HUMAN CAPITAL AND FERTILITY DECISIONS IN ITALY: A MICROECONOMETRIC ANALYSIS OF ECHP DATA*

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ABSTRACT:

In this paper we have studied the linkages between fertility decisions and human capital of both males and females in Italy by using the eight waves available in the European Community Household Panel (ECHP) data. In this aim, we have followed two steps. In the first step, we have considered 'education' as an exogenous variable and we have implemented a pooled probit model. In the second step, we have considered 'education' as an endogenous variable and, hence, we have estimated an instrumental variable probit model. The main objective has been to measure the effects of the human capital, proxied by the years of schooling, on the probability of having a new child obtaining a sort of trade-off between them in an endogenous variable case.

JEL CLASSIFICATION: I21, J13, J24.

KEYWORDS: Fertility, Human Capital, Education.

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INTRODUCTION

"*With the establishment of modern economic growth, fertility has tended to decline, first across high income countries starting largely in the last quarter of the nineteenth century, and then occurring even more rapidly across most low income countries in the last quarter of the twentieth century (Schultz 2001, p.2)*". Education may play a significant role in explaining the decreasing dynamics of fertility at both societal and individual levels. As far as cross-nationally analysis is concerned, it is evident that countries characterized by lower educational levels experiment higher fertility rates, while those ones, where the level of education is higher, register lower fertility rates. Moreover, in most of the latter, it has been registered, in the last decades of the 20th century, a shift from societies usually monogamous, with stable unions, rather high fertility and low birth control to societies characterized by a decreasing number of formal unions, an increasing number of informal unions, low fertility and high birth control. At an individual level, the human capital stock, for both males and females, may deeply affect preferences and decisions about fertility. As far as Italy is concerned, from inspection of Table 1, it can be easily seen that more educated individuals are associated to lower mean number of children.

TABLE 1. COMPLETED FERTILITY OF MEN AND WOMEN IN ITALY BY EDUCATIONAL LEVEL (1992-2000)

			Education	
		Low education	Medium education	High education
Mean number of children	Female	2.1	1.7	1.7
	Male	1.9	1.7	1.5

Source: *World Population Monitoring 2003, United Nations.*

The relationship between fertility and education has been widely explored in economic literature. Ben-Porath (1973) had suggested how the parents' educational level may influence not only their preferences for children, but also their productivity for child caring. Also Michael (1973) had emphasized the mechanisms through which parents' educational level may influence their fertility. More recently, it is very interesting to consider a study done by Kalwij (2000). The author obtained some important results analysing the effects of female employment status on the existence and quantity of children across households in the Netherlands. One of them concerns the fact that more educated women plan to have children later in their life with respect to low educated ones, and as a consequence, have a lower probability of having a child, and have fewer children. Moreover, the author underlines how, after having controlled the female employment status, the educational level of both men and women in a household has a small effect on both the existence and the quantity of children. In addition, it is quite significant the study done by Kimura and Yasui (2007), which has implemented a simple overlapping generations model, where differences in education among workers are taken into account

in order to explain why higher education joint to capital accumulation can cause a decline in fertility. As emphasized in Kreyenfeld (2002), Huinink (2001) analyses women's educational level for the transition towards a second child. In particular, he uses data from the *Family and Fertility Survey* and considers the family size by women's educational level for some European countries. The evidence in West Germany shows a high quota of both childless women among college graduates, and of women with two or more children. Moreover, Kreyenfeld (2002) asserted that a negative relation between women's education and fertility may be probably due to the hypothesis that since childcare is considered a females' responsibility, and since there is a sort of inappropriateness between childcare and employment, women's education may be a good proxy for their wage expectations and labour market opportunities and, consequently, a negative relation might follow between females' education and fertility. In recent times, a lot of studies have reported a sort of positive relation, instead of the expected negative one, between education and fertility, and this phenomenon, as well argued in Kreyenfeld (2002), may be due to an income effect in the sense that more educated women get higher wages and, consequently, may sustain an outsized family. In this line, Hoem, Neyer and Andersson (2006) have shown that there could be several doubts on the hypothesis according to which higher levels of education have to outcome in a higher childlessness. They suggest that the education and childlessness relation may be affected by different factors linked in some way to the educational system, for instance, the level of flexibility, the gender structure and the role of education in the labour market; and as a consequence, a unidirectional relationship may not be expected. It is very interesting to consider the study done by Kravdal (2007), who, basing the analysis on Norwegian register data covering all men and women born in 1964, found that second and third birth rates are affected by the high levels of current education among women; these results change once the educational level attained by age 39 is taken into account, instead of the current one. The corresponding effects for men are also positive even though not more strongly positive with respect to those for women. Winkler-Dworak and Toulemon (2007), as far as the educational level attainment is concerned, assumed a positive effect for men but a negative or U-shaped for women; their data underpin, for France, the convergence hypothesis concerning the influence of education even if the pattern initially is already similar for men and women.

Dribe and Stanfors (2006) emphasized that, since the mid-1960s in Sweden, education and labour market attachment may be considered key factors in order to determine the transition to parenthood for both males and females even though with some differences according to gender.

The objective of our study is to further investigate the linkages between fertility decisions and human capital, proxied by the years of schooling, for both males and females in Italy, by using the eight waves in the European Community Household Panel (ECHP) data. We have implemented a pooled probit model. Our main aim is that of measuring the effects on the probability of having a child of three different classes of explanatory variables: pecuniary, social and occupational ones.

The remaining part of this paper is organized as follows: section 1 explores the data set used in the regression analysis and the econometric model; section 2 collects the main results of the analysis and finally our conclusions.

1. Data and Empirical Model

Our analysis is based on data taken from the European Community Household Panel (ECHP). As already emphasized in Del Boca, Pasqua (2005), the ECHP is a multi-purpose longitudinal survey performed on households in some of the Member States of the European Community; more precisely, it has been carried out in Belgium, Denmark, France, Germany, the United Kingdom, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain since 1994, and also in Austria and Finland, respectively, since 1995 and 1996. The ECHP Survey, through annual interviews to all members aged 16 and over of a representative sample of families in the different countries, collects useful information and data on various topics such as: unemployment status, education, household structure, health, working conditions, private satisfaction and dissatisfaction.

In analysing the impact of social, economic and occupational variables on fertility decisions in Italy, 8,069 individuals (4,756 men and 3,313 women) have been selected from 1994 to 2001.

For an empirical analysis, we consider the variable 'child' to measure the current fertility (at time of the interview) as a dependent variable. It is equal to 1 if there are new children and equal to zero if otherwise. As far as the explanatory variables are concerned, we consider three classes of variables:

a) the pecuniary class takes into account work income (*WI*), deflated by using GDP deflators;

b) the social class includes as variables the level of human capital (*Ed*), the age of the agent (*A*), the accommodation (*Acc*). In particular, *Ed* variable measure the highest educational level received at time of interview as years of schooling for males and females. Observations of females aged over 45, considering the possible biological problems of fertility, and individuals aged under 25 have been deleted. The accommodation variable is 1 if the house is owned and without mortgage, 0 if otherwise;

c) the occupational class is composed by the work contract type variable and unemployment status. In particular, *Pe*=1 stands for permanent employment (0 if otherwise); *U*=1 if individual is unemployed at time of interview, and 0 if otherwise;

Since we expect a delay in the process which leads explanatory variables to affect 'child' variable, we consider all independent variables at time t-1 (with respect to the time of interview).

As far as the econometric framework is concerned, two steps have been followed. In the first, we have assumed 'education' variable as exogenous and we have implemented a pooled probit model in order to investigate the effects of both human capital, proxied by the years of schooling, and work income on fertility decisions in Italy.

In the second step, we have considered 'education' variable as endogenous[1] and we have estimated an instrumental variable probit (ivprobit) model. In particular, we have identified two instruments for 'education': capital income (*CI*) and marital status (*Ms*). Marital status variable is 1 if the individual is married, 0 if otherwise.

All the variables used in the estimated model are collected in the following table:

TABLE 2. DEFINITION OF USED VARIABLES

	Dependent variable:
Current fertility (1=new child at time t, 0=no)	*Child*
	Independent variables:
Work income	*WI*
Years of schooling	*Ed*
Age	*A*
Accommodation (1=free, 0=otherwise)	*Acc*
Work contract (1=permanent employment, 0=otherwise)	*Pe*
Unemployment status (1=unemployed, 0=otherwise)	*U*
	Instruments for 'child'
Capital income	*Ci*
Marital Status (1=married, 0=not married)	*Ms*

TABLE 3. DESCRIPTIVE STATISTICS

Variables	Obs	Mean	Std. Dev.	Min	Max
Child					
male	38,047	0.031	0.174	0	1
female	26,505	0.043	0.202	0	1
WI					
male	38,047	13.99	16.22	0	256.979
female	26,505	7.207	10.846	0	205.219

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[1] To check whether the 'education' is an endogenous variable and how serious the bias may be, all regressions are re-estimated excluding *Ed*. Results from the specification that excludes *Ed* are quite different to those obtained in the specification that includes *Ed*. Hence, there is evidence that *Ed* may introduce serious endogeneity bias. Hausman's test is also implemented to test fixed effect and random effect probit models, providing that the fixed effect probit model is the best. But since our objective is to estimate education variable coefficient, where education does not vary over time, consequently, we run a pooled probit model. Results from this robustness analysis are avalaible from the authors upon request.

TABLE 3. (CONTINUED)

Variables	Obs	Mean	Std. Dev.	Min	Max
Ed					
male	38,047	10.889	3.220	8	18
female	26,505	11.339	3.135	8	18
A					
male	38,047	37.839	12.109	25	60
female	26,505	31.219	7.809	25	45
Ms					
male	38,047	0.610	0.488	0	1
female	26,505	0.577	0.494	0	1
Pe					
male	38,047	0.451	0.498	0	1
female	26,505	0.295	0.456	0	1
U					
male	38,047	0.030	0.164	0	1
female	26,505	0.036	0.157	0	1
Ci					
male	38,047	0.435	2.773	0	194.175
female	26,505	0.151	1.207	0	76.087
Acc					
male	38,047	0.837	0.370	0	1
female	26,505	0.823	0.381	0	1

TABLE 4. INDIVIDUALS' EDUCATIONAL LEVEL IN THE SAMPLE

	Low education	Medium education	High education
Males	0.51	0.41	0.08
Females	0.42	0.50	0.08

TABLE 5. SAMPLE FERTILITY BY SEX AND AGE

	Males	Females
Fertility (aged<36)	0.05	0.07
Fertility (aged>35)	0.02	0.02

Table 3 reports the descriptive statistics of our sample. We observe that woman have a high probability to have a new child even though the difference is low. Males have a wage and a capital income which are higher on average than those of females. This seems to indicate an income gender inequity. Females are on average more educated and younger than males. These have a higher probability to be in marital status than females, while females

are likely to be in an unemployed status. Finally, males and females have a similar probability to have a house with any mortgage. From Table 4 we are able to examine the individuals' educational level by sex. In particular, we observe that males with a low education are higher than those with a medium education, while for females the situation is opposite. Finally, males and females with a high education represent a similar proportion of our sample.

As far as age is concerned, from Table 5 we notice that the fertility is higher for individuals aged less than 36 for both males and females.

2. EMPIRICAL RESULTS

As we can observe from the inspection of Table 6, where we present the estimated coefficients of the model for both males and females in case of exogenous education, the coefficient of work income variable (*WI*) is not significant. The estimated coefficient relative to the human capital level is positive, as in Del Boca (2002). The positive sign of the human capital level's estimated coefficients might be justified from the analysis of the income and substitution effects. Indeed, according to Del Boca, Pasqua and Pronzato (2005), a rise of education induces both income and substitution effects on fertility, and the U-shaped pattern of fertility with education can be interpreted in terms of the prevalence of income over substitution effect.

This should be our case.

TABLE 6. MODEL WITH EXOGENOUS EDUCATION CASE

Child	Coeff.	Std. err.	Coeff.	Std. err.
	Males		**Females**	
Cons	-1.27*	(0.081)	-0.95*	(0.085)
WI	-0.001	(0.002)	0.003	(0.002)
Ed	0.01*	(0.005)	0.01*	(0.005)
A	-0.04*	(0.002)	-0.06*	(0.003)
Acc	1.04*	(0.048)	1.14*	(0.043)
U	1.28*	(0.140)	0.25*	(0.098)
Pe	0.09**	(0.048)	-0.01	(0.054)
Observations	29,642		13,549	
LOG LIKELIHOOD	-4,150.10		-2,612.14	
Pseudo R^2	0.21		0.18	

Notes: ***(*)=statistically significant at the 10(5)% level.*

The estimated coefficient for accommodation is positive as expected. The estimated coefficient for age is negative. This result might indicate a biological problem in the fertility decision. As far as the unemployment status is concerned, the sign of the relative

coefficient is unexpectedly positive[2]. The positive sign may be due to more time devoted to childcare activities or to an income effect for social benefits. The coefficient relative to the work contract type is positive. The above results seem to indicate that job security is relevant in fertility decisions.

The income effect of education on fertility assumes that child rearing and employment can be made compatible and that, for women, it is possible to return to work after childbirth. This assumption may be plausible for countries where full-time day care is readily available, but it is not believable for Italy. According to Del Boca (2002), public day care is scarce and there are only limited chances to arrange day care by relying on private modes of care.

Since from Table 5 a different behaviour can be observed in fertility for individuals aged less than 36 and those aged more, we can therefore re-estimate our model for these two cases.

TABLE 7. MODEL WITH EXOGENOUS EDUCATION CASE (AGED <36)[3]

Child	Coeff.	Std. err.	Coeff.	Std. err.
	Males		Females	
Cons	-1.64*	(0.088)	-1.34*	(0.088)
WI	0.01*	(0.002)	0.003	(0.002)
Ed	-0.02*	(0.002)	-0.01**	(0.007)
Observations	11,961		7,636	
LOG LIKELIHOOD	-1,975.43		-1,943.3	
Pseudo R²	0.59		0.31	

Notes: ***(*)=statistically significant at the 10(5)% level.*

TABLE 8. MODEL WITH EXOGENOUS EDUCATION CASE (AGED >35)

Child	Coeff.	Std. err.	Coeff.	Std. err.
	Males		Females	
Cons	-2.26*	(0.071)	-2.35*	(0.143)
WI	0.00	(0.001)	0.003	(0.002)
Ed	0.02*	(0.001)	0.02**	(0.013)
Observations	16,335		5,913	
LOG LIKELIHOOD	-1,785.62		-560.13	
Pseudo R²	0.44		0.52	

Notes: ***(*)=statistically significant at the 10(5)% level.*

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[2] The positive sign could be due to the fact that unemployed people could work in the informal sector.

[3] Results of all coefficients are available from the authors upon request.

From the empirical results in Tables 7 and 8, we are able to see a negative relation between education and fertility for the case with individuals aged less than 36, while the positive effect is confirmed in the second case. Therefore, the possible effect of education could be explained by taking into account different aspects. Firstly, individuals who decide to increase their educational level usually get their first child later than other individuals. This process reduces time at one's disposal before reaching the biological limits of fertility. Such a time-squeeze effect could explain a higher transition rate towards the next child (Kreyenfeld, 2002).

Secondly, we may also identify a partner effect (Kreyenfeld, 2002) in fertility decisions. In particular, the individual's decision about his/her fertility depends also on his/her partner's characteristics. Couples would be more likely to generate later when they reach a secure position in the labour market and their earnings are sufficient to support a larger family. Subsequently, results might be biased in case the partner's characteristics are not taken into account.

This partner effect suggests re-estimating our model by considering the education variable as endogenous. In particular, we use an instrumental variable probit model (ivprobit), where we identify two instruments for education: capital income and marital status. The former variable takes into account other sources of wealth, while the latter considers the dominant role of the family in the fertility decision.

TABLE 9. MODEL WITH ENDOGENOUS EDUCATION CASE

Child	Coeff.	Std. err.	Coeff.	Std. err.
	Males		Females	
Cons	1.65*	(0.319)	2.47*	(0.481)
WI	0.02*	(0.002)	0.03*	(0.004)
Ed	-0.35*	(0.031)	-0.41*	(0.047)
A	-0.04*	(0.002)	-0.06*	(0.003)
Acc	1.03*	(0.050)	1.09*	(0.069)
U	1.27*	(0.141)	0.26*	(0.099)
Pe	0.07	(0.048)	0.08	(0.067)
Observations	28,639		13,549	
LOG LIKELIHOOD	-4,140.09		-2,569.11	
Pseudo R^2	0.23		0.19	

Notes: **(*)=statistically significant at the 10(5)% level.*

The empirical results for men and women, represented in Table 9, are relative to the endogenous education case. In particular, capital income and the marital status have been used as instruments for the education variable. Work income variable, accommodation variable and unemployment status have a positive effect on both males and females, while age and education have a negative effect. Finally, the work contract type variable has no significant coefficient.

Concluding Remarks

This study has focused on the existing linkages between fertility decisions and human capital of both males and females by using data taken from the 2001 European Community Household Panel (ECHP) for Italy. The main purpose of our paper has been that of measuring the effects on fertility decisions of three different explanatory variables:

a) pecuniary variables including work income deflated by using GDP deflator;

b) social variables counting human capital, proxied by the schooling level, age, and accommodation;

c) occupational variables, such as the work contract type and unemployment status.

In line with the aim of this paper, we have emphasized the correlation between human capital level and fertility decisions since, as well underlined in Ben-Porath (1973): *"education of parents is likely to be associated with every aspect of the fertility model. It may affect not only the individual parents' preferences for children and the relative importance of husband's and wife's preferences in family decision making, but also parental productivity in child rearing".*

As far as the econometric framework is concerned, two steps have been followed. In the first, we have assumed the 'education' variable as exogenous and we have implemented a pooled probit model in order to investigate the effects of both human capital, proxied by the years of schooling, and work income on fertility decisions in Italy.

In the second step, we have considered the 'education' variable as endogenous and we have estimated an instrumental variable probit (ivprobit) model. In particular, we have identified two instruments for 'education': capital income and marital status.

In conclusion, the main result of this paper is a negative relation between investments in education and probability of having a child. This is in line with the observed decreasing trend of fertility in Italy wirh respect to its high education of individuals.

In the following table, the effects of the principal characteristics on fertility model variable for two cases have been summarised: the male sample and the female sample in case of endogenous education. The exploratory variables may be divided into two categories, depending on the sign of estimated coefficients of the variables. Work income, accommodation and unemployment status variables have positive signs, affecting positively on the probability to procreate; whereas, on the contrary, age and education affect negatively this probability. Work contract type coefficients are not significant.

TABLE 10. SUMMARY OF RESULTS (ENDOGENOUS EDUCATION CASE)

	Fertility	
	Male	**Female**
WORK INCOME	+	+
EDUCATION	-	-
AGE	-	-
ACCOMMODATION	+	+
UNEMPLOYMENT STATUS	+	+
PERMANENT EMPLOYMENT	?	?

Further study, which in particular takes into account the possible hypothesis explaining the positive effect of education on fertility in exogenous case, is certainly required for a more comprehensive analysis. Our suggestion is to shift attention to the family and consider how the couple's characteristics affect their decision to procreate. In particular, the role of individuals' education in the transition to higher order of births should be investigated. In the end, we have to distinguish the order of births in fertility variables of our data set and control this characteristic for empirical estimates. In order to investigate these issues better, further analyses may be addressed to an international comparison of most European countries, taking into account how institutions may affect fertility choices in different countries.

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