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Abstract

In Italy the participation of women has not increased very much in the last few decades relative to other developed countries and it is still among the lowest in Europe. The female employment rate stands almost 13 percentage points below the EU average and 22 below the Lisbon target. One of the most important reasons is related to the characteristics of child care system. In this paper we analyze the characteristics of the child care system in Italy and its relationship to the labor market participation decision of mothers. We present a simple discrete choice framework in which the two decisions can be jointly considered, which also allows for simple forms of rationing. We go on to estimate a bivariate probit model of the child care and employment decisions and interpret the results within the framework of our model. We find evidence that rationing is an important factor in interpreting price effects on utilization rates and employment decisions.

J.E.L Subject Codes: J2, C3, D1.

Keywords: Labor Market Decisions, Fertility, Child care.

1 Introduction

One of the most significant long term trends in the labor market in most OECD countries has been the increase in the proportion of working mothers. This is due both to the fact that a growing proportion of households with both parents present have become dual earner families, and as a result in the increase in the employment rate in the population of lone parent households. As a consequence of these changes parents have come to increasingly rely upon individuals and institutions outside of the immediate household for assistance in the child-rearing task. Because of this, the relationship between institutionalized child-care and child outcomes and the availability and affordability of child care and labor market participation decisions has been receiving increasing attention among researchers and policy-makers. As entering the labour market is strongly related with the participation in the child care market, we expect women's entry decision to depend partly on the cost of child care.

The increase in the incidence of non-parental child care has been object of study since the mid-1970s in the United States, United Kingdom, and Northern Europe, though not in Italy where it only recently has begun to receive attention. One reason is related to Italian employment trends. In Italy a much smaller proportion of married women are formally employed relative to the proportions observed in most other European countries (Boeri, Del Boca and Pissarides 2005).

A second reason is the serious data limitations that Italian researchers face. The ISTAT Multiscopo survey contains a great deal of information regarding the household's use of child care but does not provide data on family income, wages, etc. The ECHP (European Community Household Panel), which has the advantage of being comparable with that collected in several other European countries, contains only a very limited amount of information on child care. The Bank of Italy Survey of Household Income and Wealth (SHIW), which is the most complete micro-survey on the income and wealth of Italian households, does not collect information on child care on a regular basis. In order to overcome these limits, we combine two datasets (ISTAT Multiscopo and SHIW 1998), by imputing the income variables of individuals taken from the SHIW to identical individuals from the Multiscopo survey using a statistical matching method (Del Boca, Locatelli, Vuri 2005).

The objective of the analysis in this paper, which is both descriptive and analytic, is to study the effect of child care costs on employment and child care decisions. From a theoretical point of view, the impact of child care costs on labour supply is well determined: since child care costs increase the mother's reservation wage, high child care costs may lead to a lower labor force participation of women with children, especially if young. This result has been

found in a large number of empirical studies for the US, the UK and Canada. However, what makes this task particularly difficult is the fact that child care is a good with several characteristics (e.g., quality, availability, cost, convenience). We will ignore the variability in this good along most of these dimensions, and instead choose to focus on the choice between formal child care (both public and private) and no use of child care and employment decisions. In particular, this paper explicitly considers the role child care costs play in the decision of women with young children to participate in the labor market and to purchase child care services.

While each type of child care is characterized by a price to a particular household,¹ it is also characterized by hours of availability and other factors related to accessibility. This differentiation is likely to be especially great in Italy. For example, in Southern areas of the country the number of places in public child care is extremely limited.

We analyze how the costs of child care, in addition to the problem of gaining access to a public sector slot, distorts the labor market decision of mothers of young children. In the presence of rationing, while the quoted price of public child care may be relatively low in comparison to the price of private child care, its effective price is infinite to those families that cannot gain access to the system.

Our main focus will be on the “mismatch” between the characteristics of the Italian child care system and the demands of formal employment in the Italian labor market. The Italian public sector child care offers very limited hours of operation, which could be attractive to nonworking mothers or those employed at flexible, part-time jobs. However such jobs are not to be found in the formal sector of the economy. Concerning private market child care, even if all the children can gain access to it, private services are even less widespread than the public ones and their costs are relatively much higher. Therefore they can be considered only as imperfect substitute in the child care market (Del Boca, Locatelli and Vuri 2005).

Italian mothers make their decisions regarding participating to the labor market and the care of her child/ren in conditions characterized by great limitations and rigidity of the labor market as well as child care services.

The plan of the paper is as follows. In Section 2 we provide a brief overview of previous research on this subject. Section 3 contains a description of the child care system as it currently exists in Italy. This knowledge will be important for understanding the motivation behind the behavioral model developed in Section 5. In Section 4 we consider how preferences and rationing constraints jointly determine observed household choices, which is particularly

¹These prices may vary, especially in the public sector, by demographic characteristics and the financial resources of the household.

relevant in the child care choice context. Section 5 describes a theoretical model capable of providing a link between formal child care and employment decisions. In Section 6 we discuss the data used in our empirical analysis, and Section 7 contains a discussion of results obtained from a bivariate probit model which explicitly considers the joint decision of working and using child care among married women. Section 8 offers a provisional conclusion.

2 Previous Research

A number of researchers have attempted to estimate the behavioral effects of changes in income, wage rates, and the price of child care on various family decisions. Research on the relationship between child care and labor market participation in the U.S. and the U.K. has mainly focused on the effect of child care costs on employment decisions (Heckman 1974, Blau and Robins 1988, Connelly 1992, Ribar 1995, Averett et al 1997, Viitanen 2005, among others). These studies have used a variety of methodologies to estimate these impacts taking into account the potential endogeneity of observed costs due to the heterogeneity in this good (particularly along the quality dimension).

In one of the first examinations of this topic, Heckman (1974) estimates a child care price function which incorporates measures of the availability of child care and its costs; he pursues this strategy because he does not have cost data directly available. Blau and Robins (1988) include a regional average of day care expenditure as a proxy for price, but did not control for household-specific information such as the age of the youngest child. Connelly (1992) uses predicted expenditures as an instrument for child care costs in an accompanying labor force participation equation; the cost instrument controls for regional variation and family characteristics. Ribar (1992), using a more structural approach, considers expenditures per hour of care per child as a measure of child care costs.

Generally these studies have found that family behavior is significantly influenced by child care policies. Blau and Robins (1988) estimate child care price elasticities for married women of $-.38$ with respect to labor supply and $-.34$ with respect to the demand of formal child care. These estimates implied that if the child care prices were zero, 87 percent of mothers would work in contrast with a value of 58.8 actually working. In performing this policy experiment, Blau and Robins compute the response at the characteristics of the average woman in the sample. In contrast, Connelly (1992) evaluate the impact of such a policy on the labor market decisions of each woman in the sample. She finds a less substantial labor supply effect: if universal no cost child care were available, the model predicts that 68.7 per cent of women would be employed. These results refer to the U.S. but similar findings were obtained for the

U.K. (Viitanen 2005) and for Canada (Powell 1997). All these studies show that child care costs are a very significant determinant of the demand for these services and employment decisions, which are of course very highly associated themselves, ranging from -0.02 (Ribar 1995) to a low of -0.82 (Averett et al 1997).²

Other studies focusing on other countries find quite different results. Cobb-Clark et al. (2000) find that child care costs in Australia are not an important barrier to labor market participation, but affect significantly the choice of child care. A quite different picture emerges from empirical research using data from Northern European countries. Gustaffson and Stafford (1992) investigate the responsiveness of the decision of women to work and use public child care in response to variation in child care fees, availability of places, and spouse's income in Sweden.³ They found that in regions in which child care places do not appear to be rationed, higher fees significantly lowered the probability of mothers' market work and public child care choice, while in areas where rationing is more severe there is little evidence of significant price effects. Kornstad and Thoresen (2002) examine the case of Norway and analyze a model to simulate the female labor supply effects of the Norwegian home care allowance reform taking into account rationing. They find that mothers' labor supply will be reduced by about 9 percent by home care allowance reform, but this effect is considerably less pronounced if availability constraints are eliminated.

Studies analyzing Continental and Mediterranean Europe use a similar approach. Del Boca (1993) estimates a model similar to that of Blau and Robins (1988) to determine the effect of child care costs on the participation decisions of married women allowing for the choice between part-time and full-time work and between public and private child care systems. The estimation of the relationship between child care costs and labor supply shows that a reduction in child care costs increases the probability of mothers' part-time employment but has a less significant effect on the probability of working full time.⁴ These results raise some concerns given that part-time employment opportunities are in such a short supply in the Italian labor market. Moreover, these findings are in contrast to what found for other countries where full time work is more cost-sensitive than part-time work (Powell 1998,

²Some of these studies have also compared the employment responsiveness to child care costs for married mothers and single mothers. The results for single mothers are much less robust (Kimmel 1998 for the U.S., Jenkins and Symons 2001 for the U.K., among others).

³Sweden is widely held to have the highest quality child care among the countries of the region, and also offers the greatest degree of availability. The participation rate of Swedish mothers is also the highest in the region.

⁴Empirical studies employing cross-country data have found a high correlation between the proportion of part time jobs and the participation rates of women, in particular married women with children (Meulders, Plasman and Plasman 1994). The low proportion of part-time workers seems mainly to be induced by characteristics of the demand side of the labor market.

Jaumotte 2003).⁵ Using the Bank of Italy data, Chiuri (2000) does not find significant effect of child care costs.

Kreyenfeld and Hank (1999) do not find a significant effect of child care costs on the participation decision of mothers in Germany, explaining this result with the peculiar child care situation in Germany, where opening hours of child care facilities are not long and flexible enough to meet the demands of working mothers. Availability appears to be more important than costs. Wrohlich (2004) compares West and East Germany and reports significant but very small effects of child care costs on mother's labor supply.

Table 1 reports and summarizes the signs and the significance of the coefficients associated with child care costs on labor market participation and child care utilization. The varying estimates certainly reflect differences in important institutional characteristics of the countries. In countries like U.S., Canada, U.K., Australia where the child care services are provided at private level, the focus is on the costs and quality of the services, while in countries where the provision is mostly public, like Sweden, Norway, Germany and Italy, availability seems to be as important as costs.

3 The child care system in Italy

In this paper, we focus on Italy which shares with some other European countries the characteristics of the so-called "Southern model": the lowest level of social protection (especially social expenditures for families and children) and the low availability of child care for children under three (Ferrera, 1996). Italy is ranked quite high for policies directed to mothers with children between 3-6, but it is ranked quite low for policies directed to mothers with children under three: while public child care for children 3 or older has an utilization rate of 95 percent, child care for children younger than 3 is used only by 6 per cent of the population of children (Gornick, Meyers and Ross 1997, OECD Employment Outlook 2001). Because of this we focus mainly on child care for children less than 3 years of age, which is crucial if mothers of young children are to participate in the labor market.

In Italy the price of public child care for young children is very heterogenous across regions. The amount parents pay differs from one municipality to another because the structure of the subsidy and the number of spaces is set by the local government. Unlike private child care, the costs of public child care depend on family size, family income, and family composition. The cost of public child care is lower for larger families in all areas as

⁵Gustafsson and Stafford (1992) report an elasticity of -1.88 for full time work with respect to the cost of child care but unfortunately they did not report a part time work elasticity measure, making it difficult to infer something on the differential effects of child care costs on part time versus full time work.

well as private child care costs are higher than public child care costs (Del Boca, Locatelli and Vuri 2005).

There are also marked differences in the child care utilization rates across regions. The proportion of children less than three years of age in public child care is around 15-20 percent in some areas of the North and only 1-2 percent in most Southern areas (this ratio is the number of places available divided by the population 0-3 years of age, Fondazione degli Innocenti 2002). Not coincidentally, in the Northern areas the labor market participation rate of mothers is greater than 60 percent while in the Southern regions it is less than 20 percent. Different accessibility rates have created a situation of more severe rationing of public child care in some areas of the country, especially in the South of Italy. In these areas women find it difficult to find a job in the formal labor market and are unemployed or work in the underground economy.

Child care for young children is rationed in two ways: (1) in the number of places available (fifty per cent of children on average are not accepted in the public care, while the private child care service is scarcely used since less than 1 child out of 100 attend the private child care); and (2) in the hours of care offered (from an average of 8 on average in public child care to an average of 10 in private child care, Fondazione degli Innocenti 2002).

Given this characteristic of the public child care system, it is not possible to accommodate full-time work schedules of both parents with the exclusive use of public child care.⁶ The rigidity in hours of service has negatively affected the growth in labor market participation of mothers with young children, which over the past few decades has been much lower in Italy than in other developed market economies.

Interventions producing reductions in the costs of children should be a focus for reducing the burden on the family. For example, Ferrera (1996) and Addabbo (2001) who have analyzed the positive experience in family-welfare mix of Emilia Romagna (the region with highest provision of child care) have shown that expanded child care with longer hours have contributed to encourage women to work. It is reasonable to assume that similar types of interventions in other regions of Italy, particularly the South, could have very positive impacts on labor supply.

⁶Full-time employment typically necessitates that the employee be away from the home for approximately 9 hours per day, ignoring commuting time.

4 Labor Supply Decisions and Characteristics of Child Care Services

The analysis of the impact of child care policy on labor supply necessitates consideration of at least two dimensions of services: availability and costs.⁷ In this section we will discuss some issues of measurement as well as the relationship between costs and availability. In terms of the monetary cost of “formal” child care, they are typically significant. Estimates place child care expenses at from 30 to 50 per cent of the earnings of employed mothers with one child under the age of three. The analysis of availability focuses on the family’s ability to find “appropriate” child care given the going price of services. It has been found that the shortage of child care options in terms of schedules and location severely limits the use of these services.

An important component of child care costs and availability concerns the relationship between the distances of the family’s residence, the workplaces of the parents, and the location of the facilities. In a sense, availability of child care slots can only be defined with respect to a set of “acceptable” child care facilities to the family, and distance is a prime factor in defining this choice set. Say that there are 40 child care facilities in a particular urban area. Given the monetary cost of each, the distance of each from the family’s residence and employment locations, and the quality of each, the family may decide that there are 10 facilities the use of which would provide positive surplus. Over these 10 facilities the family would have an ordering in terms of preferences. Then we will say that the family is limited by “availability” if there is no vacancy for their child in any of the 10 “acceptable” facilities. While there may be vacancies in the 30 nonacceptable facilities, these will not be used.

Note that accessibility will impact the relationship we observe between price (and quality if we were looking at it explicitly) and the utilization of services even for those families who utilize formal child care. Returning to our example in the previous paragraph, say that among the 10 acceptable child care facilities the ranking the household assigns to them is a decreasing function of the price charged. If in this city accessibility is low, then it is relatively likely that one of the least favorite (but acceptable) facilities will be utilized, one with a relatively high price. However, if availability were guaranteed at all facilities, the one with the lowest price would have been observed. The point of this example is that availability will impact the characteristics of child care services chosen even when the household uses formal child care. In some real sense, the two aspects of choice are not independent and

⁷Of course child care quality is an exceedingly important dimension as well. We largely neglect it here due to the absence of any information on the characteristics of child care services used in the data.

must be considered jointly. With better data it would be possible to do much more along this dimension than we are able to do here.

These considerations regarding child care availability suggest that the usual price effects (considering child care services as a normal good) should only be observed in areas in which availability constraints are not binding (see Gustaffson and Stafford 1992). In other areas, as our example suggests, the relationship between price and utilization will be much “noisier.”

The issue of child care availability seems to be especially important in countries with low birth rates relatively to countries with high fertility rates such as the Nordic countries (Sweden, Finland, Norway). In a country like Italy where the average number of children is close to 1 and a high proportion of children grow up without siblings, the purpose of formal child care is not only supervision and care but also represents an essential socialization opportunity with other children of similar age. Moreover formal child care is preferable given the lack of economies of scale usually associated to the informal child care of two or more children. This might explain (at least partially) why a large proportion of women who do not work still use child care in these countries.

Child care costs impact family decision making in two ways. On one hand, child care costs can be thought of as a part of the cost of rearing a child and so affect decisions in which the cost of children is a relevant factor, most importantly fertility. The higher the cost of child care, the higher the cost of an additional child. This leads to the prediction that higher child care costs will tend to decrease fertility (Cigno 1991, Del Boca 2002, Ermisch 1989).

On the other, given the presence of a child, child care costs lower the mother’s effective wage in the labor market and thus impact decisions for which the mother’s wage is a relevant “state variable.” In most families mothers are the members of the families with the lowest potential earnings and hence are the “marginal” workers in the formal labor market. Once the fertility decision has been made, the major impact of child care costs is on the wage of the working mother. Given that women are the principal caregivers in the household, the mother bases her decisions on the costs and benefits of working in the labor market and these will depend on her wage minus the cost per hour worked of child care. Increasing the cost of extra-family child care decreases her effective wage. A decrease in her effective wage decreases the probability of participation in the labor market. If she is still participating a decline in her effective wage has two offsetting effects on the number of hours she will work. A decrease in the wage lowers the amount of family income, which has the effect of increasing the number of hours she will work in the market. But the decrease in the wage lowers the value of an extra hour spent in the labor market relative to the value of an extra hour spent

at home. So the number of hours of work should decrease as the cost of child care increases.

In a context like the one we consider here, characterized by relevant labor market rigidity, we can expect that the effect of child care costs will be larger on women’s participation because they may not be able to adjust their hours in the labor market to exactly equal their preferred number of hours of work.

5 Formal and Informal Childcare and the Employment Decision

In order to illustrate the impact of child care characteristics on women’s employment, in this section we look at a simple model of the mother’s decision to work and use child care and the impact of child care and job rationing. This model is useful as a guide and as an interpretation tool for the results of the empirical analysis.

We assume that informal services are used if a woman is employed and there is a difference between the number of hours of employment and the number of hours of formal child care provided. If informal child care is utilized when the woman is not employed we will miss that; in our framework, there could be a desire for such child care as a way to increase the amount of the mother’s leisure time or because the mother values the socialization and instruction her child(ren) receive at the childcare facility.

In line with the preferences assumed above, let the household’s utility be given by

$$U(C, L, d_C) = \alpha \ln L + (1 - \alpha) \ln C + \xi d_C,$$

where C is the total consumption, L is leisure, $d_C = 1$ if the child is enrolled in formal child care and ξ is the valuation of using formal child care, which may take any value on the real line. As above, consumption is given by

$$C = Y + wH - M_C,$$

where Y is the non labor income of the mother, M_C denotes the monetary cost of childcare and H denotes the “standard” hours of work associated with full time employment.

By assuming that formal child care supplies an amount of hours of services lower than the hours of work worked by the mothers, the monetary costs of childcare are given by

$$M_C = d_C \pi_F \tau + d_E \{d_C \pi_I (H - \tau) + (1 - d_C) \pi_I H\},$$

where τ are the hours of service, π_F denotes the hourly cost of formal child care, π_I denotes the hourly price in the informal sector, and d_E is an indicator variable that takes the value 1 if the mother is employed.

In a complete choice set in which the mother is assumed to have access to a job offer of w and to have access to child care, then her choices and their associated values are as follows:

Work (d_E)	Use child care (d_C)	Value
0	0	$\alpha \ln(T) + (1 - \alpha) \ln(Y)$
1	0	$\alpha \ln(T - H) + (1 - \alpha) \ln(Y + (w - \pi_I)H)$
0	1	$\alpha \ln(T) + (1 - \alpha) \ln(Y - \pi_F\tau) + \xi$
1	1	$\alpha \ln(T - H) + (1 - \alpha) \ln(Y + wH - \pi_F\tau - \pi_I(H - \tau)) + \xi$

We can summarize the value of the various choices by the expressions $V(d_E, d_C|w, Y, \pi_I, \xi)$, where the other arguments (T, H, τ, π_F) are suppressed for simplicity and because they are assumed to be constant in the population. We let the distribution of wage offers to mothers with productivity characteristics Q be denoted by $G(w|Q)$ with associated (conditional) density $g(w|Q)$.

As we discussed above, an important limitation of the Italian child care system is the relatively small number of available slots. To take this into account in a crude way necessitates that we view the availability of formal child care as probabilistic. If we let Z denote demographic characteristics of the household that are formal and informal determinants of the mother's probability of obtaining a childcare slot, then we denote the probability that formal child care is in the choice set of the mother by $\delta(Z)$. Let X denote a set of exogenous characteristics that affect the mother's chances of obtaining a job offer, and let the probability of receiving an offer be given by $\theta(X)$.

Consider first the case in which we observe the woman at a job and using formal child care services. In this case we know that $w > 0$, that is, she received a positive wage offer, and she was granted access to formal child care services. Given these conditions, we know that the probability that the household chooses ($d_E = 1, d_{CC} = 1$) is given by

$$\begin{aligned}
& p(d_E = 1, d_C = 1|w, Y, \pi_I, \xi) = \\
& P(V(1, 1|S) - V(1, 0|S) > 0, V(1, 1|S) - V(0, 1|S) > 0, V(1, 1|S) - V(0, 0|S) > 0) \\
& \quad \times \theta(X) \times \delta(Z) \\
& = P((1 - \alpha)(\ln(Y + wH - \pi_F\tau - \pi_I(H - \tau)) - \ln(Y + (w - \pi_I)H)) + \xi > 0, \\
& \alpha(\ln(T - H) - \ln(T)) + (1 - \alpha)(\ln(Y + wH - \pi_F\tau - \pi_I(H - \tau)) - \ln(Y - \pi_F\tau)) > 0, \\
& \alpha(\ln(T - H) - \ln(T)) + (1 - \alpha)(\ln(Y + wH - \pi_F\tau - \pi_I(H - \tau)) - \ln(Y)) + \xi > 0) \\
& \quad \times \theta(X) \times \delta(Z).
\end{aligned}$$

We note the following features of this expression. Assume that the parameter α is fixed in

the population, but that π_I , w , and ξ are random, with each taking values on the positive real line $(0, \infty)$.

Then in terms of the difference $V(1, 1|w, Y, \pi_I, \xi) - V(1, 0|w, Y, \pi_I, \xi)$, there are always combinations of (π_I, ξ) for which this difference is positive. In terms of the difference $V(1, 1|w, Y, \pi_I, \xi) - V(0, 1|w, Y, \pi_I, \xi)$, the term ξ cancels since formal child care is received under either alternative. For a sufficiently high value of w and high value of π_I this expression can be positive.

Finally, in terms of $V(1, 1|w, Y, \pi_I, \xi) - V(0, 0|w, Y, \pi_I, \xi)$, this difference can be positive given relatively large values of w , high values of ξ , and low values of π_I . Of course, the fact that any given difference can be positive for certain combinations of (w, ξ, π_I) does not mean that there exists values of these random variables for which all inequalities are simultaneously satisfied.

When we observe a household in which the mother is not employed and/or is not using formal child care services instead, we don't know whether this is due to the fact that all options are available to the household (i.e., both work and formal child care services) and the particular outcome observed yields the highest value in the choice set with four possibilities, or whether it is attributable to the choice set being "restricted." Consider the case in which the mother is employed but does not use formal child care. By the fact that she is employed, we know that a job was available to her. That she does not use formal child care is due to the fact that it is available to her but its use does not yield as high a value as does using informal care or the fact that she would use it if available but it is not. The probability that the mother does not work but does utilize formal child care and the probability that the mother does not work and does not use child care is expressed in a similar manner. We report the expression for the probability of the other outcomes in Appendix 1.

We now provide some simulation evidence regarding the performance of this model. To keep things simple, we will assume that the probabilities of receiving a job offer, the probability of having access to child care, and the wage offer distributions are *fixed* in the population at the common values θ , δ , and G . We assume that the probability of having a child care slot available to a family, δ , is .7, and the probability of having access to a job, θ , is .6. We assume that G is lognormally distributed with parameters such that the logarithm of the wage distribution has mean 1.5 and standard deviation .5.

The preference weight given to the woman's time in the household, α , is set at .4. The woman is assumed to have a weekly time endowment of $T = 90$, and other family income is set at $Y = 500$. If the woman accepts employment, she must supply exactly $H = 40$ hours

at the job, and if her child participates in formal child care they spend $\tau = 35$ hours a week in the program. If the mother is employed and the child participates in formal child care, it is assumed that the child is in formal child care while the mother is working.

These imputed values are coherent with average data reported in the data as well as with assumptions on the limitations of the labor market and service market.

The other random variables in the model in addition to the wage offer (if there is one) are the costs of informal child care, π_I , and the valuation of having the child participate in a formal child care program, ξ . We assume that both are lognormally distributed in the population. The ln of π_I has mean $-.3$ and standard deviation 1 . The ln of ξ has mean -2 and standard deviation 1 .

In a first stage, we simulated choice probabilities by drawing 200 pseudo random draws for each of the random variables (w, π_I, ξ) . Using each of the 8 million combinations of these draws we computed the optimal choice assuming that jobs and child care slots were available in all cases - that is, the full choice set of four options was present.

In a second stage, we drew other pseudo random variables for each case to determine the individual's "actual" choice set for this combination of the draws of (w, π_I, ξ) . Given the outcomes of these draws we redefined the choice set and determined the best choice within it. We then computed population averages of choices in the restricted and the unrestricted regimes. The proportions appear in Table 2.

We look first at the case without rationing. We see that the probability that a family with these characteristics would be using formal child care and have the mother at work is $.45$. The probability that the mother would be employed but the child would not be in formal child care is $.07$, so that the overall employment probability is about $.52$, with more than 80 percent of working mothers using formal child care. The probability of using formal child care and not working is $.18$, so that the proportion of families using formal child care and having the mother employed is about $.72$. The proportion of families in which the mother neither works nor uses formal child care is $.29$.

The situation changes dramatically when rationing is added. The most severely impacted choice is that involving both being employed and using formal child care, since that is subject to rationing in both the labor market and the formal child care sector (which for simplicity we have assumed operate independently). The probability of having both choices available is only $.42$ ($.6 \times .7$). Accordingly, we see that the probability of working and using child care is reduced from $.45$ to $.19$.

The "double rationing" has especially interesting implications for the choices $(1, 0)$ and

(0, 1). For example, for some combinations of the draws (w, π_I, ξ) the preferred choice of the household would be (1, 0) when all choices were available. When a job is not available, however, this choice is not available and the household must make another one. This lowers the likelihood of observing (1, 0).

Thus rationing can only reduce the probability of observing (1, 1), can only increase the probability of observing (0, 0), but the net effects on the likelihood of observing the “mixed” cases (1, 0) or (0, 1) would seem to be ambiguous. In the example here we see that both have increased, with the probability that the household would have the woman working and the child not in formal child care changing from .073 to .095. The probability of observing child care but not employment also increases from .183 to .216.

The purpose of this section has been to outline a model that is capable of providing a link between formal child care and employment decisions. The model could be used to carry out policy simulations through manipulation of some of the parameters, especially the rationing probabilities δ and θ . We use it here to guide and motivate the empirical analysis performed in the following section that investigates the link between these two choices.

6 Methods and Data

The data used in this section combine information from Italian datasets, the SHIW and the Multiscopo survey, the first containing information on income and earnings and the second containing information on child care use, costs, hours of service and type of child care, i.e. formal (public and private) and informal. In order to merge these two datasets, we employ a statistical matching method which consists in imputing income and earnings variables of an individual from the SHIW to an *identical* individual from the Multiscopo (see Appendix 2 for the details on the matching procedure).

To be included in the sample used for estimation, households have to contain married adults with the youngest child under three years of age. Only 7 per cent of married couples in have the youngest child in this age range. This small percentage is a result of the low fertility rate in Italy (see Del Boca (2002) for an econometric analysis of the fertility decision in the Italian context). The geographic distribution of our final sample has 33.9 percent of households from the South, 12.8 from the Islands, 16.9 percent from the Central section, 19.3 percent from the Northwest, and 17.0 percent from the Northeast. In terms of labor market participation rates of the wives and mothers, 44.1 percent of the sample works (almost twice the the national figure).

Regarding child care utilization, we note that both formal child care (which includes

public and private child care provided by schools) and informal child care (provided by relatives or friends or baby-sitter) are reported. However, the Multiscopo survey does not give information neither on the costs of the informal child care nor on the number of hours used, therefore we focus on the use of public and private services. Among families with children less than three years of age, 20.5 percent of households use child care. Of the working mothers, around 28 percent use formal child care, while only 14 percent of the not working mothers use formal child care.

The fact that the use of public and private child care is relatively low indicates the potential impact of the constraints presented by the high degree of rationing in access to public child care and the limited supply of both public and private child care slots. While the situation regarding private child care has changed somewhat during the intervening ten years, it remains true that there is an underprovision of formal child care services in general.

We use a bivariate probit model to jointly estimate the probability of working and using child care. Given previous results (Heckman 1993) that have shown a very low responsiveness of hours of work to all measured variables (given the prevalence of full time jobs in the labor market), we use employment instead of hours. The dependent variables are whether the wife is working at the time of the interview and whether or not the household uses formal child care, both public and private.

Descriptive statistics for the variables used in the estimation are reported in Table 3. The variables utilized in the analysis include:

Personal Characteristics: parents' age and schooling, family non labor income and husband labor income.

Family Support: even if we have information on informal child care use from relatives and friends, we decide not to use it directly in the estimation since it is potentially endogenous. We prefer using a variable indicating whether one of the parents is still alive (as a proxy for potential informal child care). We also use a variable indicating whether the family has received monetary transfers from relatives during the year of the interview as a proxy for family financial support.

Child Care System: As an indicator of the characteristics of the child care system, we use the percentage of public and private child care services across region given 100 the total in Italy (see Table A1). To test for the relevance of the rationing in child care we use as a proxy a dummy variable (NR) indicating that the household is situated in one of the region in which the provision of formal child care is greatest (Emilia Romagna, Lombardia and Veneto). We also employ a variable indicating the percentage of public subsidies obtained

by both public and private child care services (see Table A1).

Child care costs: the costs paid by households using school child care (either public or private). As a measure of supply costs we use the regional wage rate⁸ (as previously done by Ribar 1992).

Labor Market: As an indicator of the probability of locating a part-time job, we use the ratio of the number of part-time jobs to total employment in the region, and as an indicator of availability of a job in the region, we use the regional unemployment rate (Istat, *Indagine sulle Forze Lavoro* 1998), both reported in Table A1.

7 Empirical Results

As discussed in the description of the child care system in Italy and given the model we have constructed, we can expect that the price of child care may not “significantly” influence its use since for many regions there is a severe rationing of spaces. Only for less rationed areas would a clear impact be expected. Conditional on other household characteristics, we will assess whether the costs of child care have a larger (negative) effect on its utilizations in regions where rationing of spaces is less severe.

One important problem that we face in estimation is the issue of the endogeneity of child care costs.⁹ Since we would like to consider the two equations as constituting a (partial) demand system for the household, naturally we would like to include the parameters that characterize the household choice set. These include the prices of child care, both public and private, as well as any limitations on the uses of these services by a specific household. Since we only have child care costs paid by the household, this is not primarily a measure of the price but instead measures of utilization. To get around this endogeneity problem, we estimate the hourly child care costs equation from which to predict the child care costs potentially paid by all the households in the sample. The child care price regression is estimated using the appropriate correction for Heckman selection (see Heckman 1979). The

⁸Source: Bank of Italy Survey 1998.

⁹One could object that availability itself may be endogenous in that where women’s employment is higher (in the North of Italy), voters demand more slots be made available. However, the total number of slots in Italy has increased by about 20% (from 97,654 in 1992 to 118,517 in 2000, *Fondazione degli Innocenti* 2002), which means less than 3% per year. An early growth rate of less than 3% makes the potential endogeneity of child care less than a problem since, even if this increase was demand driven, it did not change significantly the number of available child care slots over time. Furthermore, in the Italian context, households’ mobility is extremely low. In the early 1990s, annual changes of residence from one town to another were less than 0.2% of the total population compared with an average of about 0.32% in the 1960 (Cannari, Nucci and Sestito 2000, p.1900), and started to decrease from the 60s’, partially due to the differentials in the cost of housing across areas. We can therefore assume that people rarely move in order to live in places with better child care opportunities (as well as better labor market).

results from the child care price equation, corrected for sample selection, are used to construct a predicted price of care for each mother in the sample.¹⁰ In this context, the child care cost equation can be estimated by OLS since all the families who use formal child care face some costs.¹¹ Let the child care cost equation be:

$$\pi_F = \alpha' D + \nu_F$$

where π_F is observed only for those families using market child care, D is a vector of observed determinants and ν_F represents unobserved variation.

It is assumed that the costs of child care will vary according to some family characteristics. Expenditures on child care are expected to be higher for those families with higher levels of unearned income (or receiving transfers from their parents) reflecting variations in the quality of care. The presence of alternative caregivers in the household, as represented by having parents still alive, is expected to affect the availability of low-cost care and hence expenditures. Wife's and husband's years of schooling are expected to affect positively child care expenditures, since more schooling is often associated with higher labor earnings.¹² We also use regional dummies which should capture differences in regulation and prices across regions. In order to identify the child care costs equation we need to find at least one variable that should have a little direct effect on the decision variables to work and use child care and only affect the price of childcare. Two variables, regional wages and local childcare subsidies, appear to be reasonable candidate for identification, and have been collected externally.¹³ In particular, the paper uses data from the 1998 Bank of Italy Survey to construct average regional wages for all workers. The average wage is intended to proxy differences in child care provider wages and the costs of living between regions (Ribar 1992). The local child care subsidies are instead derived from the dataset reported in Fondazione degli Innocenti (2002) and are computed as the fraction of public subsidies obtained in each region from both public and private child care centers. Finally, we use the ratio of the number of child care places available (for children under 3 years of age) to the number of children 3 years of

¹⁰Most studies using U.S. or U.K. data employ a double selection model, since in many datasets childcare expenditures is observed only for working mothers who report paying for childcare. Therefore the selection arises from two sources: the decision to participate in the labor market and the decision of using paid care. However, in Italy, the link between the utilization of child care and employment is not very strong and therefore we employ a single sample selection correction term, as in Ribar (1992) and Wrohlich (2004).

¹¹Wrohlich (2004) estimates the child care equation with a Tobit model since in her sample 10% of households using formal child care do not have to pay for it, i.e. face zero costs and this could lead to negative predictions if using OLS.

¹²Household labor income is usually one of the criteria which determines the household child care expenditures.

¹³We thank an anonymous referee for suggesting us the use of these two variables.

age or less by area of residence in 1998 which should only influence the access to child care.

From the estimation of the child care equation, it turns out that the regional wage rate and the regional child care subsidies are positively related to child care costs. This result is quite plausible since regions with relatively higher child care subsidies and higher regional wage rates are also the richer regions with higher costs. Regions in the South of Italy and Islands have lower child care costs, while in the North East (which is the wealthiest part of Italy) child care costs tend to be higher with respect to the Centre and North West. Families with higher levels of unearned income pay significantly more for care, as expected, while husband labor income does not have a significant effect. The presence of alternative caregivers has the expected sign, i.e. grandparents decreases child care costs, while parental schooling increases child care costs, but these effects are not significantly different from zero. The selection term of the child care price equation, which accounts for the possibility that those mothers who work and choose formal child care may face lower prices than the population as a whole, is negative but not significant. It means that the "amount" one pays for child care among those who do pay is not significantly affected by selectivity into the set of child care payers.¹⁴

Table 4, Model I presents the estimates from a specification in which child care costs (as a proxy for price) enter the employment and child care equations alone (columns 1 and 2). We consider the effect of child care costs and the effect of availability of child care conditional on several characteristics of the environment (the proportion of part time work and the level of unemployment) and household characteristics. The results show that the price of formal child care does not have a significant impact on either choices. Households living in one of the three selected regions (i.e., NR=1) have a higher probability of working, while it does not seem to have a significant effect on the choice of using child care.¹⁵

In terms of personal characteristics, we see that more highly educated women are more likely to work. Presumably, the main impact of higher education is on the market wage offer, so this finding is consistent with a wage effect. Furthermore, highly educated parents are more likely to use formal child care even if this effect is weakly significant and it holds only for the husband. This result is consistent with the fact that more highly-educated parents place greater value on the services provided by regulated child care settings (the

¹⁴Results are available on request from the authors.

¹⁵The same results holds even if we use the regional child care coverage rate of children as an explanatory variable of female participation and use of child care, instead of the dummy variable NR. However, we would rather prefer the specification with the dummy variable because it turns out to make it easier the interpretation of the interaction between child care costs and availability of child care shown in the following models in Table 4.

opportunity for socialization with other children, relationship with teachers, etc.). Older mothers of young children are more likely to work and to use child care services probably because they invest more in human capital accumulation, have longer tenure if working and therefore might need to rely more on non maternal childcare. Higher household non labor income is associated with an increased probability of working. The positive signs of the income variables, both household non labor income and husband labor income, on the child care choice potentially suggest the existence of a higher level of demand for leisure, free of child care burdens by mothers from wealthier households, but they fail to reach a statistical significance level.

Households in which there is at least one living parent have a higher probability of mother's work and a lower probability of using formal child care, indicating that these households may be using parents as substitutes for formal child care (but the latter effect is weakly significant at 15%). Those women receiving family transfers tend to use significantly more formal child care, which may indicate that such transfers are provided to help subsidize child care use.

The presence of children 4-5 years of age increases the probability of using formal child care (increasing the probability of being accepted in the public child care as well as reducing several costs associated to the use of formal child care, both public and private, like transportation costs and other after school arrangements); at the same time it decreases the probability of working, likely because having two or more pre-school children makes it more difficult for a woman to reconcile work and family life. Other explanations could be related to the facts that grandmothers may be more available to watch one child rather than two. The presence of school-children younger than 13 years have a negative impact on mother's employment because they still need maternal care. A possible explanation of this finding is that child care activities for school-aged children outside school are still scarce in Italy and mainly for payment.

Concerning the regional variables, the availability of part time jobs does not have a significant impact on the decision to work, and a negative and significant effect on the use of child care. We would have expected that where part time jobs are more widespread it is easier for a woman to continue working and using child care overcoming the problems due to the rigidities in the child care opening hours. However, this counter-intuitive effect could be due to the fact that part time work is a recent phenomenon in Italy and in 1998 only 7% of the population held part time jobs (Istat, Indagine sulle Forze di Lavoro, 1998), making these results not very reliable.

As expected, the condition of the local labor market proxied by the regional unemployment rate negatively influences women’s employment: in areas where the rate of unemployment is higher, women are less likely to work. At the same time the use of formal child care is discouraged by higher unemployment rate, likely because areas where there is lack of labor market opportunities are also characterized by lack of services like child care.¹⁶

Finally, the coefficient of correlation between the errors of the two equations is positive and strongly significant, thus indicating the simultaneity in the choices of female employment and use of market child care; demographic and household characteristics, and only to a certain extent child care characteristics, mainly seem to affect child care decisions.

In Models II of Table 4 we reestimate the model after including an interaction term between regional child care cost and residence in the “high child care provision” areas (Emilia Romagna, Lombardia and Veneto). Actually these three regions turn out to be also areas at low unemployment rate, which means that we can interpret the variable NR as an indicator of low rationing both in terms of availability of child care and of employment.

The child care cost variable interacted with residence in the three region area (NR) has an associated coefficient on the probability of using formal child care and working that is negative and significant, whereas the “main effect” of child care costs continues to be insignificantly different from zero in both decisions equations. This is consistent with our argument that the price matters only when rationing is not severe. Moreover, the “main effect” of living in the high availability region now becomes significantly different from zero in both equations, showing that a higher availability of child care increases both the probability of working and using child care. This could indicate that the main reason why people living in these three regions have higher employment rates and utilization rates of child care is because supply is greater, a conclusion quite consistent with competitive market models.¹⁷

7.1 Simulation results

Let us finally examine the public policy implications of our empirical estimates, similarly to Viitanen (2005) for the UK, Wrohlich (2004) for Germany and Connelly (1992) for the

¹⁶We have also used in the estimation the percentage of women employed in the public sector in each region as an indicator of the probability of being employed in the public sector. This variable was meant to capture the flexibility in the working hours typical of public sector jobs. However, it turns out to be not significant and the results do not change if this variable is excluded from the estimation.

¹⁷Other important potential sources of rationing as we discussed in the previous sections are in the lack of flexibility in the hours of mothers’ work and in the hours of service of child care. However part time opportunities are very scarce in all regions of Italy and the low variability does not allow to identify its effect (see Table A1). The indicator of hours of service on the other hand is potentially highly correlated with the availability of private child care (which have longer hours of service than the public one) which implies a difficult interpretation on the impact of child care choice.

US. The simulations are intended to illustrate the implied behavioural features of the model. Using our estimates, we simulate the change in female employment when child care costs are partially or fully subsidized. Viitanen (2005) reports an increase in the labor force participation by 25.4 percentage points in case of a 100 percent subsidy of private child care costs. Running a policy simulation of a hundred percent subsidy to child care costs for Germany, Wrohlich (2004) finds an increase in the participation rate of mothers with preschool children of about 3.0 percentage points in the West and about 1.5 in the East (starting from a labor force participation of 63% in east and 43% in west Germany).

In our case, the same simulation exercise run for the sample of women who are not rationed in the child care market, i.e. those affected by the change in child care costs, leads to an increase in the employment rate of about 26 percentage points (see Table 5). If the child care costs are subsidized only by 50%, the change in employment would be of about 11%. Our results appear to be greater than the results obtained in the studies related to Germany (Wrohlich 2004) and the US (Connelly 1992) and is in line with what found by Viitanen (2005) who predicts for the UK that if childcare costs were subsidized 50%, 64.4% of married women with young children would be employed (from the baseline 50.7) and if there were universal no-cost child care available 75.5% of women would be employed. We should note that in general the increase in child care subsidies involve large deadweight losses introducing large inefficiencies in the economic system. The estimated costs of these distortions may vary broadly, the magnitude of which depend mainly on the elasticity of labour supply of women with children. Previous studies show that social costs fall if child care subsidies are reduced to some extent (Rosen 1995). Nowadays in Italy a large share of child care activities are provided privately within the informal household sector. As the fraction of women participating in the labour market increases over time, the potential for such deadweight loss could be reduced due to the fact that the pool of informal carers may shrink, yielding women to purchase substantially more child care than currently done. Furthermore, in presence of child care rationing we cannot know what child care women would use if unconstrained, thus implying that the deadweight loss calculated at the current subsidies might be too large (Rosen 1995).

8 Conclusion

In this paper we analyse the effect of child care system characteristics on women's labour supply and child care decisions. The availability of affordable child care has been identified by policy makers and social scientists in most countries as one of the most important

preconditions for high levels of married female participation in the labor market.

The characteristics of the Italian child care system are peculiar. While the quality of public child care is quite high in general, and fairly homogeneous across regions, availability is both limited and heterogeneous (with respect to household characteristics such as income and area of residence). Child care, although partially subsidized, lacks both local availability and flexibility in the hours of service. Therefore it is hardly compatible with the full time employment opportunities which prevalently characterize the Italian labor market.

To analyze the effect of child care costs on mothers' employment and child care decisions in the Italian context we need to take into account the effect of rationing in the provision of care services as well as in the labor market. Our results are coherent with the implications of our discrete choice framework indicating that rationing is an important factor in interpreting price effects on employment and utilization of child care.

The empirical investigation of the various sources of rationing indicates that while the availability of child care seems to be the most relevant source of rationing affecting both employment and utilization of child care, the limitations in the labor market affects only employment and not child care decisions. It is likely that other factors (related to mothers' preferences and family "culture") may contribute to explain the use of formal child care for very young children.

In terms of policies implications our empirical results appear to suggest that policies which would reduce the financial burden on the Italian family *and* provide an expansion of the child care system could have a positive impact on the mothers' decision to participate to the labor market.

Table 1: **Effect of child care costs on mothers' labor supply and child care utilization**

<i>Author</i>	<i>Country</i>	<i>Labor supply</i>	<i>Child care use</i>
Blau and Robins 1988	US	negative and significant	negative and significant
Connelly 1992	US	negative and significant	negative and significant
Ribar 1995	US	small, negative and significant	large, negative and significant
Viitanen 2005	UK	negative and significant	negative and significant
Powell 1997	Canada	negative and significant	-
Gustafsson and Stafford 1992	Sweden	sig. only in areas not rationed	sign. only in areas not rationed
Del Boca 1993	Italy	significant only on part time	-
Wroolich 2004	Germany	greater in West Germany	-
Kornstad and Thoresen 2002	Norway	greater in non rationed areas	-
Kreyenfeld and Hank 1999	Germany	not significant	-
Chiuri 2000	Italy	not significant	-
Cobb Clark et al 2000	Australia	not significant	negative and significant

Table 2: **Simulated probabilities of working and using formal child care with and without rationing**

<i>Choice</i>	<i>No Rationing</i>	<i>Rationing</i>
<i>(work and child care)</i>	.454	.191
<i>(work; no child care)</i>	.073	.095
<i>(no work; use child care)</i>	.183	.216
<i>(no work; no child care)</i>	.289	.499

Note: Each cell represents the fraction of households in the population choosing each pair of work/no work and use/not use child care decisions according to the simulation performed.

Table 3 Descriptive Statistics
Means and (Standard Deviations)

<i>Variables</i>	
Employment	44.1 (49.7)
Age of the Wife	32.2 (4.74)
Age of the Husband	35.68 (5.34)
Wife Schooling	10.91 (3.47)
Husband Schooling	10.71 (3.73)
Family non Labor Income (in thousands Euro)	8.74 (2.69)
Husband Labor Income (in thousands Euro)	14.41 (4.24)
Family Transfers	0.11 (0.31)
Parents Alive	0.90 (0.30)
Children aged 4-5	0.14 (0.35)
Children aged 6-13	0.44 (0.65)
Hourly Child Care Costs (only those who pay)	1.45 (2.03)
Part Time (%)	7.27 (1.05)
Unemployment rate (%)	13.26 (6.49)
Regional wage (in thousands Euro)	20.21 (26.64)
Regional subsidies (%)	37.11 (2.27)

Table 4

Employment (E) and Child Care (CC) Decisions				
Variables	Model I		Model II	
	E	CC	E	CC
Hourly CC costs	-.151 (.113)	.004 (.123)	-.126 (.113)	.027 (.121)
NR	.269* (.124)	.082 (.137)	1.002** (.360)	.750* (.331)
Hourly CC costs*NR	-	-	-.447** (.209)	-.407* (.186)
Unemployment rate (UR)	-.053** (.009)	-.020* (.010)	-.053** (.009)	-.019~ (.010)
Hourly CC costs*UR	-	-	-	-
Age of wife	.053** (.014)	.034* (.016)	.051** (.014)	.031* (.015)
Education of wife	.128** (.015)	.018 (.016)	.131** (.016)	.021 (.016)
Age of husband	-.020* (.010)	.002 (.011)	-.020~ (.011)	.002 (.011)
Education of husband	-.002 (.014)	.025~ (.015)	.002 (.015)	.028~ (.016)
Non labor income	.040* (.017)	.019 (.018)	.047** (.017)	.024 (.020)
Husband labor income	.015 (.013)	.003 (.012)	.015 (.011)	.002 (.012)
Family transfers	-.067 (.147)	.410** (.151)	-.060 (.152)	.415** (.150)
Parents alive	.368** (.143)	-.205 (.142)	.342** (.157)	-.225~ (.143)
Children aged 4-5	-.217* (.123)	.311* (.129)	-.213~ (.121)	.308* (.129)
Children aged 6-13	-.130~ (.079)	.086 (.066)	-.126~ (.077)	.091 (.072)
Part time	.022 (.042)	-.108* (.049)	.014 (.045)	-.116** (.049)
Constant	-2.71** (.572)	-1.51* (.635)	-2.71** (.600)	-1.51** (.601)
N cases	1267		1267	
log likelihood	-1321.479		-1371.011	
correlation coefficient (ρ)	.249** (.053)		.238** (.053)	

Note: Asymptotic Standard Errors in Parentheses. Standard errors given in parentheses are computed by bootstrapping with 500 repetitions. Significance levels are indicated with $p < 0.1 = \sim$, $p < 0.05 = *$ and $p < 0.01 = **$.

Table 5 Labor supply simulations

	Country	Baseline	50% subsidy	100% subsidy
Our study	Italy	61.5%	+15.5%	+26.5%
Viitanen (2005)	UK	50.7%	+13.8%	+25%
Wrohlich (2004)	Germany	43% west, 63% in east	-	+3% (west),1.5% (east)
Connelly (1992)	US	58.8%	+5.2%	+9.9%

Table A1 Child care, Part time and Unemployment rates by Region

Regions	Child care	Subsidies	Part Time	Unemployment rate
Piemonte/Valle d'Aosta	8.61	7.5	6.61	7.38
Lombardia	18.85	58.4	7.8	7.4
Trentino	2.09	50	9.7	5.4
Friuli	1.89	42.3	8.7	5.8
Veneto	10.70	55.6	8.9	5.6
Liguria	3.26	41.7	8	7.3
Emilia	13.40	45.7	7.4	5.2
Toscana	8.41	88.9	7.8	8.8
Umbria	2.19	25.0	7.7	8.9
Marche	4.59	16.1	7.5	8.7
Lazio	8.48	11.6	6.5	10.1
Abruzzo	1.40	100	5.7	15.9
Molise	0.17	100	7.0	17.7
Campania	3.39	9.3	5.4	20.7
Puglia	2.43	27.3	6.6	20.2
Basilicata	0.93	40.0	6.1	19.8
Calabria	1.33	22.2	7.6	21.1
Sicilia	5.72	n.r.	7.5	21.5
Sardegna	2.16	22.2	6.7	19.2

Sources: Fondazione degli Innocenti (2002): I servizi educativi per la prima infanzia(columns1 and 2); Istat, Indagine sulle Forze di Lavoro, 1998 (columns 3 and 4, authors' calculations);
Note: The child care has been computed as the fraction of public and private child care centers by region given 100 the total in Italy.

8.1 Appendix 1-

We show here the probabilities associated to the cases other than (1,1) in which we do not know whether the choice is due to the fact that all options are available.

When we observe a household in which the mother is not employed and/or is not using formal child care services, we don't know whether this is due to the fact that all options are available to the household (i.e., both work and formal child care services) and the particular outcome observed yields the highest value in the choice set with four possibilities, or whether it is attributable to the choice set being "restricted." Then we write the probability

$$\begin{aligned}
 p(d_E = 1, d_C = 0|w, Y, \pi_I, \xi) = \\
 P(V(1, 0|S) - V(1, 1|S) > 0, V(1, 0|S) - V(0, 1|S) > 0, V(1, 0|S) - V(0, 0|S) > 0) \\
 \times \theta(X) \times \delta(Z) \\
 + P(V(1, 0|S) - V(0, 0|S) > 0) \times \theta(X) \times (1 - \delta(Z)),
 \end{aligned}$$

where the second and third lines of the expression give the probability that the option (1, 0) is the best in the four element choice set multiplied by the probability that the household faced that choice set and the last line is the probability that (1, 0) was superior to (0, 0) times the probability that the household faced the two element choice set containing $\{(1, 0), (0, 0)\}$.

The probability that the mother does not work but does utilize formal child care is expressed in a similar manner. In this case the mother has the option of formal child care clearly, but we do not know whether she had a job offer or not. The probability of this event is

$$\begin{aligned}
 p(d_E = 0, d_C = 1|w, Y, \pi_I, \xi) = \\
 P(V(0, 1|S) - V(1, 1|S) > 0, V(0, 1|S) - V(1, 0|S) > 0, V(0, 1|S) - V(0, 0|S) > 0) \\
 \times \theta(X) \times \delta(Z) \\
 + P(V(0, 1|S) - V(0, 0|S) > 0) \times (1 - \theta(X)) \times \delta(Z).
 \end{aligned}$$

The situation in which the mother does not work and does not use formal child care, which is the most frequently observed of the four outcomes in the data, has the most complicated expression for its probability since it could have been selected from any of four distinct choice

sets. The probability is

$$\begin{aligned}
& p(d_E = 0, d_C = 0|w, Y, \pi_I, \xi) = \\
& P(V(0, 0|S) - V(1, 1|S) > 0, V(0, 0|S) - V(1, 0|S) > 0, V(0, 0|S) - V(0, 1|S) > 0) \\
& \quad \times \theta(X) \times \delta(Z) \\
& + P(V(0, 0|S) - V(0, 1|S) > 0) \times (1 - \theta(X)) \times \delta(Z) \\
& + P(V(0, 0|S) - V(1, 0|S) > 0) \times \theta(X) \times (1 - \delta(Z)) \\
& + (1 - \theta(X)) \times (1 - \delta(Z)),
\end{aligned}$$

where the last line is the probability that no job or child care slot was availability - in this case, the outcome (0, 0) is the default.

8.2 Appendix 2- Statistical matching

The purpose of this section is to explain how the statistical matching was performed. First, we select married couples with both partners present. Next, we take into consideration only women who are housewives, unemployed, students or employed; in addition, they have to be married to men who are either unemployed, retired or employed.¹⁸ This reduces the sample to 3140 couples belonging to the SHIW survey and to 8347 from the Multiscopo survey. In order to impute non labor household income, the total sample of 11487 households is used. When the labor earnings and hours of work from women and men of the SHIW survey to women of the Multiscopo survey have to be imputed, the statistical matching is realized respectively only on women who work (1122 from the SHIW and 3039 from the Multiscopo) and on men who work (2003 from the SHIW and 5669 from the Multiscopo) to further reduce imprecision.

As a baseline analysis, we compare the averages for all of variables the two surveys have in common. We compute descriptive statistics for women and for men related to selected variables from the two surveys (members, number of children in different age groups, age, education, area of residence).¹⁹

The next step would be to match units from the two surveys, conditional on the common variables X. However, when the vector of common variables is large, this procedure is rather complicate. Rosenbaum and Rubin (1983) suggest that matching can be performed on the propensity score, which is the conditional probability of belonging to a sample, e.g. the

¹⁸We exclude self-employed workers in order to have a more uniform sample for the matching procedure, and retired women because they are not relevant to the problem at hand (child care opportunities for very young children).

¹⁹Descriptive statistics and comparisons are available on request from the authors.

Multiscopo sample. In order to compute the propensity score, we have run a probit regression of the binary indicator taking value 1 for observations in the Multiscopo sample (and 0 for the SHIW sample) over the set of above-mentioned common household characteristics plus some interaction terms.²⁰ Since the propensity score is a continuous variable, exact matches will rarely be achieved and a certain distance between individuals belonging to the two samples has to be allowed. Thus, we choose to use the *radius method of matching*; among the units within the radius, we randomly select one unit, and we repeat this procedure 20 times. The final value of each imputed variables is obtained by averaging the 20 values previously obtained.²¹ After the statistical matching is performed, each individual from the Multiscopo will be imputed the annual labor earnings, the annual hours of work and the household non labor income of a similar individual from the SHIW according to the value of the function of the propensity score.

Finally, we proceed with an internal evaluation of the statistical matching in two steps. First, we compare the average values between the values of the imputed variables after the matching and the corresponding average values in the donor set, i.e. the SHIW sample; then we evaluate the preservation of relations between variables. The results are quite satisfactory since the imputed variables are not statistically different from the original ones in almost all the cases and the differences between the common-fusion correlations in the SHIW data set versus the fused Multiscopo data set seem to be well preserved for most variables (see Del Boca, Locatelli and Vuri 2005 for details).

²⁰The choice of interaction or higher order term to include for estimating the propensity score is determined solely by the need to obtain an estimate of the propensity score that satisfies the *balancing property* (see Dehejia and Wahba, 1999). To build the propensity score we follow the algorithm proposed by Dehejia and Wahba (1998).

²¹The standard errors are computed by bootstrapping.

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