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# Environmental Effects on the Participation and Fertility Decisions of Married Women\*

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## Abstract

Economic models of the household allocation have predicted that increased levels of education and wage rates of women would lead to increases in their labor supply and lower levels of fertility. In international comparisons, however, differences in this pattern appear which cannot easily be explained by the traditional model. In some countries a high fertility rate is observed together with a high female participation rate, while in others, like Italy, low female participation rates are observed together with low birth rates. In this paper several possible explanations for this phenomenon are explored. Our proposed explanations involve institutional characteristics such as rigidities and imperfections in the labor market, the social service system, and the housing market. We will provide empirical evidence of the effects of some of these institutional characteristics on labor supply and fertility using panel data from the Bank of Italy.

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## 1. Introduction

The costs of children consist of expenditures for market goods and the opportunity costs of the time spent for child care (see Becker 1981, Cigno, 1991). Assuming that children are not inferior goods, the demand for quantity as well as quality increases with the household's non-labor income. When husbands are not involved in child care activities [as time-providers], an increase in the husband's wage has the same positive effect on the demand for the quantity and quality of children as an increase in non-labor income. Because the wife typically supplies substantial amounts of time to child care activities, an increase in her wage increases household demand for child quantity and quality though an income effect but decreases in demand result from increases in her time cost of child care. One of the main implications of microeconomic models of time allocation in the household is that increases in the wage rates of women should lead to increasing female labor market participation rates and decreasing fertility rates.

In almost all industrialized countries a rise in female participation and a decline in birth rates have been observed in the last few decades. Figure 1 shows that the total fertility rate in OECD countries decreased from 2.45 to 1.63 while the average female participation rate increased from 44.1 to 60.8 percent. However, in Italy (as in other Mediterranean countries such as Spain and Greece), fertility has declined dramatically while increases in participation rates have been modest. Time series evidence shows that, while in the U.S., Sweden, Denmark, and Norway (countries with high female participation) the total fertility rate recovered after 1990, in Italy as in Spain and Greece, (countries with low participation) the decline has been monotonic (Fig 2). Clearly these differences in the evolution of fertility and the female participation rates drove the reversal of the cross-sectional correlation between them (Ermisch, 1989, Hotz et al 1997). In Italy (as well as in the other Southern European countries) a positive relationship now characterizes fertility and female participation at the individual level

Table 1 shows that in Italy (as in Spain and Greece) the fertility rates *and* the participation rates are relatively lower than in other countries.

**Table 1**  
**Participation and Fertility rates 1996**

<b>Country</b>	<b>LFP</b>	<b>Birth rates</b>
<i>Italy</i>	.44	1.2
<i>France</i>	.56	1.8
<i>Greece</i>	.36	1.3
<i>Spain</i>	.44	1.2
<i>Great Britain</i>	.65	1.8
<i>Sweden</i>	.81	1.9

Sources: OECD (Labour Force Statistics) and Eurostat, 1997

We will explore several possible interpretations for this phenomenon. Our proposed explanations involve institutional characteristics such as rigidities and imperfections in the labor market, the social service system, and the housing market. In regards to the labor market, the work rules and wage-policies implemented during the seventies and eighties have served to increase job security and reduce male/female wage differentials. On the other hand, they increase the costs of finding temporary or part-time employment [the type of job options of particular interest to married women]. As a consequence, married women who work will tend to have full-time work commitments incompatible with child-care responsibilities while married women who are not employed will tend to limit fertility due to insufficient family financial resources. Another consequence of the high costs of entry and the low demand for part-time jobs is the high unemployment rate of the youth which contributes to their economic dependency on the family.

In regards to the social service system, married women have high costs of labor market participation due to the lack of synchronization of public child care, school, and employment hours. These institutions were developed in an era when the wife did not participate in the labor market and organized all family activities. They are evolving slowly over time and continue to serve as a disincentive to the labor market participation of wives.

Characteristics of the Italian housing market, most importantly strict limitations on the size and duration of mortgages, have resulted in parents largely assuming responsibility for providing housing for their mature children. A large proportion of young couples purchasing homes rely on family loans or receive the house as a gift or bequest. Italian children live with their families longer than in any other developed country.

The financial burden associated with having children in Italian families is not only larger than in other countries, but also lasts for a longer period of time, creating additional demands on women's time. The characteristics of the choice set facing Italian families bias demand toward children's quality and away from quantity. Several institutional rigidities essentially necessitate high investments in children, increasing their costs and reducing the number of children the Italian family can afford to have.

In light of these considerations we will include other factors in the determination of labor participation and fertility besides traditional individual-specific determinants of prices and income. In this paper I will provide empirical evidence, using data from the Bank of Italy survey (SHIW), on the effects of several aspects of institutional characteristics on women's decisions regarding working and having children. In Section 2 we discuss some of the empirical literature on fertility and participation decisions which uses Italian data. Section 3 describes several types of market rigidities in Italy, namely, the nature of employment contracts, publicly-provided services which impact the cost of children, and the credit market. In Section 4 we discuss the characteristics of the econometric model we will use in the empirical analysis. Section 5 provides a description of the sample used in the empirical analysis and variables and a discussion of the empirical results, and Section 6 provides some closing remarks.

## **2. The Literature**

In the last few years there has been an increasing interest in the role of the Italian family in supporting their members in circumventing difficulties deriving from market limitations and imperfections.

As is well-known, the Italian labor market is one of the most regulated in the OECD. Del Boca (1997) analyzed the relationship between institutional characteristics of the Italian labor market and unemployment experiences of various subpopulations. Trade union policies have increased job security for the male heads of households but limited the possibilities of entry for first job seekers. The high incidence of long-term unemployment among first job seekers may have added an additional negative influence on fertility beside the income effect for households in which the husbands is unemployed. The feelings of uncertainty associated to long term unemployment among first job seekers could also be an important factor in discouraging fertility (Bettio and Villa 1998).

On one hand a high proportion of the youth unemployment rate concerns women, who may feel worried about future job opportunities in presence of children, on the other hand unemployment children unemployment adds financial burden on the family. Belli (1997) analyzed how the Italian family compensate

for the job rationing, providing income support for the children during the period of unemployment and helping actively in their job search.

Another characteristic of the Italian labor market which directly impacts married women's choices sources stems from the limited development of the service sector. Since women are disproportionately represented in service-sector jobs in OECD countries, this property reduces both the demand and the supply of female labor

The characteristics of the service sector are also relevant. Del Boca (1993) analyzed the characteristics of the supply of public child care. These services are typically inexpensive, though capacity, in terms of number of children and hours per child, is extremely limited. This makes the service compatible with mothers' part-time but not with full-time work (which are the only types of jobs available). The analysis of the relationship between child care costs and labor supply shows that a reduction in child care costs increases only the probability of mothers' part-time employment. On the other hand, the presence of another adult in the family significantly increases the probability of the mother's working full time.

In some sense, it appears that Italy is stuck in a "low female participation rate" equilibrium in which one of the major reasons for low participation rates is the mismatch between the types of jobs sought by married women with children and the types of jobs offered. It would appear that this imbalance could be addressed by increasing private provision of child care, which would simultaneously increase job opportunities for women and reduce the costs of taking full-time jobs. For a variety of reasons, almost all of which are related to labor market regulation, the state retains a virtual monopoly in the provision of these types of services.

Several limitations also characterize the credit market. The mortgage market is very small, partially because the maximum amount which can be financed is quite limited as is the duration of the loan. Del Boca and Lusardi (1996) have shown that Italian households in the period 1987-1993 have overcome financial market limitations and the high burden of the mortgage debt repayment by increasing wives's labor supply. Imperfections in the Italian credit market such as strict limitations on the size and duration of mortgages, have also resulted in parents largely assuming responsibility for providing loans also for housing purchases (Guiso and Iappelli 1995, Della Zuanna 1995, Cigno et al 1997, Barbagli and Saraceno 1997).

In addition to financial transfers from parents to their adult children, parents also provide support by having their mature children live in their household. Italian children live with their families longer than in any other developed country (Della Zuanna 1995, Giannelli and Monfardini 1998, Ongaro 1998). The financial burden associated with having children in Italian families is not only larger

than in other countries, but also lasts for a longer period of time, during which the family supports the adult children in their search for a stable job and as they make human capital investments.

### **3. Institutional rigidities in Italy**

In spite of recent institutional changes, the Italian labor market still remains a highly regulated one. Eurostat (1995) provides a ranking from 0 to 10 measuring the degree of labour market regulations and reports that Italy is the highest [8] relative to Great Britain and the U.S. [0], Germany [5], France [6], and Sweden [4]. Strict rules apply about hiring and firing workers and types of employment arrangements.

The hiring system and the high entry-wage severely restrict employment opportunities for labor market entrants. In spite of recent changes towards a more flexible system [which took place during the 1990s], Italy is still the only European country where job placement is a state monopoly and private employment agencies are banned. As a consequence an informal network as a source of recruitment has been developed: according to the recent Bank of Italy Survey data in 1995, over 50% of all hiring have been obtained through friends and relatives.

The firing rules are also very strict. Severance payments are very high and redundancy is not explicitly mentioned as a just cause: the penalty for employers in case of "unfair" dismissal is very high [rehire and compensate]. Because of the high costs of hiring and firing, employers tend to use overtime instead of hiring new workers when demand increases. When the regulations on overtime were relaxed the use of overtime increased significantly, partly reflecting the decline of the power of the unions.

Another important aspect of the rigidity of the labor market is the menu of available employment arrangements. While the contract of indefinite duration has been the norm in Europe, during the last fifteen years a number of flexible contractual forms have developed, such as fixed term or part-time work, temporary work, overtime and work-sharing. In Italy the process towards a more flexible system started later and has been much slower given the strong opposition of unions. The Italian unions have opposed different employment contracts fearing that potential division of the workers force could reduce the workers' cohesion. Current regulations still make the employment of two part-time workers more costly than one full time. Italian women would prefer to work part-time: recent surveys at different points of time and different areas of the country have reported similar results (Del Boca 1993). More than half of women who were not employed at the time of the interview would like to work, but with a flexible or part-time schedule, and a great proportion of the women who already work would prefer to

work fewer hours. Tab.2 shows the low percentage of part-time work and female employment rate relative to other European countries.

**Table 2**  
**Part-time and Female Employment**

<b>Country</b>	<b>% Part-time</b>	<b>%Female Employment</b>
<i>Italy</i>	6.1	28.9
<i>France</i>	12.0	41.5
<i>Greece</i>	6.1	30.9
Denmark	22.8	53.8
Spain	10.5	25.5
<i>Sweden</i>	24.0	52.4

Eurostat labor Force Statistics 1997

The highly protective regulations have made female labor more costly relative to male labor, reducing the incentive for employers to hire them. Employers have preferred male workers, both because they are less expensive (do not receive maternity benefits) and are more likely to work overtime (Del Boca 1995). These regulations have been largely responsible for the high unemployment rates of women and youth, which increase the economic burdens on the family.

**Table 3**  
**Long-Term Youth Unemployed**

<b>Country</b>	<b>Long term Unemployed</b>
<i>Italy</i>	63.4
<i>France</i>	23.7
<i>Sweden</i>	
<i>Denmark</i>	9,3
<i>Greece</i>	49,8
<i>Spain</i>	45,7

Source: Eurostat Labor Force Survey 1997

The Italian unemployment rate is the highest among industrialized countries especially the long-term unemployment. The evidence related to the unemployment rate by family composition also shows a particular position of Italian and the other mediterranean countries. Table 4 shows that in Italy the unemployment rate of children is much higher than in the countries (such as Germany, France, Great Britain) indicating a concentration of unemployment on younger component of the labor force.

**Table 4**  
**Unemployment rate by Family Position 1995**

<b>Country</b>	<b>Head</b>	<b>Children</b>	<b>Wife</b>	<b>Other</b>
<i>Italy</i>	17.7	60.9	18.0	3.4
<i>Germany</i>	50.0	12.7	19.5	4.8
<i>Greece</i>	22.9	51.5	23.2	3.5
<i>Spain</i>	24.6	51.5	29.5	4.8
<i>France</i>	40.8	23.3	32.2	3.5
<i>Sweden</i>				
<i>Great Britain</i>	55.1	24.9	55.1	24.9

Eurostat Labor Force Statistics 1996

The proportion of unemployed children receiving unemployment benefits is very low in Italy (17.7), Greece (5.43) and Spain (18.7), while is much higher in Germany, France, Denmark (35-55%).

Another source of rigidity concerns the Italian child care sector, which is largely subsidized but characterized by extreme rigidity in the weekly hours and frequent interruptions. This makes the service compatible with part-time work but not with full-time activities. The school hours are also limited to half-day while in most countries are extended to full day. In Italy the percentage of children less than 3 who are in child care is quite small. The child care system shows strong geographical differences. The proportion of children between 0 and 3 years of age in public child care is about 30% in some areas of the North and only 1-2 % in most Southern areas (number of places available to the population 0-3 years of age) .

**Table 5**  
**Children 0-3 yrs in public child care**

Country	Percentage
<i>Italy</i>	6
<i>Denmark</i>	30.7
<i>Spain</i>	10
<i>France</i>	23.1
<i>Greece</i>	5
<i>Sweden</i>	33.9

Source: E. C. Network on Child Care 1995

Other sources of rigidities lie in the credit market. The mortgage market is very small, its duration is on average much shorter than elsewhere, and the ratio of the downpayment required to the house value is very high. The duration of the mortgage loans is on average 10-15 while it 25-30 years in the US, Sweden and the UK. The down-payment ratio for housing mortgage loans is still around 30-40 while it is around 80-90 per cent in most other advanced countries. These limitations have reduced the options of younger households to buy: the proportion of younger household (under 29 years of age) who own their house is smaller than in other selected countries. It is only 25 per cent in Italy, while it is between 45 and 50 per cent in other advanced countries (Del Boca Lusardi 1996).

The Italian family has compensated for the financial market rigidities in various ways, creating alternative informal markets Guiso and Jappelli (1991,1995) have shown that intergenerational family transfers compensate borrowing constraints for young cohorts. Transfers contribute to shorten the saving period to buy a house, reducing the intertemporal distortion induced by mortgage market imperfections. Other behavior is modified in order to overcome liquidity constraints and increase savings: living longer with their parents. The proportion of children over 20 living with their parents is much higher than in other advanced countries.

**Table 6**  
**Percentage of Children 20-29 living with their Parents**  
**1987 and 1995**

Countries	1987	1995
Italy	60	71
Denmark	32	29
GB	30	31
Greece	41	49
Spain	49	59
Sweden	28	26

Sources: Eurostat 1997

Table 6 shows the proportion of children 20-29 living with their parents in 1987 and 1995. The proportion is very high in Italy,(as well as in Greece and Spain) and has increased during the period of observation, while it is much lower in the other countries and tends to decrease. Table 7 shows evidence regarding the proportion of children between 20-29 years of age who are employed and the proportion who are economically dependent from their families. Italy is ranked the lowest for the employment rate and ranked the highest for the dependency rate (followed by Spain and Greece).

**Table 7**  
**Employment Rate and Dependency of Children 20-29**

Countries	Emp- rate	Econ. Dep
<i>Italy</i>	42.2	67.6
<i>Denmark</i>	63.4	18.7
<i>Great Britain</i>	66.4	17.3
<i>Greece</i>	44.3	50.9
<i>Spain</i>	38.3	62.4

Source: Eurostat Labor Force Statistics 1997

In the next sections, we empirically analyze the determinants of fertility and female labor supply in a model which takes into account not only prices and incomes, but also some relevant aspects of family support as well as some aspects of the institutional environment.

#### 4.

## The Econometric Model

In this section we conduct an empirical analysis of women's participation to the labor market and fertility.

Let individual  $i$  experience the event in period  $t$  with probability given by

$$p(d_{it} = 1|X_{it}, \eta_i) = \frac{\exp(X_{it}\beta + \eta_i)}{1 + \exp(X_{it}\beta + \eta_i)}, \quad i = 1, \dots, N; \quad t = 1, \dots, T;$$

where  $X_{it}$  is a  $(1 \times k)$  vector of covariates associated with individual  $i$  in period  $t$ ,  $\beta$  is an (unknown) associated  $(k \times 1)$  parameter vector, and  $\eta_i$  is an individual-specific, time-invariant error term which is unobservable to the analyst. Since the probability that an individual experiences the event in any period  $t$ , conditional on  $X_{it}$  and  $\eta_i$  is independent of the probability that she experiences the event in any other combination of periods, the probability of any given sequence  $d_{i1}, \dots, d_{iT}$  given  $X_i \equiv (X_{i1}, \dots, X_{iT})$  and  $\eta_i$  is

$$p(d_{i1}, \dots, d_{iT}|X_i, \eta_i) = \frac{\prod_{t=1}^T \exp[d_{it}(X_{it}\beta + \eta_i)]}{F_i}, \quad (4.1)$$

where  $F_i = \prod_{t=1}^T [1 + \exp(X_{it}\beta + \eta_i)]$ .

The form of the dependence between the scalar random variable  $\eta_i$  and the covariates  $X_i$  is not specified. The estimator for  $\beta$  proposed by Chamberlain is consistent no matter what the form of the conditional distribution of  $\eta_i|X_i$ . The idea behind the estimator is to find distributions of the data which are functions only of  $\beta$  and not the problematic  $\eta_1, \dots, \eta_N$ . Define the total number of periods in which the individual experiences the event by  $D_i = \sum_{t=1}^T d_{it}$ . First, consider the event  $D_i = 1$ . The probability that  $D_i = 1$  is given by

$$p(D_i = 1|X_i, \eta_i) = F_i^{-1}[\exp(X_{i1}\beta + \eta_i) + \dots + \exp(X_{iT}\beta + \eta_i)].$$

This expression is the probability that the individual experiences the event in period one but not in the other periods plus the probability that the individual experiences the event in period two but not in the other periods, and so on. Now given that  $D_i = 1$ , the conditional probability that the individual experiences the event in period  $t$  is

$$\begin{aligned} p(d_{it} = 1, d_{is} = 0, \forall s \neq t | D_i = 1, X_{it}, \eta_i) &= \frac{p(d_{it} = 1|X_{it}, \eta_i) \prod_{s \neq t} p(d_{is} = 0|X_{is}, \eta_i)}{p(D_i = 1|X_i, \eta_i)} \\ &= \frac{\exp(X_{it}\beta + \eta_i)}{F_i} \\ &= \frac{\sum_{s=1}^T \exp(X_{is}\beta + \eta_i)}{F_i} \end{aligned}$$

$$\begin{aligned}
&= \frac{\exp(\eta_i) \exp(X_{it}\beta)}{\exp(\eta_i) \sum_{s=1}^T \exp(X_{is}\beta)} \\
&= \frac{1}{1 + \sum_{s \neq t} \exp((X_{is} - X_{it})\beta)}.
\end{aligned}$$

Now consider the case for which  $D_i = 2$ , assuming that  $T > 2$ . The probability that the individual experiences the event in periods  $t$  and periods  $t'$  but not in any other period is given by

$$p(d_{it} = 1, d_{it'} = 1, d_{is} = 0 \forall s \neq t, t' | X_i, \eta_i) = F_i^{-1} [\exp(X_{it}\beta + \eta_i) \times \exp(X_{it'}\beta + \eta_i)].$$

The probability that individual  $i$  experiences the event in exactly two of the periods is given by

$$p(D_i = 2 | X_i, \eta_i) = F_i^{-1} \left[ \sum_{j=1}^T \sum_{k>j}^T [\exp(X_{ij}\beta + \eta_i) \times \exp(X_{ik}\beta + \eta_i)], \right]$$

which is the sum of the probabilities of the  $T(T-1)/2$  ways in which the event can occur twice in  $T$  periods. Then the conditional probability that the individual experienced the event in period  $t$  and period  $t'$  given that she experienced the event twice in  $T$  periods is

$$\begin{aligned}
p(d_{it} = 1, d_{it'} = 1, d_{is} = 0 \forall s \neq t, t' | D_i = 2, X_i, \eta_i) &= \frac{\exp(X_{it}\beta + \eta_i) \exp(X_{it'}\beta + \eta_i)}{F_i} \\
&= \frac{\sum_{j=1}^T \sum_{k>j}^T [\exp(X_{ij}\beta + \eta_i) \times \exp(X_{ik}\beta + \eta_i)]}{F_i} \\
&= \frac{\exp(2\eta_i) \exp(X_{it}\beta) \exp(X_{it'}\beta)}{\exp(2\eta_i) \sum_{j=1}^T \sum_{k>j}^T [\exp(X_{ij}\beta) \times \exp(X_{ik}\beta)]} \\
&= \frac{\exp([X_{it} + X_{it'}]\beta)}{\sum_{j=1}^T \sum_{k>j}^T \exp([X_{ij} + X_{ik}]\beta)} \\
&= \frac{1}{\sum_{j=1}^T \sum_{k>j}^T \exp([(X_{ij} + X_{ik}) - (X_{it} + X_{it'})]\beta)}.
\end{aligned}$$

This conditioning method to eliminate the fixed effects can be used for any set  $D$  which is greater than 0 and less than  $T$ . In particular, let  $D_i = k$ ,  $1 \leq k < T$ , and let  $E_i = (e_{i1}, \dots, e_{ik})$ , where the  $\{e_i\}$  denote the  $k$  time periods in which individual  $i$  experiences the event. Then we have that

$$\begin{aligned}
p(d_{ie_{i1}} = 1, \dots, d_{ie_{ik}} = 1, d_{is} = 0, s \notin E_i | D_i = k, X_i, \eta_i) &= \frac{1}{\exp(\sum_{j_1=1}^{T-k} \sum_{j_2>j_1}^{T-(k-1)} \dots \sum_{j_k>j_{k-1}}^T \{(X_{ij_1} + X_{ij_2} + \dots + X_{ij_k}) - \sum_{t \in E_i} X_{it}\} \beta)} \quad (4.2)
\end{aligned}$$

In our application, we actually are modeling two decisions simultaneously, the participation decision and the fertility decision. Let  $d_{it}^j$  be an indicator variable which takes the value 1 for individual  $i$  in period  $t$  if event  $j$  is observed, where  $j = f$  for a birth and  $j = p$  for labor market participation. We specify the probability that  $d_{it}^f = 1$  and  $d_{it}^p = 1$  as

$$\begin{aligned} p(d_{it}^f = 1, d_{it}^p = 1 | X_{it}^f, X_{it}^p, \eta_i^f, \eta_i^p) &= p(d_{it}^f = 1 | X_{it}^f, \eta_i^f) p(d_{it}^p = 1 | X_{it}^p, \eta_i^p) \\ &= \frac{\exp(X_{it}^f \beta_f + \eta_i^f)}{1 + \exp(X_{it}^f \beta_f + \eta_i^f)} \times \frac{\exp(X_{it}^p \beta_p + \eta_i^p)}{1 + \exp(X_{it}^p \beta_p + \eta_i^p)}, \end{aligned}$$

where  $X_{it}^j$  are the exogenous variables in the index function for decision  $j$ ,  $\beta_j$  is the coefficient vector associated with the exogenous variables  $X_{it}^j$ , and  $\eta_i^j$  is the individual specific constant term in the index function for decision  $j$ . Just as we do not restrict the form of dependence between  $X_{it}^j$  and  $\eta_i^j$ , we also do not make any assumption concerning the relationship between  $\eta_i^f$  and  $\eta_i^p$ . Given the independence of the decisions  $f$  and  $p$  conditional on the  $X$ 's and the  $\eta$ 's, and given that the fixed effects estimator defined below conditions on the  $X$ 's and eliminates the  $\eta$ 's, the estimator for each decision  $j$  is independent of the estimator for the decision  $j'$ .

Thus we are able to consistently estimate  $\beta_j$  using only the information on the outcomes  $d^j$  and the  $X^j$ , even though the probabilistic model allows for relatively general forms of dependence between the fertility and the participation decision. The brief discussion of the fixed effects estimator which follows thus considers the univariate choice problem without any loss of generality.

This simple functional form can be used to build likelihood functions which yield consistent maximum likelihood estimators of identified elements of  $\beta$  for each  $D$  between 1 and  $T - 1$ . In our application of the fixed effects logit estimator,  $T$  is at most equal to 3. In this case, subsamples of individuals who experience the event once or twice can be used to estimate  $\beta$  consistently using this method. Let the subsample for which  $D_i = 1$  be denoted by  $S_1$  and let  $S_2$  denote the subset of sample members for which  $D_i = 2$ . Then we define the conditional maximum likelihood estimator as

$$\hat{\beta}_c = \arg \max_{\beta} \{L_1(\beta) + L_2(\beta)\},$$

where

$$L_1(\beta) = \sum_{i \in S_1} \sum_{t=1}^3 d_{it} \left\{ -\ln \left( 1 + \sum_{s \neq t} \exp[(X_{is} - X_{it})\beta] \right) \right\}$$

and

$$L_2(\beta) = \sum_{i \in S_2} \sum_{t=1}^2 \sum_{t' > t}^3 d_{it} d_{it'} \left\{ -\ln \left( \sum_{j=1}^2 \sum_{k > j}^3 \exp([(X_{ij} + X_{ik}) - (X_{it} + X_{it'})]\beta) \right) \right\}.$$

Chamberlain proved that the conditional likelihood estimator is consistent and asymptotically normally distributed under standard regularity conditions.

We also report the results of some tests of a specification which does not include either of the individual specific constants  $\eta_i^f$  and  $\eta_i^p$ . In this case cross sectional logit estimators for each decision independently will be consistent for  $\beta_j$ . Standard “Hausman” tests are used to test the the fixed effect logit structure against the cross-sectional logit structure [i.e., the model without the  $\eta_i^f$  and  $\eta_i^p$ ].

In addition to implementing the conditional likelihood estimator we also present estimates and specification test results based on cross-sectional logit specifications. When estimating the logit models, the entire available sample for each year is used. Besides being based on much larger samples, the cross-sectional logit estimator yields coefficient estimates for each variable in the appearing in the index function, even those with values which are time-invariant for each individual. The test results apply to the null hypothesis that the individual effects are identically equal to 0 in each equation and for all individuals. Results appear in Tables 9 and 10.

## 5. Data and Empirical Results

The empirical analysis utilizes a three-year panel from the Bank of Italy’s Survey of Household Income and Wealth (1991-1995). The survey is conducted every two years by the Bank of Italy and contains detailed information on the incomes and wealth of family members, several characteristics of the workplace (such as wages and hours of work), and socio-demographic characteristics of the households (age of the members of the family and the number of children). The sample design of the Bank of Italy panel, which is somewhat unorthodox, is described in detail in Cannari and D’Alessio (1993), and Trivellato (1997).

As was pointed out in the last section, using a fixed effects logit estimator with panel data allows us to isolate the effects of a subset of the variables included in the analysis on the probabilities of work and fertility allowing for unobserved individual-specific effects which have an unrestricted relationship to the included regressors. Using the conditional likelihood approach means that we can only identify the coefficients associated with time-varying [at the individual level] regressors. Our conditional maximum likelihood estimators are consistent no matter what the form of the dependence between and individual’s characteristics and the value of her unobserved “type,” but will also be consistent if the “error terms” are correlated across sample members in any manner (Moulton 1990).

For purposes of our analysis of fertility and labor market participation we have selected cases of married women in the age range 21-45 in order to exclude those who might be enrolled in school or of retirement age. For the analysis of fertility,

we wanted to ensure that women included in the final sample would have a high probability of being fecund. The sample size after excluding women who didn't meet the age criteria or who had missing information on the variables included in the analysis was 1708.

In order to use the conditional likelihood estimator we need to limit our analysis to the women who changed states over the observation period. For the participation analysis, this sample includes wives who worked at least one period and less than three periods (227 women). For the fertility analysis, women who had had a least one birth and less than three in the three periods numbered 201. The dependent variables are whether the wife work is working at the time of the interview and whether or not she had a child in the last two years. For each sample member, we have three observations on each of the two dependent variables.

Only a few of the independent variables are not time-invariant: We include in our analysis variables related to:

**Personal Characteristics:** Wife age, family income (total income minus wife's labor earnings), and the number of children living with the family.

**Family Support:** Variable indicating the transfer the family has received from relatives during the year of the interview as well as a dummy variable indicating whether one of the parent is still alive.

In order to measure the impact of rigidities of the aggregate market and publicly-provided goods on household decisions we have merged our panel data with regional characteristics of child care facilities, credit markets, and labor markets.

As indicators of environmental characteristics, we have introduced the following variables:

**Credit Market :** Interest rate on mortgage loans by region.

**Child Care System:** As an indicator of the characteristics of the child care system, we use the ratio of the number of child care places available (for children < 3 years of age) to the number of children < 3 years of age by area of residence in 1991, 1993, and 1995.

**Labor Market:** As an indicator of available employment arrangements we use the ratio of the number of part-time jobs to total employment by region

Table 8 reports descriptive statistics for the variables used in the empirical analysis for the three years we have considered. The evidence from these data are in accordance with the premises of our earlier arguments. Fertility rates (the proportion of women who had a child in each of the three two-year periods) are very low and tend to decline over 1991-1995. Participation (proportion of women working) also declines over the period (from .48 to .47). The number of children living with the family is only 1.6 and increases to 1.7 in 1995. The amount of transfer does not change much during the period (about 4 millions when they

receive it). The proportion of households in which one of the parent is still alive is 88 per cent and decreases slightly during the period.

We also present the means and standard deviations of the “environmental” data by region. It shows that there exists quite a remarkable variability in child care availability across regions, with a far higher supply of facilities in the Northern regions compared with Southern regions. . Part-time employment shows much less variability and does not appear to be significantly different in the North and South. Interest rates on family debts show a greater variability over the period that can be explained with the entry of foreign banks in Italy offering mortgage loans at more affordable rates.

In the empirical analysis we use a dummy variable for participation given the limited choices women [and men] face with respect to choice of hours. Recent studies have shown that the relevant decision for women’s participation in Italy is a binary one: to work full time or not work at all rather than how many hours to work (Colombino and Del Boca, 1990).

In addition to implementing the conditional likelihood estimator we also present estimates and specification test results based on cross-sectional logit specifications. When estimating the logit models, the entire available sample for each year is used. Besides being based on much larger samples, the cross-sectional logit estimator yields coefficient estimates for each variable in the appearing in the index function, even those with values which are time-invariant for each individual. The test results apply to the null hypothesis that the individual effects are identically equal to 0 in each equation and for all individuals. Results appear in Tables 9 and 10.

The signs of the estimates of comparable parameters are often similar between the cross-sectional logit and conditional likelihood estimators. The signs of the estimates of the personal characteristics obtained in our panel estimation conform to other results reported in the recent literature on fertility and labor force participation using cross section data (Colombino and Di Tommaso, 1996; Del Boca, 1997). The wife’s age has a negative effect on participation and fertility. Family income has a negative effect on the probability of working and a positive effect on fertility. Wife’s schooling has a positive effect on participation and fertility. The positive effect of wife’s schooling on fertility can be interpreted as permanent income effect, given that father’s education is not included in the analysis (assortative mating).

The number of children has a negative effect on participation (not significant however). In other research we have shown that the participation probability decreased significantly in the presence of two or more children (Del Boca 1997). The variable that we have introduced as an indicator of family support (which is here the amount of family transfers) has a positive effect on the likelihood of

both events. Transfer recipients are on average younger, have lower income than households who do not receive transfers. Studies on intergenerational transfers have shown that transfer recipients are also more likely to be denied credit than the rest of the population (50 per cent of transfer recipients have been denied credit from the financial institutions) confirming an important role for the family as a system of household finance (Guiso and Iappelli 1991). The positive effect of transfer on fertility has also an interpretation related to the characteristics of the transfers. Given that most transfers go from the parents to the children, transfers are more likely to increase with the number of children confirming other empirical results that show that relatives are more likely to transfer money to families with children (Mayer and Engelhardt 1994).

We have analyzed the effect of other indicators of potential family support such as the presence of at one parent of the wife. We believe that this variable can be interpreted as indicating a potential opportunity for child care in conditions of limited public child care facilities. While the fact that at least one of the parent is still alive has a positive effect on participation while effect on fertility is positive but less significant.

We now examine the effect of environmental characteristics. The coefficient associated with the regional variable indicating child care availability is positive in both equations, but is significant only on women participation. The estimate of the effect of the availability of part-time jobs is also positive in both equations. The regional interest rate has negative signs on both the probability of working and having children, even if is not significant. These results seem to indicate that participation and fertility are influenced by similar factors. They are both positively related to the likelihood of support from the family network and opportunities of child care services and more flexible employment arrangements in the local labor market.

## 6. Conclusions

We have extended the standard labor supply model to include several variables reflecting variables indicating family support as well as institutional characteristics of the Italian labor market, housing market and child care system, in order to take into account relevant constraints that Italian households have to face in their labor market and fertility decisions.

Our results indicate that labor force participation and fertility decisions are both affected by similar forces. While the decisions to work and have a child are negatively affected by the high rates of interest on family debt, they are positively influenced by the available supply of public child care. The availability of family support, both in the form of transfers than in the form of presence of parents

increases both the probability of market work and having children.

Policies which would reduce the financial burden on the Italian family by providing more flexible working hours choices for working mothers, looser restrictions on family loans, an expansion of the child care system could contribute to reducing the financial burden on the Italian family and have a positive effect on *both* women's employment and fertility.

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**Table 8**  
**Descriptive Statistics of Variables**  
**(Means and Standard Deviations)**

<b>Variables</b>	<b>1991</b>	<b>1993</b>	<b>1995</b>	
Fertility	.099 (.262)	.095 (.261)	.094 (.325)	
Participation	48.5 (.371)	48.0 (.367)	47.8 (.377)	
Family Income	42.535 (26.587)	45.490 (27.603)	46.876 (35.889)	
Age of the Wife	34 (12.5)	36 (12.5)	38 (12.4)	
Family Loans <i>positive values</i>	4536 (1584)	3149 (1067)	4232 (1856)	
Number of Children	1.58 (1.10)	1.63 (1.11)	1.76 (1.12)	(7.1)
Wife Schooling	10.33 (4.40)	10.44 (4.5)	10.43 (4.40)	
Child Care	8.90 (.7.6)	9.43 (7.7)	10.33 (7.8)	
Parents Alive	88.5 (37.6)	87.7 (37.7)	86.2 (37.7)	
Interest Rate	15.0 (1.20)	14.51 (2.9)	14.06 (3.78)	
Part time	6.78 (4.56)	6.88 (4.77)	7.00 (4.78)	

**Table 9**  
**Participation Probabilities**

Variable	FE	CS-1991	CS-1993	CS-1995
Income	-.068 (.045)	.192 (.032)	-.225 (.031)	.049 (.022)
# Children	-.075 (.187)	-.059 (.061)	-.117 (.070)	-.051 (.064)
Interest Rate	-.033 (.023)	-.059 (.064)	-.126 (.067)	.025 (.049)
Family Loans	.062 (.032)	.111 (.040)	.113 (.017)	.081 (.030)
Age	-.105 (.077)	-.062 (.006)	-.061 (.006)	-.079 (.006)
Child Care	.040 (.024)	.046 (.010)	.050 (.012)	.052 (.010)
Part-Time	.033 (.014)	.056 (.020)	.023 (.062)	.034 (.011)
Schooling	-	.165 (.016)	.233 (.017)	.122 (.016)
Parents alive	.022 (.010)	.034 (.021)	.045 (.023)	.047 (.028)
		4.506 (3.216)	4.906 (3.236)	4.771 (2.896)
Spec. Test		107.165 ( $p < .0001$ )	Not Avail.	20.560 ( $p < .003$ )

**Table 10**  
**Fertility Probabilities**

Variable	FE	CS-1991	CS-1993	CS-1995
Income	.069 (.051)	.024 (.043)	-.024 (.072)	-.015 (.054)
Interest rate	-.095 (.107)	-.068 (.115)	-.032 (.148)	-.003 (.102)
Family Transfers	.039 (.020)	.061 (.038)	.052 (.025)	.034 (.018)
Age	-.077 (.035)	-.169 (.017)	-.269 (.031)	-.240 (.025)
Child Care	.057 (.036)	-.042 (.030)	.022 (.028)	-.011 (.023)
Part-Time	.065 (.035)	.056 (.040)	.031 (.011)	.044 (.023)
Schooling	-	.045 (.029)	.042 (.040)	.089 (.037)
Parents Alive	.027 (.018)	.293 (.018)	.270 (.112)	.489 (.335)
Constant		4.506 (2.236)	5.829 (2.901)	5.586 (2.078)
Spec. Test		Not Avail	17.963 ( $p < .003$ )	45.829 ( $p < .0001$ )

**Table 11**  
**Child care, Part Time, Fertility, Participation by Region 1995**

Variable	Child Care	Part Time	Participation	Fertility
Piemonte	18.1	6.8	33.7	1.05
V. Aosta	14.0	6.8	39.0	1.03
Lombardia	17.9	7.1	33.9	1.11
Trentino	13.7	8.0	34.1	1.37
Friuli-Veneto	9.9	7.0	31.8	1.10
Liguria	10.1	6.5	28.2	0.97
Emilia	30.0	7.3	36.9	0.98
Toscana	12.2	7.5	32.9	1.03
Umbria	11.9	7.1	29.8	1.12
Marche	13.5	5.6	32.4	1.14
Lazio	10.2	5.9	28.1	1.22
Abruzzo	7.0	5.4	27.0	1.31
Molise	2.4	3.9	29.6	1.34
Campania	1.0	4.7	22.9	1.60
Puglia	4.0	6.5	20.7	1.50
Basilicata	5.8	6.0	23.8	1.40
Calabria	1.3	6.91	24.5	1.50
Sicilia	3.4	6.7	19.2	1.65
Sardegna	5.8	6.3	24.9	1.18