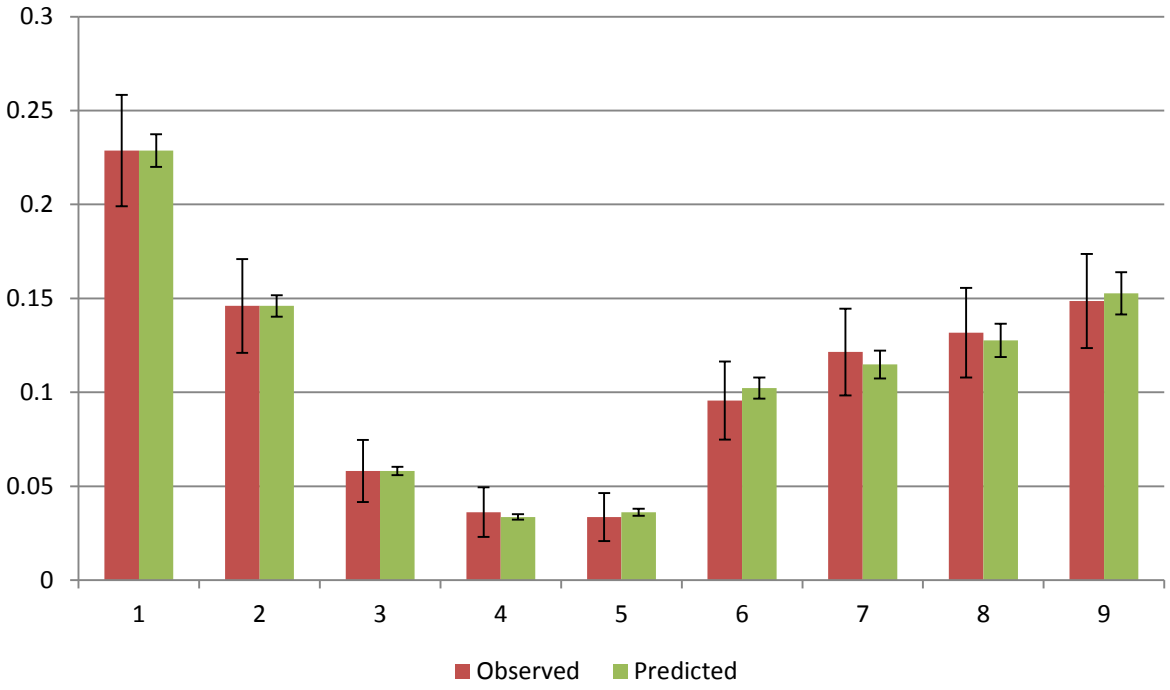
		Estimate	Standard error	
Preferences				
Income				
Constant	α_0	2.733	1.132	***
log(age/10)	α_1	-2.085	0.895	***
Children	α_2	0.475	0.217	***
Formal Care	α_3	0.085	0.052	
Exponent	λ	1.466	0.180	***
Leisure				
Constant	β_0	4.202	0.86	***
log(age/10)	β_1	-1.077	0.674	*
Children	β_2	0.626	0.183	***
Formal Care	β_3	0.077	0.197	
Exponent	δ	0.408	0.072	***
Leisure*Income	ρ	0.049	0.048	
Density of offered hours				
Part Time	π_1	-5.922	0.406	***
Full Time	π_2	-3.17	0.256	***
Density of Formal Child Care				
θ_2	θ_2	-0.335	0.546	
Foreign	μ_{12}	-0.851	0.289	***
Coverage	μ_{22}	4.352	1.234	***
Having siblings	μ_{32}	0.481	0.209	***
μ_2	μ_2	5.611	0.77	***
Density of Informal Child Care				
θ_3	θ_3	-1.369	0.167	***
South	μ_{13}	-1.291	0.235	***
Grandparents proximity	μ_{23}	4.361	0.509	***
μ_3	μ_3	3.636	0.749	***
Log-likelihood			-1368.83	
Number of observations			774	
Wald chi2			9.64	
Prob>chi2			0.022	

Source: authors' analysis based on EUROMOD.

Figure 5 shows the observed and predicted values of simultaneous labour supply and child care choices made by women based on the estimated parameters of the model. While, by construction, the model predicts perfectly labour supply choices and child care choices when they are separately

considered, it also performs well in predicting their combinations (see Dagsvik and Strøm (2006), Dagsvik and Roine Hoff (2011), and Mastrogiacomo et al. (2011) for similar patterns).

Figure 5: Predicted and observed distribution of choices



Source: 95% confidence interval shown. Authors' analysis based on EUROMOD.

5.2 Labour supply elasticities

One of the advantages of the estimated labour supply model is that it allows one to numerically compute elasticities. In particular, direct wage elasticities are calculated as follows: for each woman the hourly wage is increased by 10% and then, keeping the labour supply estimates constant, changes in the choice probability and the expected working hours are predicted, on the basis of the disposable income recomputed at each choice. Indirect elasticities are calculated as a consequence of a 10% increase in the gross wage of the male partner. Elasticities are then expressed as a percentage variation with respect to the baseline.

The estimates reported in Table 3 show an average direct elasticity at around 0.6 for the overall sample of women, with larger elasticities at the bottom of the income distribution. As expected indirect elasticities are really small and close to zero.

Table 3. Estimated average wage elasticities

	Direct elasticities		Indirect elasticities	
Decile groups	Total hours	Participation	Total hours	Participation
1	0.68 (0.02)	0.60 (0.01)	0.03 (0.00)	0.03 (0.00)
2	0.64 (0.01)	0.58 (0.01)	0.02 (0.01)	0.01 (0.01)
3	0.72 (0.02)	0.66 (0.02)	0.04 (0.01)	0.03 (0.01)
4	0.68 (0.01)	0.61 (0.01)	0.12 (0.01)	0.11 (0.01)
5	0.61 (0.01)	0.55 (0.01)	0.15 (0.01)	0.14 (0.01)
6	0.52 (0.01)	0.46 (0.01)	0.11 (0.00)	0.11 (0.00)
7	0.56 (0.01)	0.49 (0.01)	0.09 (0.00)	0.09 (0.00)
8	0.44 (0.01)	0.37 (0.01)	0.07 (0.00)	0.07 (0.00)
9	0.42 (0.01)	0.35 (0.01)	0.05 (0.00)	0.05 (0.00)
10	0.42 (0.01)	0.35 (0.01)	0.06 (0.00)	0.07 (0.00)
Total	0.57 (0.01)	0.51 (0.00)	0.07 (0.00)	0.07 (0.00)

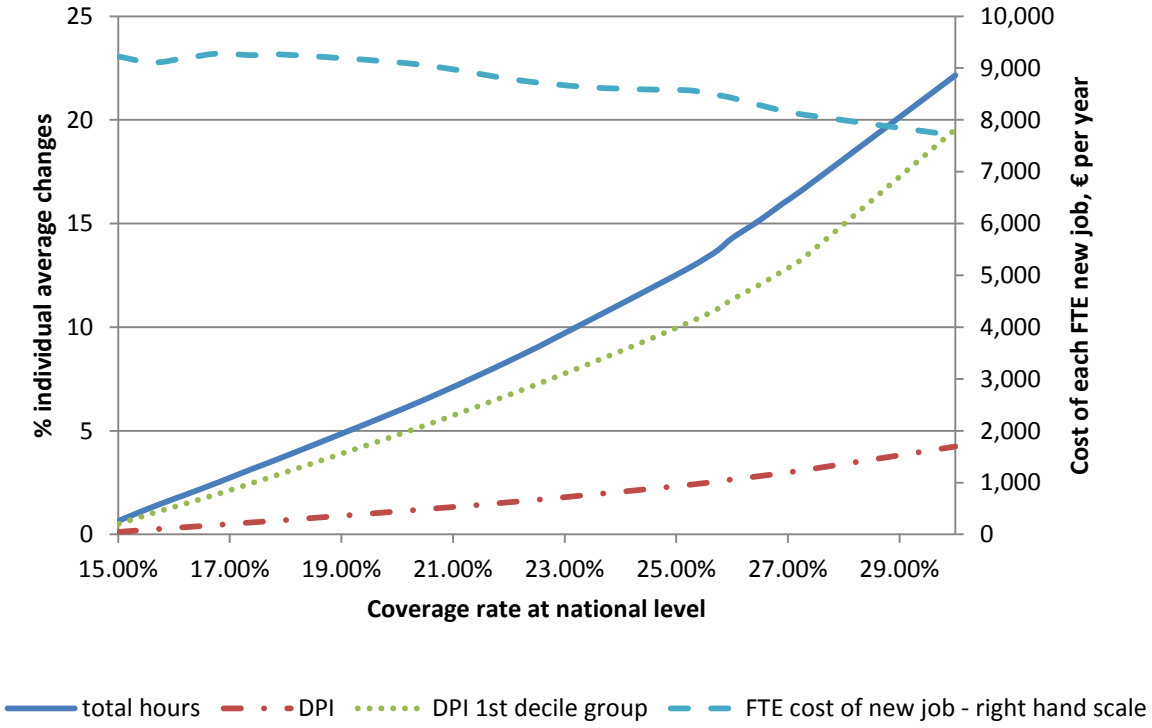
Source: Standard errors in parenthesis. Authors' analysis based on EUROMOD.

6 Policy simulations

The estimated parameters of the labour supply model can be used to calculate the effects of various policy scenarios characterized by different coverage rates or child care fees. Rather than focusing on a hypothetic reform, we do present the results of a continuum set of policy changes which is far more informative of the potential effects of policy reforms in this area.

As such, Figure 6 reports the main results of increasing the coverage rate by 5% in each region up to the point in which the coverage rate is at 30%. In the horizontal axis the figure reports the average coverage rate obtained at national level at each increase of the regional coverage rate. The blue line shows the individual average change in total hours worked, showing an almost linear positive association with increase in childcare coverage rate. The red dashed line shows the percentage variation in disposable income for the overall sample which follows an increasing trend, but always much lower than the percentage variation in disposable income for women in the first decile group (green dotted line), confirming the important potential effect of childcare availability in particular for the poorest ones. The blue dashed line represents the cost of each new full time equivalent job which is around 8.000€ and 9.000€, slightly more than the cost of a single slot in the public childcare sector.

Figure 6: Labour supply, redistributive and cost effects of increasing childcare availability of 5% in each region up to 30% at regional level



Source: authors' analysis based on EUROMOD.

Most of the effects, both in terms of labour supply reactions and disposable income, are observed in the Southern Regions and in the Islands. As a consequence of the limited existing coverage rates in these areas of the country, we observe that reaching a coverage rate of 30% would increase labour supply by 47% in the South and 35% in the Islands against a national average of 22% (Table 4).

Table 4. Estimated percentage changes in labour supply and disposable income with public coverage rate increased up to 30% in each region – by macro area

	% change in labour supply		% change in
Area	Intensive margin	Extensive margin	Disposable income
North West	11.43 (0.28)	11.56 (0.28)	2.49 (0.13)
North East	13.90 (0.35)	14.02 (0.36)	2.32 (0.09)
Centre	13.80 (0.40)	13.90 (0.40)	2.09 (0.07)
South	46.62 (0.83)	46.91 (0.83)	8.70 (0.39)
Islands	34.32 (0.67)	34.54 (0.68)	8.98 (0.38)
Italy	22.14 (0.29)	22.31 (0.29)	4.24 (0.11)

Source: Standard errors in parenthesis. Authors' analysis based on EUROMOD.

As expected most of the changes in labour supply and, potentially, disposable income (assuming that the labour supply effect corresponds to an employment effect of the same size) happen at the bottom of the income distribution. Reaching a coverage rate of 30% would increase labour supply of around 38% both at the intensive and extensive margin, with a corresponding variation of disposable

income close to 20 against an overall change in labour supply at around 22% and an overall change in disposable income at around 4% (Table 5).

Table 5. Estimated percentage changes in labour supply and disposable income with public coverage rate increased up to 30%, by income groups

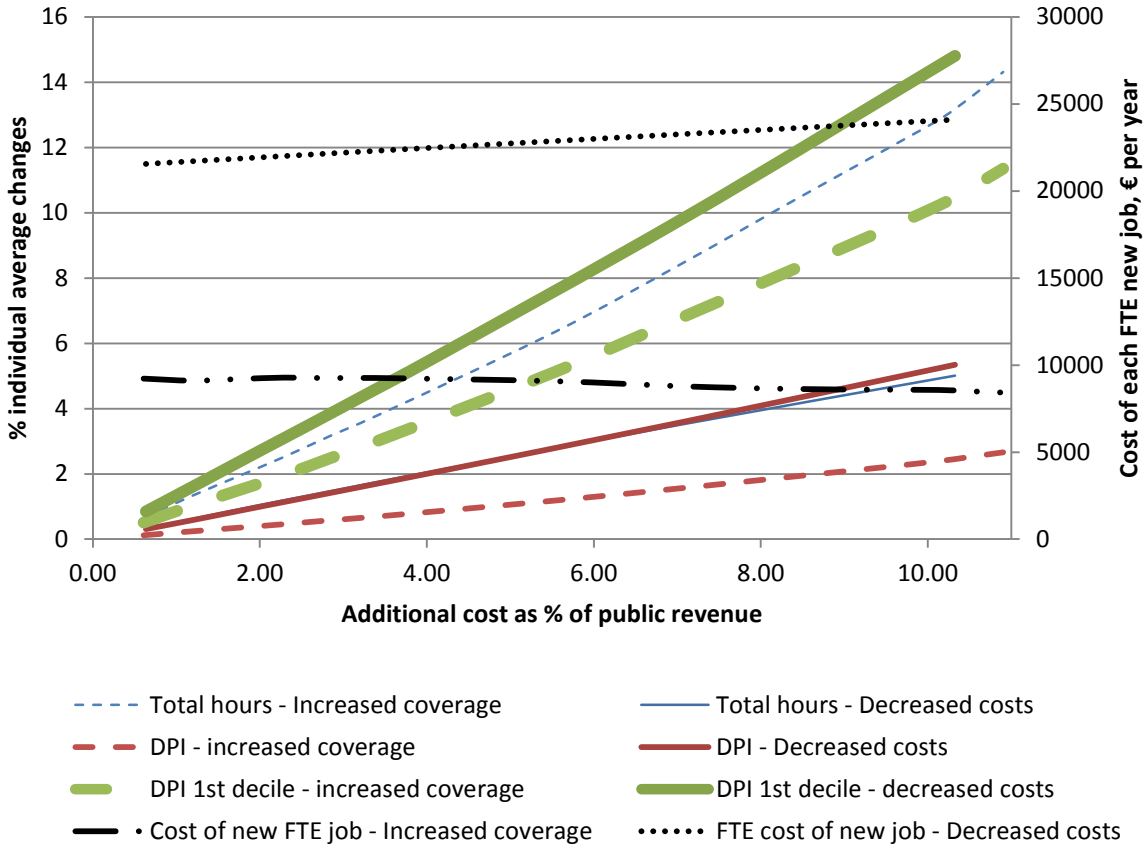
Decile groups	Intensive margin	Extensive margin	Disposable income
1	37.62 (1.12)	37.88 (1.13)	19.54 (0.82)
2	34.05 (1.17)	34.31 (1.17)	5.96 (0.17)
3	36.71 (1.11)	36.97 (1.11)	3.97 (0.11)
4	28.05 (0.84)	28.3 (0.85)	3.17 (0.09)
5	23.15 (0.93)	23.33 (0.93)	2.62 (0.09)
6	16.49 (0.63)	16.63 (0.63)	2.11 (0.06)
7	14.19 (0.56)	14.32 (0.56)	1.85 (0.08)
8	11.77 (0.55)	11.85 (0.56)	1.17 (0.06)
9	10.11 (0.51)	10.17 (0.51)	1.2 (0.08)
10	9.16 (0.48)	9.17 (0.48)	0.68 (0.06)
Total	22.15 (0.29)	22.31 (0.29)	4.24 (0.11)

Source: Standard errors in parenthesis. Authors' analysis based on EUROMOD.

Further results, presented in Figure 7, confirm the presence of an efficiency-equity trade off represented by the choice between promoting higher childcare availability versus abating the childcare fees guaranteeing the same budgetary cost. In particular, the results are related to a decrease in the childcare costs by 5% in each region presented at the same additional cost as % of public revenue, as the previous scenario. The cost is assumed to be net, taking into account the public cost for additional public childcare slots but also the additional tax revenue generated by the increasing female labour supply.

Figure 7 shows that increasing child care coverage (dashed blue line) is more effective in enhancing labour incentives than decreasing existing child care costs (blue line), at the same budgetary cost. In fact, under the latter scenario, the individual average change in total hours worked changes much less with respect to the scenario where the childcare availability constraints were relaxed. However, the potential consequences on the disposable income are opposite: decreasing the childcare costs (red line) is beneficial also for women who do not change their labour supply behaviour, and the cost of each new full time equivalent (yellow line) job which is much higher, at around 20.000€-25.000€ with lower childcare costs. Furthermore, we observe a potential larger effect of decreasing childcare costs for families at the bottom of the income distribution (green line) than the effects of increasing childcare availability (dashed green line).

Figure 7: Higher availability vs lower costs: efficiency-equity trade off



Source: authors' analysis based on EUROMOD.

7 Conclusions

In this paper we have presented a first attempt to apply a structural discrete choice model of labour supply and childcare to the Italian case. Italy is characterized by relatively low female labour market participation, low public childcare availability and high fees paid by the families. At the policy level, there is an increasing interest in issues that involve structural changes in the opportunity sets of households such as changes in the work or care decisions. The latter is for instance witnessed by the European policy targets for childcare and female labour market participation. Given the relatively poor performance of Italy in these domains, gaining more insight into labour market participation is of key policy relevance.

The structural approach that we applied in this paper is particularly informative given that it allows one to estimate the changes in labour supply and childcare choices under different policy simulation scenarios. Structural models are necessary for ex-ante policy evaluation because they allow for a separate identification of preferences (assumed to be invariant with respect to policy changes, i.e. structural parameters) and policy parameters (Aaberge and Colombino, 2014). Alternative 'reduced form analysis' might represent a correct approach with a linear budget constraint. However, the assumption of linear budget constraints is often not valid, for instance in the presence of progressive taxes with different tax relief schemes, in the case of transfers, or when there are important fixed costs. Therefore, in our approach, we make use of the microsimulation model EUROMOD to model in

sufficient detail Italian tax and benefit policies, to adequately take non-linear budget constraints into account.

Nevetheless, some caveats need to be kept in mind when interpreting the results. First, with respect to the demand-side constraints, it is important to consider the distinction between labour supply effects (as those estimated in this paper) and the employment effects. Structural models can be interpreted as giving a "month-after" response (Creedy and Duncan, 2005), estimating the labour supply effects when labour market mechanisms are still late in the process of adjusting wage rates and labour demand. A more simplistic interpretation assigns to the structural model a long-run perspective interpretation characterized by perfectly elastic labour demand defined by the current wage rates. In any case, structural models are needed to consider individual preferences which are otherwise not separated by constraints in a reduced form analysis. Second, the lack of information about public and private childcare attended in the SILC data does not allow us to estimate such alternatives in the choice set. As an alternative, we opted to operationalize the alternative choice through the expected child care costs (Haan and Wrohlich, 2011), exploiting the regional differences characterizing both childcare coverage and costs.

Keeping these caveats in mind, the structural model presented in this paper proves to adequately capture the influence of childcare, both in terms of availability and costs, on mothers' labour supply. The robustness of the model seems satisfactory, and results are in line with what we find in the literature (Del Boca, 2015). First, our estimates confirm earlier findings that if the availability of public childcare is limited, labour supply can be more effectively increased by investing in more childcare slots rather than by decreasing the childcare fees for the (relatively few) places available. Second, the responsiveness of female labour supply to childcare availability is much stronger for mothers with a low level of income than for those with a higher household income. Third, labour supply effects seem to be stronger in the southern regions of Italy than in the North.

Nevertheless, our empirical simulations show the presence of a relevant equity-efficiency trade-off. Given the same amount of public resources invested in childcare, increasing child care coverage is more effective in enhancing labour incentives than decreasing existing child care costs. However, the potential consequences on the disposable income of households may be less positive: decreasing the childcare costs is beneficial also for women who already participate in the labour market and do not change their labour supply behaviour. Therefore, decreasing childcare costs may have a larger impact than increasing childcare availability on the disposable income of households, and in particular for those at the bottom of the income distribution.

These results confirm that childcare programs have important policy implications for the Europe 2020 targets addressing both child poverty and female employment (Del Boca 2015). However, it is not clear whether a policy action should be more focussed on increasing availability (and hence enhancing labour supply) or decreasing childcare costs. The latter would inevitably produce windfall beneficiaries but would allow families with children to get a reduction of their financial burden in a phase of the economic cycle when the demand side constraints are too binding.

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ImPRovE: Poverty Reduction in Europe. Social Policy and Innovation

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The two central questions driving the ImPRovE project are:

> How can social cohesion be achieved in Europe?
>
> How can social innovation complement, reinforce and modify macro-level policies and vice versa?

The project runs from March 2012 till February 2016 and receives EU research support to the amount of Euro 2.7 million under the 7th Framework Programme. The output of ImPRovE will include over 55 research papers, about 16 policy briefs and at least 3 scientific books. The ImPRovE Consortium will organise two international conferences (Spring 2014 and Winter 2015). In addition, ImPRovE will develop a new database of local projects of social innovation in Europe, cross-national comparable reference budgets for 6 countries (Belgium, Finland, Greece, Hungary, Italy and Spain) and will strongly expand the available policy scenarios in the European microsimulation model EUROMOD.

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