Women's employment around childbirth

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Abstract

We model the decisions of pre-fertility participation, fertility and after-childbirth participation of married Italian women selected in year 1998 from the sample of the Bank of Italy Survey on Household Income and Wealth (SHIW). We estimate the probability of having a child conditional on both labour market participation and non-labour market participation the year before childbirth as well as the probability of participation two years after childbirth. We control for the correlation between unobserved individual characteristics affecting both the probability of having a job, the probability of having a child and the probability to work two years after childbirth. The results demonstrate that estimating post-childbirth employment without controlling for selection into pre-childbirth employment gives biased estimates because of the correlation between unobservable characteristics.

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Introduction

The relationship between fertility and labour force participation has become of great interest in recent years because of the trends that are characterising many developed countries. Female labour force participation has been increasing in most industrialised countries, accompanied by decreasing fertility rates. However, female participation rates are still much lower than those of men and much industrialised countries have not reached the levels aimed by their governments. In the European Union the participation of women is on average of the 48%, instead of the 60% targeted by the European Commission in order to reach a total employment rate of 70% by year 2010.

Despite this general trend, cross-country comparisons show that countries with the highest fertility rates experience the highest labour force participation as well. Empirical studies tend to explain this trend through the availability of childcare services and family related assistance. A high rate of participation of women in the labour market can be achievable together with a high rate of fertility if childcare services are easily available. The Nordic European countries seem to represent a good example of family policies facilitating women to reconcile work activities with family duties. The availability of childcare services strongly reduces female drops out of the labour activity after childbirth. The Nordic European countries have recently become the countries with the highest total fertility rates accompanied by the highest female activity and occupational rates (more than 70%). The Southern European countries, on the contrary, are experiencing the lowest total fertility rates in the European area with female activity and occupational rates still much lower than the Nordic ones'.

Italy is the country with the lowest total fertility rate in the whole European Union. The decrease in the total rate of fertility has been driven by two phenomena; not only the total number of children per woman has been decreasing in the last thirty years, but the average age of the women at their first child has been steadily increasing. However, recent data from a national survey on motherhood and participation (ISTAT 2002) reveal that female labour activity does not represent an

obstacle in the moment of the first child; however, the desire to work can disincentive the procreation of additional children (Righi, 2003).
Some stylised facts emerge from different studies. First of all the educational level has a strong power in explaining both the participation in the labour market, the postponement of maternity and the attachment to work after childbirth. The occupational condition of the husband as well as his income availability are relevant with respect to the decisions of fertility and to the choice of after childbirth work activity. From the study of the National Statistical Institute it emerges that the strategies of the couples are becoming more and more important (Costa, 2003).
After childbirth the rate of drops is quite high. Almost 20% of women, who had a job before maternity, leave the labour activity. This phenomenon is higher the younger the mother. The educational level is still important in explaining the attachment to work; the probability of leaving the labour activity is lower the higher the educational diploma. Moreover the real wealth has a positive effect on the attachment to the labour activity (Lo Conte e Prati, 2003).

Aim of the paper is the analysis of post-childbirth employment of Italian women. We are especially interested in the analysis of the impact of education and of socio-economic family conditions on the likelihood to keep working after motherhood.
We implement a model of post-childbirth employment that corrects for the selection into fertility and for the employment initial choice. We estimate a multivariate probit model where the error terms are allowed to be correlated in order to capture the effect of unobservable characteristics that jointly affect the choices of initial participation, fertility and after childbirth employment. We show that the estimate of post-fertility employment without correcting for pre-childbirth labour activity implies biased estimates of the post-childbirth choice.
The adopted methodology allows also to identify different behavioural models affecting the choice of fertility conditional on the employment condition of the female before childbirth.

Previous literature

Much empirical work has been done in order to explain temporal changes in female behaviour and cross-country differences in the rates of labour force participation and in total fertility.

Several studies find a negative relation between female labour supply and the number of children and between wages and the number of children (Heckman and Walker 1990, Mincer 1963, Becker 1965 and Willis 1973). The research on fertility-labour force participation across countries, however, shows the persistence of a negative correlation between the two variables in the Southern European countries, while the correlation becomes positive when considering all European countries. In the Southern European countries there appear to be high obstacles in reconciling work and fertility.

The literature on Italian female labour force participation and fertility has mainly focused on the correlation between completed fertility and labour force participation. First contributions are due to Colombino and Di Tommaso (1996), Di Tommaso (1999) and Del Boca (1999). Colombino and Di Tommaso, using a bivariate probit model, estimate the impact of unearned income and wealth to investigate income effects; Di Tommaso, some years later, estimates a trivariate model of participation, fertility and wages, finding a strong effect of wages on the decision to participate and to have children. Del Boca (1999) analyses the effect of market rigidities on the participation and fertility behaviour of Italian married women.

More recently, Del Boca (2002) investigated the role of family networks in providing financial support as well as potential help in childcare services; the role of the family seems to increase significantly the probability of the mothers working, especially full-time. Other analyses focus on the role of individual characteristics and of job characteristics. Bratti (2003) estimates a multinomial logit model with endogenous education. The estimates show that highly educated women postpone fertility and have a higher labour market attachment. Bratti, Del Bono and Viuri (2004) find that working in the public sector or in a large private firm increases the probability of working after childbearing.

The majority of both international and national literature has mainly focused on the correlation between total fertility and participation, studying the relationship between children-participation choices and individual-family characteristics once the choice of fertility is made and total fertility sometimes completed. Few recent works have focused on the employment-children relation around childbirth and on the work attachment of women after childbirth, taking into consideration the employment dynamics around childbirth. Bloemen and Kalwij (2001) develop a simultaneous analysis of the timing of births and labour market transitions of women in the Netherlands. Using a multiple state transition model, the authors are able to disentangle the effect of the woman's market status on the timing of birth and the extent to which labour market transitions are affected by fertility status. First of all they find that when considering the impact of schooling on female employment conditional on the presence of children, the effect is underestimated. Secondly, as the educational level of the woman increases, the likelihood of her moving into a job increases and births delay, without significantly affect completed fertility. Moreover, birth cohorts are not significant or small and quantitative effects of unobserved heterogeneity are relatively large.

Lauer and Weber (2003) compare the work attachment of French and German women after childbirth. In order to avoid the problems of selection into childbirth, they estimate the post-childbirth decision, modelling explicitly the selection into motherhood. They therefore estimate a biprobit model of childbirth and employment post-childbirth allowing for the correlation of the error terms. The test on the correlation of the error terms reveals that selection into motherhood is important in France but not in Germany.

The model

Much of the work on Italian female employment and fertility choices analyses the relationship between total fertility and participation. Our model, instead, focuses on the participation choice around childbirth. We are interested in studying the employment transitions of women around childbirth and to explain women's

attachment to work after childbirth in function of individual human capital characteristics and family socio-economic conditions.

Bloemen and Kalwij (2001), who study the attachment to work of Dutch women employing a multiple state transition model, give an interesting contribution to this subject. Lauer and Weber (2003), instead, use a biprobit model to compare employment of mothers after childbirth in France and Germany. They jointly estimate the post-maternity participation equation and the childbirth equation allowing for the correlation of the error terms. Taking account of the selection of mothers into childbirth is necessary if mothers differ systematically from non-mothers in factors unobserved to the researcher. In this case, if these characteristics also significantly explain the post-maternity employment decision of mothers and the researcher does not include the equation of selection into childbirth, the estimates of some variables of the post-birth equation will be biased. The authors find out that this correlation is not negligible for French females.

The same reasoning can be extended to the relationships between pre-childbirth employment and childbirth choice and between pre-childbirth and post-childbirth employment. If pre-childbirth employment selection is explained by unobservable characteristics affecting also the post-motherhood employment choice, then the estimates of some variables can be biased. The same can be true for the selection into childbirth and the choice to work after motherhood.

We therefore estimate a model of post-childbirth employment taking into account both the selection into pre-child labour and the selection into fertility. We end up with a multivariate probit model where we allow for the correlation among the error terms. Following the approach of Cappellari and Jenkins (2003a) to the analysis of employment-unemployment transitions, our multivariate probit model also takes into consideration both the endogeneity of pre-childbirth employment in the fertility equation and the endogeneity of childbirth choice in the post-motherhood employment equation. We are able to predict the probability of childbirth conditional on initial labour force participation and the probability of post-childbirth participation conditional on fertility decisions. We show that the employment choices made before the childbirth event identify different fertility patterns. Moreover, the choice of having a child can change the employment

preferences of initially working women, depending on the socio-economic conditions of the family.

The model we estimate is a dynamic model. The initial condition equation is represented by the propensity to work at time t-2. The latent utility index E^{*}_{it-2} is a linear function of individual characteristics at time t-2 plus the error term:

$$\mathrm{E}^{*}_{\mathrm{it}-2} = \beta' \mathrm{X}_{\mathrm{it}-2} + \varepsilon_{\mathrm{it}-2} \qquad \varepsilon_{\mathrm{it}-2} \approx \mathrm{N}(0,1) \qquad (1)$$

We can not observe the latent utility index $\mathrm{E}^{*}_{\mathrm{it}-2}$ but only the dichotomous event $\mathrm{E}_{\mathrm{it}-2}$ whether the woman participates or does not participate in year t-2. Therefore we estimate the dichotomous variable $\mathrm{E}_{\mathrm{it}-2} = \mathrm{I}(\mathrm{E}^{*}_{\mathrm{it}-1} > 0)$, which is a dummy variable indicating whether *i* is employed in year t-2. Matrix *X* includes individual and family characteristics, such as schooling, the partner's income, family wealth and the presence of children of different ages.

The second equation of the model is about fertility at time t, C^{*}_{it}. The latent variable C^{*}_{it} is explained by two different set of regressors. The first set is referred to the individual characteristics of women working the year before childbirth while the second set of explanatory variables captures the incidence of the characteristics of women not employed the year before. Therefore we condition the fertility utility index on the employment choice of the previous observable period and derive different coefficients depending on the employment condition at time t-2.

The fertility equation is specified as follows:

$$\mathrm{C}^{*}_{\mathrm{it}} = \mathrm{E}_{\mathrm{it}-2}(\delta_1' \mathrm{Z}_{1\mathrm{it}-2}) + (1 - \mathrm{E}_{\mathrm{it}-2})\delta_2' \mathrm{Z}_{2\mathrm{it}-2} + \upsilon_{\mathrm{it}} \qquad \upsilon_{it} \approx N(0,1) \qquad (2)$$

Equation (2) is composed by two parts: a first part relative to individuals previously working in the labour market ($\mathrm{E}_{\mathrm{it}-2} = 1$) and a second part relative to females who did not work in period t-2. We therefore separate the effect of each characteristic when females are working or not and estimate the probability of

having a child when in each of the occupational conditions. Matrix Z_{1it-2} includes individual characteristics as well as occupational characteristics; matrix Z_{2it-2} includes all individual characteristics present in Z_{1it-2} but it does not include any occupational characteristic.

Here again the latent utility index C_{it}^{*} can not be observed and we estimate the index variable C_{it} that assumes value one if the woman had a child in year t.

Fertility is evaluated at time t, as the birth of a child, and is explained in function of individual and family characteristics two years before. Actually, a child born at t is conceived at time t-1, except for those children born from the beginning of October onwards. Therefore, we can affirm that the choice of a childbirth is explained in function of the individual characteristics one year before the conception.

The third equation represents the post-motherhood employment equation.

Employment at time t+2 depends on the outcome on fertility in period t. We specify different coefficients for women who had a child two years before and for females not experiencing a motherhood in that period.

$$E^{*}_{it+2} = C_{it}\left(\phi_{1}^{'} X_{1it}\right) + \left(1 - C_{it}\right)\phi_{2}^{'} X_{2it} + \omega_{it+2} \qquad \omega_{it+2} \approx N(0,1) \qquad (3)$$

Matrices X_{it} contain the same variables of the participation equation (1), however evaluated at time t.

The unobservable factors summarised in each equation by the error terms are allow to be correlated. We therefore imagine that there exist characteristics unobservable to us which can affect both fertility and pre or post-childbirth employment choices. The error terms are jointly distributed as a three-variate normal distribution with zero means, unit variances and unrestricted correlations:

$$\left(\varepsilon_{it-1}, \upsilon_{it}, \omega_{it+2}\right) \approx N_{3}(0, \Sigma) \qquad (4)$$

The system of equations (1-3) plus the condition on the error terms allows to estimate the probability of post-childbirth employment controlling for the problem of selection both into pre-fertility employment and into fertility. It also allows to correct the estimates for likely correlation of the error terms due to unobservable characteristics influencing more than one equation. It also allows to predict the conditional probabilities of fertility and of post-fertility employment.

Data and explanatory variables

We estimate the model (1-4) on data from the Bank of Italy Survey on Household Income and Wealth (SHIW) for the years 1998-2002.

We select women aged 19-45 in 1998, cohabiting with their husbands and not having a child younger than two years neither in the starting year of observation (1998) nor in the sample final year (2002). We drop those women in order to avoid misrepresenting the employment choice because of a maternity-leave period. We drop from the sample also well-being females, students, handicap that retired and retired people.

With respect to the dependent variables, we decided to focus on the employment choice instead of the participation choice because of the time constraint. Therefore, we consider as non-employed females those women unemployed, looking for the first job, housewives or in other conditions.

We measure fertility as the birth of a child in year 2000 and evaluate through the fertility equation the relationship between childbirth and the mother's characteristics two years before. Actually, a childbirth in year 2000 means, with a high probability, that the child was conceived in year 1999; all children born between January and September were conceived in 1999. Therefore, the equation evaluates the impact of the individual characteristics evaluated a year before the conception of the child.

The explicative variables of all equations include age, education, husband's income and household's real wealth. The inclusion of age in the employment equations is

justified by the evidence on the activity and employment rates; female participation and employment rates increase as the woman reaches the age of thirty years and then keep stable till the forties. The empirical evidence for Italy seems to detect a negative impact of age on participation (Del Boca, 2002).

Age is also included in the fertility equation. The literature explains the timing of births as the result of the tension between having children early in life, in order to enjoy them longer, and the desire to have them when their price is low (Gustafsson, 2001). We do not focus on the age of the first child, but simply take account of age in order to find the theoretical peak age of women having children.

The evidence on the impact of education on female labour force participation and fertility choices shows a negative correlation between education and total fertility rates while a positive correlation between education and labour force participation, in all European countries. The empirical results are consistent with a positive and significant impact of education on female employment and on job attachment of women after childbirth (Del Boca, 2002, Bratti, 2003; Bloemen, Kalwij, 2001). On the contrary, the relationship between education and fertility is complex and can act through several channels (Bratti, 2003). Some empirical estimates do not show a significant impact of education on fertility (Del Boca). Bratti (2003) shows that education increases marital fertility at ages 21-39, except for women with tertiary education. The dominant effect in this case seems to be attributed to the income effect due to education. Bratti concludes that in order to increase labour force participation and marital fertility a good policy would aim to increase women's education at least up to the upper secondary level. We estimate the effect of education through several dummies for the educational levels higher than the primary one. We even distinguish between professional upper-secondary and upper-secondary education.

We take into consideration the role of husband's income as exogenous with respect to both female labour supply and fertility decisions (Del Boca, 1997).Women decide their participation in the labour market and their fertility rates conditional on the resources they can share with their partner. The sign of the empirical analyses is not certain. The empirical studies on Italy (Colombino e Di Tommaso, 1996; Di Tommaso, 1999) find a positive impact of husband's wage on total fertility and a

negative effect on labour market participation. The Istat survey on women motherhood and labour participation shows that childbirth is more likely in families with higher incomes and with higher participation of women; however, women from these families indeed are those that leave their jobs after motherhood with a higher probability.

The effect of the family's wealth on participation and total fertility has been estimated in Italy by Colombino and Di Tommaso (1996) and Di Tommaso (1999). In the first study the impact on participation is significant and positive while the impact on fertility is insignificant. In the latter, household wealth affects positively the choice of fertility and negatively the choice of participation. The Istat analysis seems to confirm the role of the familly's wealth even after childbirth. Women from families owning their own house are less likely to leave their jobs after motherhood. We introduce family's wealth in all equations.

We estimate the model of equations (1-3) in function of these variables, including dummies for age cohorts and for city-size, in each conditional specification. First results are reported in the following paragraph.

First estimates

We estimate the system of equations 1-3 using a multivariate probit model, allowing for correlation among the error terms. Our first aim is to demonstrate that the error terms of the three equations are correlated, due to unobservable characteristics influencing all equations.

Estimates are obtained through the GHK simulated maximum likelihood method (Cappellari and Jenkins, 2003b).

We present in Table 1 first preliminary results of the estimates and in Table 2 the correlation among the unobservables. The correlation between the error terms of the employment equations is significantly different from zero, confirming our hypothesis that post-childbirth employment can be affected by relevant unobservable factors influencing the initial choice of employment. Estimates of around child-birth participation need to be corrected for the initial participation

equation in order to be unbiased. The correlation between unobservables is, however, insignificant when considering employment and fertility decisions.

The coefficients reported in Table 1 are all significant at least at 10% level.

The educational dummies are all significant at 1% level in the employment equation at the initial period. Their coefficients confirm the positive impact of increasing levels of education on the decision of female employment. Professional upper-secondary diploma has a much positive effect than the upper-secondary level. All educational coefficients are confirmed positive with respect to the decision of employment in period t+2 conditional on non-childbirth.

As regard the choice of fertility, professional upper-secondary and university educational levels have a significant and negative effect on fertility independently on the employment choice made two years before. Lower and upper-secondary levels of education, indeed, positively affect the choice of childbirth, when females were not working in the starting period of observation.

Age positively affects the decision of fertility at decreasing rates. Its effect is smaller when females are not working in the year before fertility.

The level of the husband's income has a significant effect on the choice of childbirth, conditional on employment, and on the employment decision conditional both on the event of childbirth or not. A higher husband's income, conditional on female employment has a negative impact on the decision of childbirth. On the contrary, once the woman had her child, her attachment to work decreases as the husband's income increases. Both results confirm the facts that emerged from the Istat analysis on motherhood and participation. Also the estimates of the family's wealth variable confirm the results derived from the Istat survey; the higher the wealth of the family, the higher the probability to be employed and to keep working after childbirth.

The number of children in the family negatively affects the fertility choice. If they are younger than five, they positively affect employment; if older than six they have a negative impact on the decision of post-childbirth employment.

Table 1. Multivariate Probit Estimation

	Participation at t-2		*Fertility at t /Participation t-2*		*Fertility at t /Non Participation t-2*		*Participation at t+2 /Fertility t*		*Participation at t+2 /Non Fertility t*	
	Coeff.	Std.Err	Coeff.	Std.Err	Coeff.	Std.Err	Coeff.	Std.Err	Coeff.	Std.Err
No education or primary (ref. category)										
Lowersecondary education	0.7908	0.1078			1.5957	0.1914			0.2645	0.1133
Prof. Upper secondary education	1.3318	0.1467	-4.583	0.2646	-2.859	0.2829			0.6132	0.1869
Uppersecondary education	1.2839	0.1089			2.0378	0.2210			0.8391	0.1155
Unversity education	1.8143	0.1674	-3.827	0.1496	-3.5189	0.4616			1.1983	0.1777
Variables at t-2										
Age			0.4693	0.1805	0.3167	0.169				
Age2			-0.0069	0.0025	-0.0041	0.0022				
Husband income/10000			-0.22	0.0876						
Wealth/1000000	0.231	0.0757			0.472	0.203				
Number of children 3-5 years	0.149	0.0714	-0.847	0.2203						
Number of children 6-13 years			-0.289	0.1118	0.1584	0.0830				
Variables at t										
Age										
Age2							0.0010	0.0004		
Husband income/10000							-0.174	0.0756	0.0515	0.0124
Wealth/1000000							1.74	1.02		
Number of children 3-5 years							0.8807	0.4299		
Number of children 6-13 years							-0.9112	0.4550		
N. Obs.	2502									
Log Likelihood	-2630.5									
Wald chi2(11)	4445.74									
Prob > chi2	0									

Table 2. Correlation of unobservables

	Correlation estimate	*p-value*
Fertility and initial employment	0.1602	0.2
Post and pre-fertility employment	0.025	0.000
Post-fertility employment and fertility	0.1832	0.572

Conclusions

In the article we estimate a multivariate probit model of post childbirth employment of women. We correct for selection into fertility and pre-childbirth employment and show that pre-childbirth employment has to be taken into consideration in order to have correct estimates of post-fertility employment. We estimate even the conditional equations and find interesting results on the impact of husband's income and family's income on the participation-fertility choices.

These are first estimates! Our aim is to add some variables on the employment condition. We are implementing the model also on ECHP data.

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Appendix

Table A1. Descriptive statistics

	N. obs.	*Sample average*
Participation at t-2	2502	0.571
Age	2502	39.079
Age2	2502	1564.028
Husband income plus no labour income at t-2	2502	32084.28
Husband income plus no labour income at t	2502	53574.96
No education	2502	0.01
Primary education	2502	0.157
Lowersecondary education	2502	0.361
Prof. Upper secondary education	2502	0.07
Uppersecondary education	2502	0.332
Unversity education	2502	0.067
University education * age	2502	2.742
Number of children 3-5 years at t-2	2502	0.195
Number of children 6-13 years at t-2	2502	0.837
Number of children 3-5 years at t	2502	0.075
Number of children 6-13 years at t	2502	0.727
Cohort 1950-54	2502	0.18
Cohort 1955-59	2502	0.363
Cohort 1960-64	2502	0.252
Cohort 1965-70	2502	0.128
Citysize 20000	2502	0.262
Citysize 40000	2502	0.216
Citysize 500000	2502	0.46
Citysize max	2502	0.061
Fertility at t	2502	0.035
Participation at t+2	2502	0.563

Table A2. Probit Estimation results: single equations

	Participation at t-2		*Fertility at t /Participation t-2*		*Fertility at t /Non Participation t-2*		*Participation at t+2 /Fertility t*		*Participation at t+2 /Non Fertility t*	
	Coeff.	Std.Err	Coeff.	Std.Err	Coeff.	Std.Err	Coeff.	Std.Err	Coeff.	Std.Err
No education or primary (ref. category)										
Lowersecondary education	0.8211	0.1102			1.5029	0.1833			0.3298	0.1158
Prof. Upper secondary education	1.3452	0.1556							0.6671	0.1889
Uppersecondary education	1.2796	0.1132			1.9018	0.1698			0.8925	0.1177
Unversity education	1.8466	0.1772							1.3051	0.1917
Variables at t-2										
Age	0.0141	0.0078	0.4694	0.1804	0.3059	0.1697				
Age2			-0.0069	0.0025	-0.0040	0.0022				
Husband income/10000			-0.223	0.0871						
Wealth/1000000	0.449	0.094			0.460	0.200				
Number of children 3-5 years			-0.8641	0.2143						
Number of children 6-13 years			-0.2912	0.1134	0.1730	0.8561				
Variables at t										
Age							0.1157	0.036	0.15	0.0621
Age2									-0.0021	0.0008
Husband income/10000							-0.154	0.0297	0.0435	0.0146
Wealth/1000000							2.14	1.05		
Number of children 3-5 years										
Number of children 6-13 years							-1.769	0.4564	-0.0848	0.0511
N. Obs.	2502		1679				2502			
Log Likelihood	-1408.87		-182.37				-1485.45			
Wald chi2(11)	285.32		456.88				302.76			
Prob > chi2	0		0				0			

***Coefficients significant at 1% level, ** Coefficients signiicant at 5% level, * Coefficient significant between 5% and 10% level. We add dummies for age-cohorts and for citysize in each conditional estimate. Constants iinclude