Total Fertility Rates and Female Labour Force Participation in Great Britain and Italy: Estimation of a Reduced Form Model Using Regional Panel Data

Emilia Del Bono*
Pembroke College, University of Oxford
Telephone: 0044-1865-281282
Fax: 0044-1865-271094
emilia.delbono@pembroke.oxford.ac.uk

Abstract:

In this work we explore the hypothesis that unemployment may be responsible for recent trends in fertility and participation rates in some European countries. We estimate a reduced form model of fertility and female participation using regional panel data, considering 10 regional aggregates for Great Britain over the period 1983-1997 and 14 regional aggregates for Italy over the period 1983-1996. Within each country the model is specified for women in their entire fertile age span and for three different age specific groups and is estimated using fixed-effects in order to control for region-specific unobservable characteristics, such as the cost and the availability of child-care. Our results show that unemployment exerts a significant and negative effect on both fertility and female participation. We calculate that the total rate of unemployment contributed to almost a quarter of the actual decline in fertility rates in Italy.

Key words: Labour Supply, Fertility, Unemployment, Simultaneous Equations, Panel Data

JEL Classification: J22, J13, J60, C3, C33

---

* This research forms part of my DPhil dissertation and I would like to acknowledge the contribution of my supervisors Margaret Stevens and Steve Nickell for their help and advice. I am also indebted to Francesca Bettio and Adriaan Kalwij for helpful discussion. I received very valuable comments from participants in seminars held at the Department of Economics, Oxford University, and at the Centre of Labour Economics and Economic Policy (CELPE), Salerno University. All mistakes are my full responsibility.

1. Introduction

Since the mid 1970s in most European countries the Total Fertility Rate (TFR hereafter) has not been sufficient on its own to prevent the natural decline of the population and, with the only exception of Ireland, the Completed Fertility Rates (CCFR hereafter) of women born in 1960 will be below 2.1 children per woman, the threshold at which generations are replaced.

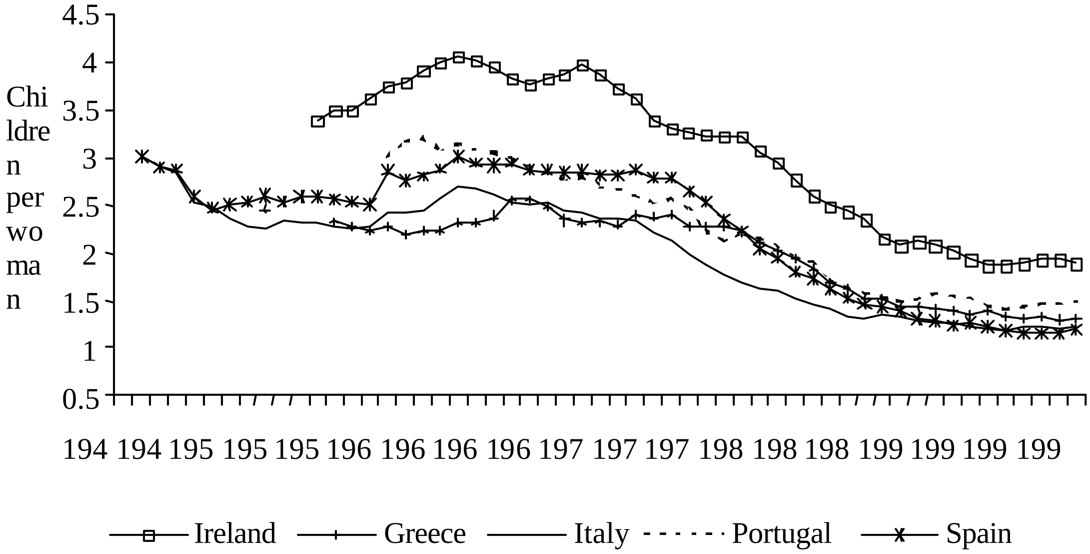
Official statistics show that all EU countries experienced a downward trend in fertility rates in the last thirty years, but the extent and the timing of this process vary substantially from one country to another. For example, the United Kingdom, France, the Netherlands and Belgium experienced their 'baby boom' in the mid 1960s and a period of declining fertility between 1965 and 1975. During the last two decades their TFRs appear to have been much more stable, but while France and the United Kingdom average about 1.70 children per woman, Belgium and the Netherlands are experiencing slightly lower levels of TFR, which range around 1.55.

Southern European countries and Ireland, on the contrary, recorded a later and rapid decrease in total fertility, which started around the mid 1970s. This decline is still in progress and we can see from Graph 1 that it has been particularly dramatic in the case of Spain and Greece. At present these countries, once the most fertile in Europe, have reached levels well below the replacement rate and Spain and Italy every year alternatively score the lowest fertility rate in the world, with TFRs ranging around 1.16-1.19 children per woman.

The downward trend in fertility rates over the past few decades is usually attributed to a number of factors, which highlight the interaction between social and economic changes occurred during this period.[1] Women have become more educated and more active in the labour market and the increased economic independence of the younger generations has induced these cohorts to either live alone or cohabit, creating informal unions rather than formal ones. Increasing levels of female participation have gradually led to postponement of motherhood, voluntary childlessness and declining family size with a resultant drop in fertility rates.

[1] The theory of the "second demographic transition" stresses the importance of social and economic factors as the main forces behind the fertility decline occurred in Western economies since the 1960s (Lestaeghe, 1983; van de Kaa, 1987).

Graph 1
Total Fertility Rates in Mediterranean Countries and Ireland

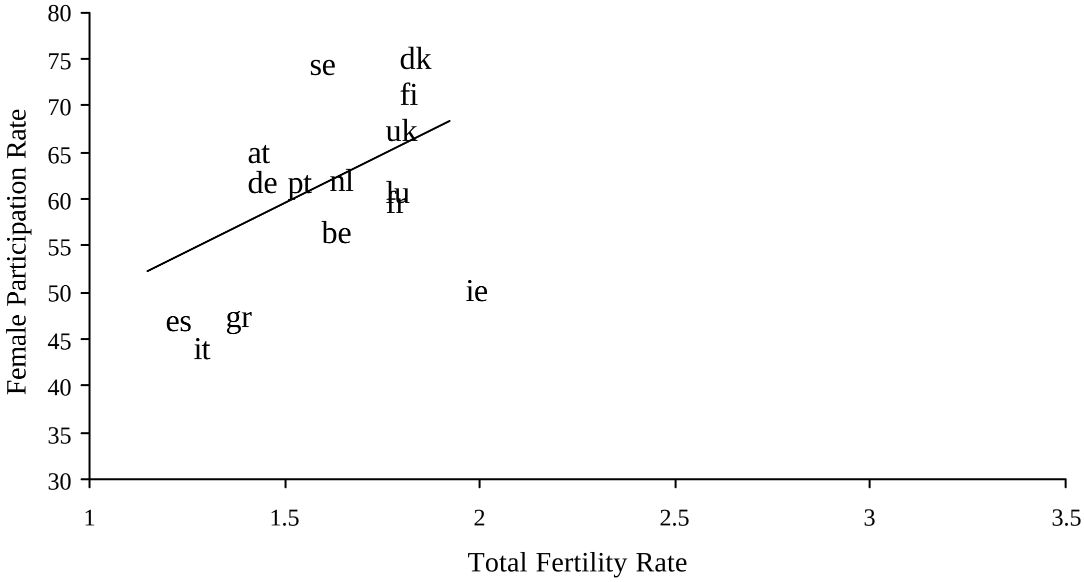


These ideas have been formalised within the framework provided by the New Home Economics[2], an essentially neoclassical theory of fertility which suggests that female labour force participation and fertility are endogenous components of the same microeconomic model and represent choices affected by the same economic variables. This theory of fertility emphasises the opportunity cost of the mother's time, i.e. the market wage, as the key economic variable for understanding fertility behaviour and suggests a negative correlation between TFRs and female labour force participation rates (FPRs hereafter).

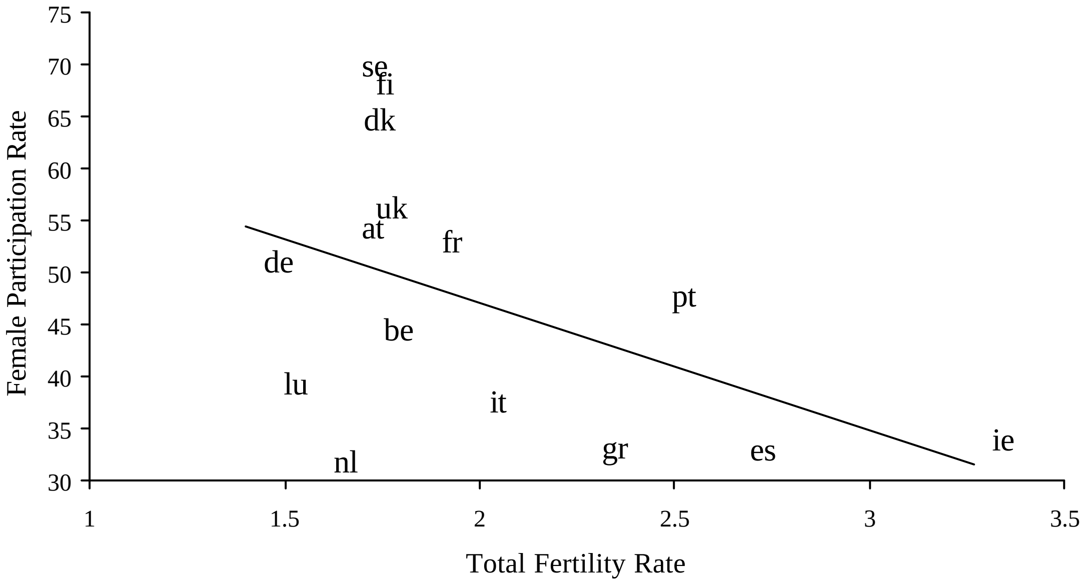
A closer look at the data reveals, however, that Southern Europe seems to combine relatively low female labour market participation with low fertility rates. Graph 2 shows that in 1997[3] Spain, Italy and Greece exhibited the lowest TFRs and FPRs among all European countries, while two decades earlier (see Graph 3) the situation was very different and the cross-country correlation between female participation and fertility rates was clearly negative.

[2] Developed by Becker (1960), Becker and Lewis (1973) and Willis (1973).
[3] This is the latest year where comparable figures for all the EU-15 countries are available.

Graph 2
Female Participation Rates and Total Fertility Rates 1997

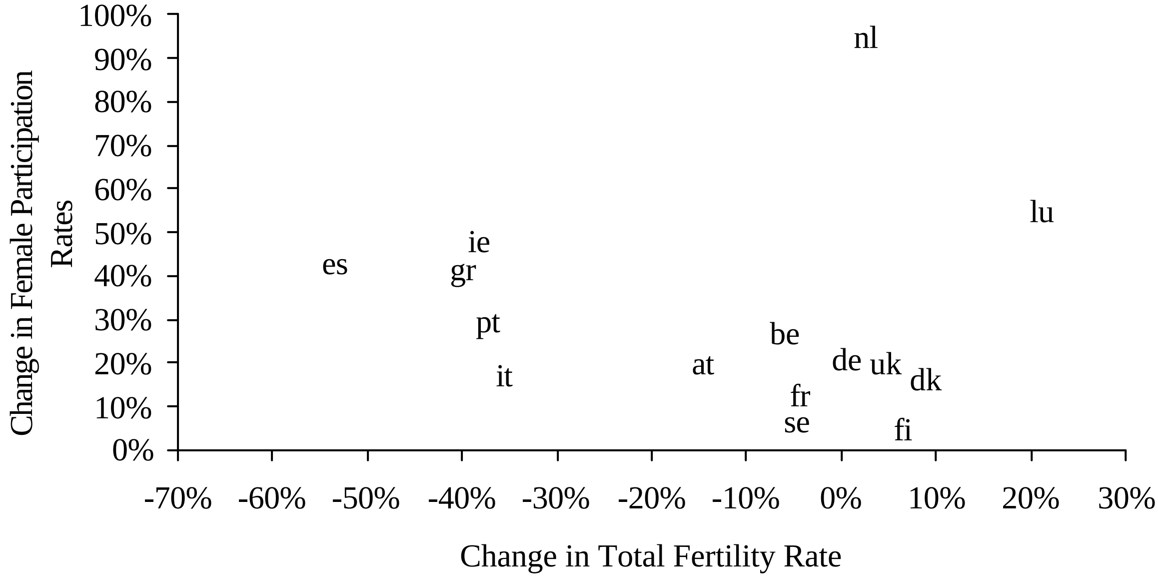


Graph 3
Female Participation Rates and Total Fertility Rates 1977



The comparison between levels of fertility and female activity at different points in time can be misleading and in Graph 4 we compare changes in the level of the fertility rate with changes in the level of the female participation rate. With the exception of the Netherlands and Luxembourg, the position of all the other countries clearly indicates the existence of a negative relationship between changes in fertility and participation rates; countries in which participation has been rising more significantly have also experienced above average decreases in fertility.

Graph 4
Female Participation Rates and Total Fertility Rates
Percentage change 1977-1997



However, even from this comparison, striking differences emerge. For example, in Italy, during the two decades between 1977 and 1997, female participation increased from 37.6 per cent in 1977 to 44.1 per cent, while fertility rapidly declined from 1.98 to 1.22 children per woman. On the contrary, in the United Kingdom, female participation increased from 56.3 per cent to 67.5 per cent but fertility rates remained roughly stable around 1.7 children per woman over the same period.

This evidence suggests that in the last few decades Southern European countries experienced a dramatically rapid demographic decline without reaching the same levels of female participation observed in other labour markets across Europe and in some cases without even experiencing comparable increases in female activity. Moreover, if there is a negative relationship between fertility and female participation, and female participation in these countries is expected to rise in the future, we can also expect fertility rates to fall even further. Since Southern European countries average TFRs of around 1.16 children per woman, the consequences of a further drop in fertility could be extremely serious.[4]

An interesting question is whether other economic variables might have contributed to the fertility decline in Southern Europe and exacerbated the trade-off between fertility and female activity to the extent shown above. Del Boca (2001) focuses on the availability of child care and of part-time opportunities for working mothers in Italy, while Ahn and Mira (2001) point out the effect of unemployment among OECD countries.

The latter hypothesis is particularly interesting because the effect of unemployment on fertility behaviour cannot be determined a priori. From the one hand, an increase in unemployment reduces family income and, under the assumption that children are a normal good, reduces fertility. On the other hand, an increase in unemployment lowers the cost-opportunity of the woman's time and therefore the cost of having children, increasing desired fertility. The overall effect of unemployment is theoretically ambiguous and can be determined only through empirical analysis. What is striking, however, is that the reversal of the sign of the cross-country correlation between TFRs and FPRs occurred in correspondence with the emergence of high and persistent unemployment rates in Europe (see Graph 5).

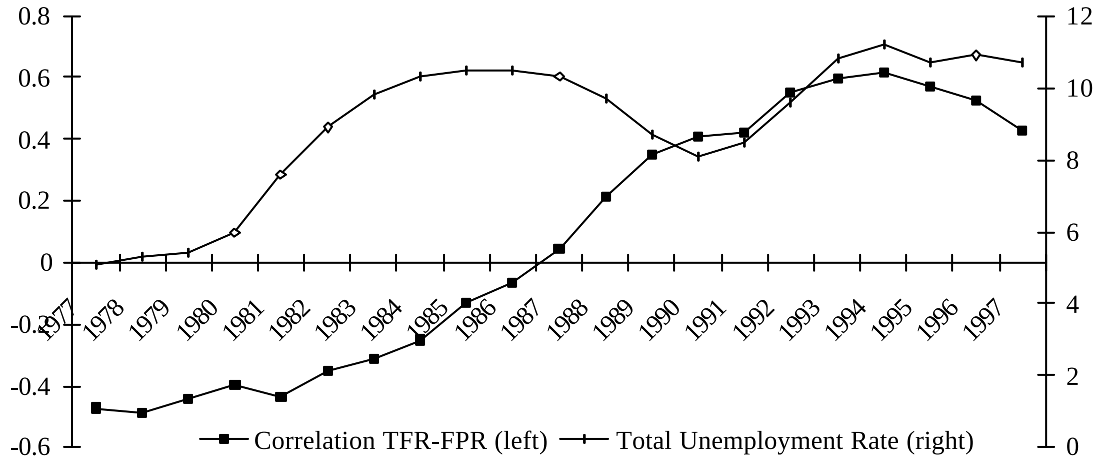
According to Ahn and Mira (2001) an increase in unemployment in countries characterised by low rates of female activity, such as Spain, Italy and Greece, is likely to reduce fertility, as female participation in the labour market is low and the substitution effect arising from a decrease in the opportunity cost of the woman's time is bound to be small compared to the income effect arising from the loss of male income. They maintain also that, in countries where a higher proportion of women choose to work, female wages are an important

[4] According to Eurostat's baseline scenario for population projections, Italy will be the first country to experience a negative rate of population growth, starting from 2008, while the EU as a whole will experience a decrease from 2023 onwards.

determinant of family income and an increase in unemployment is likely to generate income effects of higher order of magnitude than traditionally thought.[5]

According to their hypothesis, in both low and high female participation countries, income effects have a dominating influence and higher unemployment rates should reduce fertility. Since the rise in unemployment in Europe was considerably more pronounced in low-participation countries, the dramatic drop in fertility rates experienced by these countries drove the change in the cross-country correlation between participation and fertility.

Graph 5
Cross-country correlation between TFR and FPR and
Total Unemployment Rate in EU-15



In this work we explore the hypothesis that the observed increase in unemployment in Europe may be (at least partly) responsible for recent trends in fertility and participation rates. We estimate a reduced form model of fertility and female participation using regional panel data for each country. We consider 10 regional aggregates for Great Britain over the period 1983-1997 and 14 regional aggregates for Italy over the period 1983-1996 (see Tables 1 and 2). Within each country we specify the model for women in their entire fertile age span -

[5] See Butz and Ward (1979).

which includes women between 15 and 44 years - and for three different age specific groups, considering women aged 15-24, 25-34 and 35-44.

It is important to point out that our results are not a direct test of the hypothesis in Ahn and Mira (2001). These authors are concerned with the cross-country correlation between fertility and female participation, while we examine the influence of unemployment on fertility and female activity within each country. However, our work can be suggestive of the relevance of their hypothesis, as it gives us the opportunity to compare the role of unemployment in Great Britain and Italy, two countries broadly representative of high and low female participation patterns in Europe.

Section 2 offers a description of the simple static model of household production. We focus on the predictions of the standard model and the issues related to the interpretation of the effects of the exogenous variables when aggregation and identification problems are taken into account. In section 3 we present a reduced form model of fertility and female labour force participation, which is estimated using fixed-effects in order to control for region-specific unobservable characteristics, such as the costs and the availability of child-care. Section 4 provides a description of the regional data set used. The results are discussed in section 5, while section 6 raises some questions about the specification of the model and calculates the effect of unemployment on the recent decline of fertility rates in Italy.

2. The theoretical framework

2.1. The static model

In many respects the economic approach to fertility is a straightforward application of the standard neoclassical model of consumer demand. Parents choose the number of children in order to maximise their utility subject to the budget constraint they face. The household's utility[6] is a function of parents' joint consumption of market goods and of the number of children and the household's maximization problem can be written as:

[6] In the discussion that follows we will assume that the household's utility is equivalent to the parents' joint utility, ignoring any conceptual distinction between the two definitions.

$$\underset{x,n}{Max}\, U(x,n), \quad (1)$$

subject to:

$$p_x x + p_n n = I, \quad (2)$$

where x is a composite market good, n represents the number of children and p_x and p_n are the price of the market good and the price of children respectively. Taking the price of the composite market good as numeraire, the derived demand for children is simply:

$$n = n(p_n, I), \quad (3)$$

and the standard analysis in terms of income and substitution effects applies. As it is well known, the theory yields ambiguous predictions about the sign of the income effect, although it is generally assumed that children are a normal good.

In order to reconcile the latter assumption with the empirical finding that fertility rates decrease with income levels both in cross section and time series analyses, Becker (1960) introduced a third argument into the household's utility function: the 'quality' of children.[7] He strongly argued that parents do not derive utility only from the number of children they have, but also from the 'quality' they associate with each of them or, put another way, that "a family must determine not only how many children it has but also the amount spent on them".[8]

This implies that (1) becomes:

$$\underset{x,n,q}{Max}\, U(x,n,q), \quad (4)$$

subject to a *non-linear* budget constraint:

[7] For an extensive overview on the models of fertility behaviour see Hotz, Klerman and Willis (1997).
[8] See Becker (1960).

$$p_x x + p_n n + p_c nq = I, \quad (5)$$

where q is the quality of children $p_n n$ indicates child costs independent of quality (for example birth and contraceptive costs), p_c is a price index of goods and services devoted to children and associated to both their number and their quality. As clearly analysed by Willis (1973), the maximization of (4) subject to (5) yields the following first-order conditions:

$$MU_n = \lambda[p_n + p_c q] = \lambda\pi_n, \quad (6)$$

and,

$$MU_q = \lambda[p_c n] = \lambda\pi_q, \quad (7)$$

where λ is the marginal utility of income, MU_i are the marginal utilities associated to the number and the quality of children and π_p and π_q are the shadow prices of quantity and quality respectively.

The conditions in (6) and (7) point out one of the most important implications of the quality-quantity model, namely that the shadow prices of the choice variables are now *endogenous* to the model. In particular, the shadow price of quantity depends on the quality chosen by parents, and the shadow price of quality depends on the number of children. It follows, that a rise in income, I, which affects the levels of n and q, will also induce a price effect and the relationship between income and n or q (holding observable market prices constant) may differ from the "true" income effect (holding shadow prices constant).

In the simplest model, if children are a normal good, an increase in income must increase fertility. According to the quality-quantity model, however, additional income can be translated into an increase in the quality per child and does not necessarily yield an increase in the number of children. A negative effect of income on fertility does not necessarily imply that children are an inferior good, but it might indicate that the income elasticity of quality is larger than the income elasticity of quantity.

In order to analyse the interaction between female labour force participation and fertility decisions, Becker (1965) argued that parents do not receive utility directly from the consumption of market goods or leisure, but that they combine the time supplied by family members with goods and services purchased in the market to produce the commodities that are the true objects of their utility.

Assuming that parents' lifetime utility is a function of household-produced goods, x, and child services, c, the representative household solves the following problem:

$$\underset{x,c}{Max}\, U(x, c), \qquad (8)$$

subject to the technological constraints:

$$x = g(t_x^f, s_x), \qquad (9)$$

$$c = nq = f(t_c^f, s_c), \qquad (10)$$

where only the woman's time is an input for the production of household-produced commodities and we indicate with s_x and s_c the market goods used to produce 'household goods' and child services respectively. $f(\cdot)$ and $g(\cdot)$ are constant returns to scale production functions and it is assumed that the production of c is relatively more intensive in the use of the woman's time than x.

The maximization of (8) is also subject to the usual time and budget constraints:

$$t_x^f + t_c^f + h = T, \qquad (11)$$

and,

$$s_c + s_x = wh + Y = I \qquad (12)$$

where the prices of the input goods are taken as numeraire and we do not distinguish between leisure and time spent at home, indicating with T the woman's endowment of time and with h the number of hours of paid work.[9] Men specialise in market work and this is indicated by the fact that Y, the partner's income, is treated as exogenous.

2.2. The problem of identification and aggregation

The specification of even this simple, static model is not straightforward since we do not observe some of the market prices described above. In particular, the price associated with the number of children, p_n, is unlikely to be collected by existing data sets or to exhibit enough variation across observations. This greatly limits the possibility of identifying the structural relationships between the endogenous and exogenous variables and constitutes the most severe challenge for those attempting to study the relationship between fertility and female labour supply.

The argument can be exemplified by assuming that the structural form of our system is given by:

$$h = f(\mathbf{w}, \mathbf{y}, n), \qquad (13)$$

and

$$n = g(\mathbf{w}, \mathbf{y}, \mathbf{v}_1, \mathbf{v}_2), \qquad (14)$$

where h represents the number of hours supplied in the labour market, n is a variable representing fertility, $\mathbf{w}$ and $\mathbf{y}$ are vectors of prices and income variables respectively, $\mathbf{v}_1$ is a vector of observed exogenous variables which do not directly affect labour supply decisions and $\mathbf{v}_2$ is a vector of unobservable exogenous variables.

[9] In order to consider explicitly the effect of unemployment we could impose a constraint on the hours of work an individual is able to supply and analyse the implication of this constraint for fertility and labour supply decisions. This extension to the model is not developed here.

Following the "standard"[10] approach we would predict n using $\mathbf{w}$, $\mathbf{y}$ and $\mathbf{v}_1$ and then use this predicted value to estimate consistent responses of labour supply decisions to changes in income and prices. If we were to adopt a reduced form approach and use $\mathbf{v}_1$ instead of n in equation (13) we would have to take into account the possibility that the omitted vector of variables $\mathbf{v}_2$ could be correlated with wages and non labour income variables. If and only if $\mathbf{v}_2$ is uncorrelated with $\mathbf{w}$, $\mathbf{y}$ and $\mathbf{v}_1$ do we obtain consistent estimates of the unconditional responses.

This argument rests upon two implicit assumptions Firstly, it is assumed that the structural form of the causality between fertility and labour supply decisions can be expressed by (13) and (14), where we are saying that some measure of current and/or past fertility affects current labour supply decisions, whereas fertility itself is not affected by current or past hours of work supplied by the mother. Secondly, it is crucial that there exists a vector of valid instruments $\mathbf{v}_1$, which affect fertility choices directly and labour supply decisions only indirectly. These assumptions appear to be contrary to the spirit of the "purist" approach.

The first formulation of a "purist" view of the relationship between fertility and labour supply is due to Mincer (1963), who wrote: " […] the choices of labour and family size are not causally related to one another. Rather, these choices are simultaneously determined by the same basic economic variables." This statement draws directly from the demand theory approach to fertility, where children are treated as a commodity and should not be included in other demand functions (for example, the demand for leisure) any more than we should consider purchases of tea on the right hand side of a demand for coffee equation.

It is clear that the "purist" approach does not advocate a structural form as described by (13) and (14). In fact, it does not support causation of fertility on labour supply and/or causation of labour supply on family size; it simply views the two endogenous variables as the joint solution to a common constrained maximization problem. This is a perfectly legitimate view if we are considering a static model of fertility and labour supply. Of course, the upshot of this argument is that by following a reduced form approach we are able to describe the outcomes of the participation and fertility decisions, but not to explain the structural interactions behind these choices.

[10] The distinction between the "purist" and "standard" approach is made in Browning (1992).

The task of establishing a causal direct relationship between fertility and labour supply is usually left to dynamic models, which express the fertility and labour supply decisions as optimal solutions to an intertemporal optimisation problem where the sequential nature of the decision process as well as issues related to the timing and spacing of births can be explicitly addressed. The econometric specification is represented by a discrete dynamic programming model and allows the identification of the structural parameters of the underlying life-cycle utility function.[11] However, the complexity of these models and the limited availability of data sets that offer the necessary information constitute a serious barrier to their implementation.

Even though we might be prepared to argue that causation runs from fertility to labour force participation on the grounds that fertility is an irreversible choice while labour force participation might be adjusted much more rapidly (at least) in the short-run, the second objection to the "standard" approach appears to be well founded. What the "purist" approach questions is the existence of a valid set of observable instruments $\mathbf{v}_1$, which is crucial for the solution of the identification problem.

There is considerable disagreement in the literature about the identifying restrictions to be imposed. For example, in Schultz (1978), the wife's residential origins at age 16, her age, and the schooling of both spouses are assumed to be exogenous determinants of fertility with no direct role in determining the current labour market behaviour of the wife. The author points out, however, that these identifying restrictions are proposed only as a starting point and they are not to be considered as theoretically correct. Others have used measures of 'ideal family size' or 'anticipated completed fertility' as long-run instruments for current fertility decisions, but the choice of an instrument is always based on a more or less questionable assumption of exogeneity.[12]

The level of aggregation of our analysis constitutes another serious obstacle for the interpretation of the estimated effects of exogenous changes in female or male wages on female labour supply and fertility choices. Some individuals occupy an interior solution and others a corner solution of their constrained maximization problem and it is obvious that the relative weight of the substitution and income effects can be very different depending on the

[11] See Heckman and Willis (1975), Wolpin (1984), Rosenzweig and Schultz (1985), Newman (1988), Montgomery (1988), Hotz and Miller (1988, 1993), Ahn (1995), Kalwij (1999) and Francesconi (2001). For a general overview, see Eckstein and Wolpin (1989).

[12] For a more extensive discussion on this point, see Browning (1992).

initial position. Moreover, these problems are likely to be further aggravated by the existence of a non-linear budget constraint.

Let us start by assuming that we could consider the relationship between “child services” and “female labour supply” as the two choice variables of a common constrained maximization problem, so that there is no direct causal relationship of one of them upon the other or viceversa. We would expect that the coefficients of the independent variables assume the opposite sign in the two estimated equations, but our dependent variables are given by fertility rates (and not by “child services”) and by female activity rates (and not “female labour supply”) and we are aggregating households across regions.

For example, consider an increase in the female wage rate. This would induce women who are already working to supply more or less hours, depending on the weight of the substitution or income effects, and will induce some women who were previously not working to supply a positive amount of hours. The aggregate effect on hours of work is undetermined, although a backward bending labour supply curve is usually ruled out, but the effect on female participation should be positive. On the other hand, we cannot determine the effect on “child services”, and given that we do not know how quality and quantity interact, we are even less able to predict the expected sign of an exogenous change in women’s wages on the number of children.

For similar reasons, we would expect an increase in male wages to have a negative effect on female participation but an undetermined effect on the amount of “child services” demanded and therefore on fertility. This problem is caused by the fact that an increase in the partner’s earnings produces an asymmetric shift in the non-linear budget constraint and the associated pure income effect has opposite implications for women with a strong preference for market activities and for women with a taste for “child services”.

It is even more difficult to assign an expected sign to the coefficient on unemployment. While the overall effect on female participation is given by the contrast between the “discouraged worker effect” and the “added worker effect” analysed in the labour supply literature, and the former has usually been found dominant, the answer is usually left to the empirical analysis. Similarly, as an increase in total unemployment creates substitution and income effects, which work in opposed directions with respect o the amount of “child services” demanded and its influence on fertility is not known.

Under these circumstances, the conditions under which the estimated effects of the exogenous variables could be taken as the partial derivatives of a labour supply equation or a fertility equation should be checked carefully. Any attempt to estimate the structural parameters of the relationship between female labour supply and fertility (or child services) will be based on a set of more or less questionable assumptions; the best we can do is to estimate reduce-form parameters and try to understand what they tell us about the underlying structure of the model.

3. *The econometric model*

In this work we follow a "purist" approach and model aggregate fertility and female labour force participation as determined by a common set of economic and demographic variables. Due to the limited availability of regional data for Italy, we estimated a static model where only current values of fertility, female participation, unemployment, male and female wages are considered. This implies that we are not able to explore a causal link between fertility rates and activity rates or to interpret the responses of the dependent variables to changes in the exogenous variables as income and price effects. However, we are still able to observe the effect of unemployment on the dependent variables and analyse the magnitude of this effect.

The reduced form to estimate is represented by the following system of equations:

$$TFR_{it} = \lambda_t + \alpha' \boldsymbol{X}_{it} + \beta_{11} \ln W_{it}^{m} + \beta_{12} \ln W_{it}^{f} + \beta_{13} \ln Un_{it}^{tot} + \varepsilon_{1it} \qquad (15)$$

$$FPR_{it} = \phi_t + \gamma' \boldsymbol{X}_{it} + \delta_{11} \ln W_{it}^{m} + \delta_{12} \ln W_{it}^{f} + \delta_{13} \ln Un_{it}^{tot} + \varepsilon_{2it}\,, \qquad (16)$$

where TFR_{it} is the variable representing the total fertility rate for each region - our unit of observation - FPR_{it} represents the female participation rate and $\boldsymbol{X}_{it}$ is a vector of observable characteristics of the female population, such as schooling[13] and age; year dummies appear in

[13] Female schooling or educational levels are considered an exogenous variable to our model. This is a very strong assumption, which is common to static models of fertility and participation and constitutes perhaps one of the most important limitations of this kind of approach.

both equations in order to control for cross-regional correlation caused by factors affecting fertility and participation at the national level. The other variables on the right hand side are the (logarithm) of male and female wages and total unemployment rates.

In order to take into account the endogeneity of female wages with respect to participation and fertility decisions and since unemployment rates are (by construction) related to the number of participants in the labour market, these variables are instrumented as described by the following equations:

$$\ln W_{it}^{f} = \boldsymbol{b}'\boldsymbol{G}_{it} + \boldsymbol{e}_{3it}\,, \tag{17}$$

$$\ln Un_{it}^{tot} = \boldsymbol{c}'\boldsymbol{J}_{it} + \boldsymbol{e}_{4it}\,. \tag{18}$$

The vectors of variables used as instruments for wages, $\boldsymbol{G}_{it}$, include all the variables in $\boldsymbol{X}_{it}$, additional educational variables and the composition by sector of activity and professional qualification of the female workforce. Unemployment rates are instrumented using the variables in $\boldsymbol{X}_{it}$, the (logarithm of the) ratio of GDP to employment lagged one period, considered as a proxy for labour productivity, and the average number of overtime hours.

The error terms of our equations are specified in order to include a region-specific time-invariant effect, which might be correlated with the vector of explanatory variables, and a stochastic component that represents the effect of omitted variables specific to both the units of observation and time periods:

$$\boldsymbol{e}_{jit} = \boldsymbol{u}_{ji} + u_{jit}\,, \qquad \text{j = 1, …, 4.} \tag{19}$$

We assume that u_{jit} can be characterized by an independently identically distributed random variable with mean zero and variance $\boldsymbol{s}_{u_j}^{2}$ and impose no restrictions on the variance-covariance structure of the model as the identification of the complete system of equations (15)-(18) is ensured by the satisfaction of the order condition.

The consistent estimation of the parameters of each equation in (15) and (16) is performed applying a two-stage least-squares procedure in order to take into account the endogeneity of wages and unemployment rates. A fixed-effect estimator is adopted in order to control for the possible correlation between unobservable region-specific time-invariant effects and the exogenous variables appearing in each equation. This is specifically meant to help solve the problem related to the unobservability of the costs and availability of child-care, which might be correlated with wages and income and differ across regions.[14]

It is clear that the model we estimate is a very simple, static model of fertility and female participation. This is partly due to the aggregate nature of our analysis and partly to the limitations imposed by the data set. For both Great Britain and Italy, our panel consists of a small number of observations and does not allow us to explore a more dynamic specification and to investigate the causal relationship between the two endogenous variables considered. It follows that equations (15) and (16) will be interpreted as long-run equilibrium relationships between the exogenous and endogenous variables.

4. *Description of the data*

One of the most serious limitations of our analysis is the quality and the availability of data for Italy, since in this country the collection of panel data started only very recently. There are few sources of longitudinal data and these are generally restricted to small territorial units or cover a period of time still too short[15] for the purpose of this study. In these circumstances the literature suggests the possibility to build a *pseudo panel* using a time series of independent cross-sections[16] and aggregating the information collected at the individual level into broader units of analysis whose characteristics can be followed through time.

The 10 Standard Statistic Regions in Great Britain and 14 Italian regional aggregates represent our units of observation (see Tables 1 and 2). The period analysed extends from 1983 to 1997 for Great Britain and 1983 to 1996 for Italy. In order to consider the total fertile life span the broadest age group analysed consists of women between 15 and 44 years. Successive specifications of the model consider a finer disaggregation, where we distinguish

[14] For evidence on the availability and cost of child care in Italy see Chiuri (2000) and Del Boca (2001).
[15] The *European Community Household Panel* provides information on three years as only the 1991, 1992 and 1993 waves have been released.
[16] See Deaton (1985).

individuals aged 15 to 24, 25 to 34 and 35 to 44 for both the fertility and participation equations.

Although we would have liked to extend our analysis further back to the mid 1970s in order to include the beginning of the post war fertility decline in Italy, the availability of time series for some of the most important economic variables is restricted to a shorter time period because changes in the methods of data collection and definitions limit the possibility of intertemporal comparability. [17]

Our database is derived by pooling together information collected from different sources. Regional time series of age-specific fertility rates have been recently published by the Italian National Institute of Statistics (hereafter ISTAT) and are available from 1975 to 1996. In the case of Great Britain, the corresponding series are derived from statistics published by the Office for National Statistics (hereafter ONS) for England and Wales and from the General Statistical Office (hereafter GSO) of Scotland for the latter. The latest available year is 1997, as from 1998 the Standard Statistical Region classification has been replaced by the Government Office Regions classification, which is not directly comparable to the previous one.

To obtain series of the levels of female labour force participation we used activity rates published in the Eurostat's *New Cronos* database and derived from the *Community Labour Force Sample Survey*. Harmonised unemployment rates and other relevant information related to the gender and age composition of the labour force have also been obtained from the same source. The *Community's Demographic Statistics*, whose main series are available in the *New Cronos*, represents the main source for calculating the composition by age group of the population.

The series for GDP for each region are regularly published by ONS and ISTAT. The GDP series have been calculated at constant prices using the regional consumer price index

[17] For example, in the *Labour Force Sample Survey* two concepts were taken into account when presenting the results of the survey for population activity: (i) the restricted concept, whereby the labour force consists of persons with a main occupation and those declaring themselves to be unemployed, (ii) the extended concept, whereby the labour force consists of persons with an occupation (main or occasional) or who are seeking paid work. The restricted concept has not been used as from the 1983 survey and this has clearly affected the computation of activity rates, unemployment rates and other important series.

published by the same sources. For Great Britain we proxied labour productivity using the regional GDP per capita, while for Italy we used the GDP to labour units[18] ratio.

In order to facilitate the comparison between the two countries, we tried to build our data set using published series of aggregate data derived from European surveys based on representative samples of the State Member's population. However, it was not always possible to derive all the relevant information from these sources and, in order to obtain some of the most important time-series disaggregated by region, gender and age group, we had to rely on national micro-surveys.

The *Labour Force Survey* for Great Britain was used in order to build consistent series of participation of women in full-time education and to obtain the educational qualification of the female population in each region and for each specific age group. Since educational qualification variables have been subject to various changes during the period of time covered by this study, we considered only broad qualification groups, roughly correspondent to National Vocational Qualification levels.

Gross hourly wages (at constant prices) for female and male employees and their occupational and industrial classification was obtained from the *New Earnings Survey* (hereafter *NES*), a national survey of a representative sample of employees working in Great Britain. The survey covers the period between 1975 and 1999, and contains over 100,000 observations per year. It allows the possibility to disaggregate the information according to region, sex and age group without excessively reducing the number of observations per cell. The survey contains also very useful information on the number of paid overtime hours worked by employees (not included in the computation of hourly wages), which has been considered as a proxy of the business cycle and is one of the most powerful instruments for unemployment.

The micro data set used for Italy is the Bank of Italy *Survey of Italian Households' Income and Wealth* (hereafter *SHIW*), which represents the most complete micro-survey on economic and social conditions of Italian households currently available. The first wave of the *SHIW* was conducted in 1965 and 27 surveys have been carried out since then, yearly until 1987 (except for 1985) and every two years thereafter (except for 1996 and 1997).

[18] Labour units refer to the full-time equivalent of the numbers of employed workers in each region and it includes both dependent and self-employed workers.

The survey collects data and demographic characteristics of household members. Sex, age and relationship to the head of the household are collected for all members, while the level of education, professional status and economic sector are recorded for income recipients until 1987 and for all household members only from 1989 onwards.

The *SHIW* constitutes our main source for the computation of gender and age-specific net hourly wage rates as well as the composition of the workforce by professional status and sector of activity. We describe in some detail the way in which we derived the net hourly wage rates because the data collected by the Bank of Italy is affected by several problems and we had to rely on a number of simplifying assumptions in order to derive the series used in our empirical analysis.

The survey collects the annual net wage for all dependent and independent workers. Our derived hourly wage rates (at constant prices) refer to dependent workers who have worked part-time or full-time for the whole year in the industry or services sector. Self-employed workers were excluded from the sample since there was not enough information on the number of months and working hours worked by them during the year. Employees who worked less than 12 months were consistently found to have very high hourly wages, perhaps because the annual wage reported was not always proportional to the number of months they effectively worked.[19]

Restricting the sample to employees who worked for the entire reference year did not solve all the problems of computation of hourly wage rates. Information on weekly hours for dependent workers was available only from 1987 onwards. For the years between 1983 and 1986 we imputed the number of weekly hours on the basis of the series of the average number of hours worked per week by employees published in the *Labour Force Sample Survey*. This information is available only at the national level and is not disaggregated by age group, so our imputation eliminates some of the regional and age-specific variation since workers in all the regional aggregates considered are supposed to follow the same percentage change in weekly hours from 1983 to 1986.

Additional problems are due to the fact that the *SHIW* is not run every year and the questionnaires do not contain retrospective information on the income and labour force status of household members for the period between two non-consecutive surveys. Our hourly wage

[19] The same selection criteria were adopted in Manacorda and Petrongolo (1998).

rates for the missing year(s) have been obtained by interpolating the hourly rates of the two closest years. This represents a simple solution to the problem and we are still considering the possibility of using information collected from alternative sources.

One of the variables for which it has been very difficult to find a satisfactory representation is the level of education of the population. As mentioned above, until 1987 the Bank of Italy collected information on the educational qualification of income recipients only. While these series are a good proxy for the education level of men of different age groups - which are used in the first-stage equations to improve the identification of the model - they are certainly not able to capture female education qualifications because of selection bias.

In order to overcome this problem, we decided to adopt a general measure of education represented by the number of pupils in secondary school as a percentage of the population between 15 and 19 years. The series is obtained using statistical records published by ISTAT in *Annuario Statistico Italiano* and is representative of a general trend towards increasing educational qualification across all regions, but does not adequately capture the different composition of educational qualifications across women.

5. Results

5.1. The first stage regressions

The first stage regressions for the logarithm of female hourly wages and total unemployment rates are presented in Tables 3 and 4 for Great Britain and Tables 5 and 6 for Italy. The set of instruments include the composition by sector and by professional qualification of the female workforce, the logarithm of the GDP to population or units of labour ratio lagged one period, the age composition of the population and time dummies. An additional instrument for unemployment was included in the first-stage equations for Great Britain, where information on the average number of paid overtime hours was available.

For Great Britain we considered the qualification levels of the female population in each age group while for the youngest age group we introduced also the percentage of women in full-time education. For Italy, where educational qualification variables for the whole population are not available, we represented the general trend towards increasing schooling by calculating the number of pupils in secondary school as a percentage of the population aged 15-19 and, in order to improve the identification of the endogenous variables, we considered the level of educational qualification of men in each age group and each region as collected by the Bank of Italy for income recipients only.

For both countries the professional qualification is a very good instrument for female wage rates. Being in an occupation characterised by lower or intermediate skills (blue collar in the case of Italy) - as opposed to being in a professional or managerial position (white collar) - is always significantly and negatively associated with the hourly wage rate. The composition by sector of the workforce is usually much less significant although it is interesting to observe how, in Italy, the percentage of women working in industry is usually associated with higher female wages and being in the public sector exerts an ambiguous influences on wages, this variable being negatively correlated with salaries of young employees.

In the first stage regression for Great Britain, female educational levels are generally positively and significantly correlated to female hourly wages and negatively and significantly correlated to unemployment, as we would expect. In Italy, on the other hand, female education as captured by the general indicator of schooling (TFTED15-19) is not positively correlated to female wages, although it exhibits a significant and negative coefficient in the unemployment equation. Male educational levels are in some cases positively and significantly correlated to female wages and in most cases negatively and significantly correlated to unemployment, providing in this respect a good proxy for the levels of female qualification.

Here we noticed, however, that the effect of male educational qualifications on unemployment is different for the group of women aged 15-24, where the coefficients indicate a strong and significantly positive correlation between education and unemployment. This may reveal that educational qualification is not exogenous with respect to unemployment and that, especially in regions in which unemployment is rising over time, young people are encouraged to pursue higher educational qualifications in order to increase the probability to find a job.

The logarithm of GDP per capita – calculated at constant prices and lagged one period – is found to be negatively, and in only one case significantly, correlated with total unemployment rates in Great Britain. The average number of paid overtime hours is, on the other hand, a very good instrument for unemployment. It appears with a negative sign also in the female wage equation, perhaps because paid unemployment is positively related to the number of hours worked declared by employees participating to the *NES*. In Italy, the ratio between GDP and units of labour is significantly and negatively correlated to unemployment.

It is perhaps important to consider that the age composition of the population is almost never significant in the first-stage regressions for Great Britain, while it has a strong effect on the unemployment equation for Italy. This effect is not very easy to interpret and might reveal an omitted variable problem or, more generally, may indicate that the unemployment equation is not correctly specified.

The general fit of the regressions is good, especially in the case of Great Britain, where the R-squared of the within-group regressions is always above 97 per cent for the wage equations and above 86 per cent for the unemployment equation. The first-stage regressions for Italy are somewhat less satisfactory and especially for the wage equations of women between 15 and 24 years the overall significance of the regressions appear to be relatively low.

5.2 The fertility and participation equations

The fertility and participation equations are presented in Tables 7 and 8 for Great Britain and in Tables 9 and 10 for Italy. In these equations we consider the effect of labour market variables, women's education and the changing age structure of the population on period fertility and female activity rates. The influence of changing labour market conditions is represented by female and male hourly wage rates and by the total unemployment rate.

Period fertility is measured by the total fertility rate – that is, the number of children a woman would have if she bore children at the prevailing age-specific fertility rates over the entire reproductive span – and by three age-specific rates. For Italy, official statistics usually report also age-specific fertility rates for women aged 45-49, but in order to carry out a meaningful comparison with Great Britain we followed the procedure in use in this country, where the number of births of women above 45 years is usually attributed to women in the 34-44 age group.

Male and female wages appear to be usually positive and significantly correlated to fertility rates in Great Britain. This is particularly evident in the regressions specified for different age groups, whereas in the regression referred to women in their entire fertile age span the coefficient of female and male wages do not appear to be significant. Even though we do not attempt to interpret the estimated coefficient in terms of income and substitution effects, a positive sign associated to women's wages may suggest the validity of the hypothesis in Ahn and Mira (2001), according to whom wages are a significant part of family income in high-participation countries.

The same observation applies to the results obtained for Italy, where female wages are positively correlated to fertility except for the group of women aged 35-44 where the coefficient is negative and strongly significant. In this case, however, we would like to point out that the female wage rate appears to be strongly significant and *negatively* correlated to female activity and this perhaps indicates problems in our derivation of the hourly wage rates for this group.

In the participation equations for Great Britain the signs of male and female wage rates appear to be in accordance with that generally predicted by the theory, although not always significant. In these regressions, female educational qualification variables appear to be the most important explanation of female activity rates. This incidentally suggests that the absence of an adequate proxy for female education most probably affects our results in the activity equations for Italy, which are generally unsatisfactory.

In fact, even if the variable representing the general trend towards increased schooling levels (TFTED15-19) assumes a negative and significant sign in the fertility equation for Italy, it fails to capture adequately the effect of education on activity. Comparing the role of educational variables in the participation equations estimated for Great Britain, it is evident that the absence of a proxy for the educational composition of the female population greatly undermines the possibility to explain activity rates in Italy.

As we can see in Table 10, the coefficient on the variable which captures the percentage of the population in the age group 15-19 still engaged in secondary school assumes a positive but insignificant coefficient for the regression of women aged 15-44 and a negative coefficient for the specific age groups considered. It clearly becomes a much less reliable proxy for the level of education of women in the older age groups.

One important result to underline is that male wages appear with a negative and significant sign in the fertility equation for women aged 15-24. In both Great Britain and Italy in the regressions for this age group, male wages are negatively and female wages are positively (although not significantly at the 5 per cent level) related to fertility. It is possible that this is due to the fact that we instrumented female wages and therefore the effect of increasing wage rates over time is better captured by male wages. It might also be that it is very difficult to separately identify male and female wage rates at the aggregate level for this age group, given that gender differences in the levels of schooling have considerably decreased through time.

Turning to the effect of unemployment, which is the variable we are mostly interested in, we can easily see that it is negatively and significantly associated to fertility and participation in both Great Britain and Italy. The only exception in this respect is represented by the positive effect of this variable on the fertility on women aged 35-44 in Great Britain, but we must consider that the fertility rates in this age group are extremely low and practically irrelevant in explaining overall fertility patterns.

In Italy, in particular, unemployment is the most significant economic variable in explaining fertility behaviour. It exhibits a negative and statistically significant coefficient in almost all the different specifications of the fertility equations. It is only in the regressions for the youngest age group that the results are different and this leads us to suspect once more that the analysis of the role of unemployment on the behaviour of this group of women might be much more difficult to capture in a static framework and that the interaction between fertility, female participation, unemployment and educational decisions needs to be modelled in a more appropriate dynamic context.

Purely demographic effects, which are linked to the changing age structure of the population, are represented by the percentages of women in the younger age sub-groups of each age group considered. They are, as we expected, one of the most important factors in explaining differences in regional fertility rates, especially in Italy. In Table 9, for example, we can clearly see that younger women in each group are generally associated with higher fertility rates.

The only exception is represented by the percentage of teenagers in the fertility equation for women aged 15-24. In this case the variable exhibits a negative and strongly significant sign even after taking into account the proportion of women engaged in full-time education. On the contrary, for Great Britain this variable assumes a positive and significant coefficient, indicating that it is perhaps capturing cultural and social factors which affect preferences for children at very young ages and which are beyond the scope of this analysis.[20]

These variables appear also to be significant in the participation equation, in particular in the regression of women aged 15-44 and 35-44. It is interesting to notice that higher percentages of younger women decrease the probability of participation in Great Britain, while have a positive effect on activity rates in Italy. This might indicate, for example, that British and Italian women have different patterns of participation in the labour force throughout the life-cycle. Italian women have a more continuous experience in the labour market, which is rarely interrupted because of the birth of a child, and tend to retire sooner than British women.[21]

6. Conclusions

6.1. The existence of a long-run relationship

We would like to verify whether our model, as specified by equations (15) and (16), provides an adequate account of the long-run relationship between the endogenous and exogenous variables. This is a problem that we address by testing for cointegration in equations (15) and (16) using the residuals obtained from the regressions. It must be noted, however, that for both Great Britain and Italy we have a very small panel, which consists of only 15 and 14 time observations respectively. Any test aimed at assessing the time-series properties of our variables on such a short period of time will have very limited power, but we think that it might nevertheless provide some useful insight into the specification of our model.

Tables 11 and 12 report the results of the panel data unit roots test suggested by Maddala and Wu (1999) (MW (1999) hereafter) on all the variables used in our regressions. The test

[20] According to data published by Eurostat, Italy has one of the lowest rates of teenage births among the Member States. The live birth rate of girls aged 15-19 was about 4 children per 1000 women in Italy as compared to 23 children for the UK in 1996.

[21] This is a feature partly due to the lack of part-time opportunities in the labour market and partly related to the incentives provided by the system of social security in Italy, which has for a long time encouraged early retirement of dependent workers in the public sector in particular.

simply combines the p-values, $\boldsymbol{p}_i$, obtained from the Augmented Dickey Fuller test performed on each regional series. As described in MW (1999) the test statistics is given by $-2\sum_{i=1}^{N}\ln \boldsymbol{p}_i$ and follows a $\boldsymbol{c}^2$ distribution with 2N degrees of freedom, where N represents the number of regions considered.[22]

As we can see in Table 11, the null hypothesis of non stationarity of the series is accepted at the 5 per cent significance level for almost all the variables used in the regressions for Great Britain. The only significant exception is represented by female participation rates, which follow a non linear pattern over time and whose time-series properties would be better captured with the inclusion of a trend. The results for Italy indicate that for some relevant variables we can reject the null with a 5 per cent significance level. This, unfortunately, does not indicate that the series are stationary, but reflects the much poorer quality of Italian data and in particular of the variables derived from the *SHIW* and constitutes another reason for interpreting the results of these tests with caution.

The results of the cointegration test are presented in Tables 13 and 14. The null hypothesis of no cointegration is rejected with 5 per cent degree of significance in the fertility equation for women 15-44 and for women 15-24 in Great Britain, while the participation equation passes the test only when we consider each specific age-group but not when we consider women in their entire fertile age span.[23] In the case of Italy, we are unable to reject the null hypothesis for almost all the different specifications of the fertility equations. The only exception is the fertility equation for women aged 15-44, for which we can reject the null of no cointegration only when a sufficient number of lags are considered. On the other hand, for the participation equations of women aged 15-44 and 15-24 we are usually able to reject the null at the conventional critical level.

---

[22] An alternative test is provided by Im, Pesaran and Shin (1997). We report only the results of the Maddala and Wu (1999) test since the critical values of the test suggested by Im, Pesaran and Shin (1997) should be appropriately computed via Monte Carlo simulations. However, we confronted the results of the two tests using approximate critical value, valid for larger sample size and we did not find any difference which could substantially change our analysis.

[23] We refer to the results of the ADF(1) test, since the consideration of higher lags order is likely to affect significantly the power of the test as we have a very short time period.

6.2. The effect of unemployment on fertility

As discussed in section 2, the estimation of a reduced form model of fertility and female participation does not allow us to address the issue of causality between the two endogenous variables or to obtain estimates of the structural parameters of our simultaneous equations model. However, from the estimation of equations (15) – (18) we expect to be able to derive a more precise idea of the effect of unemployment on fertility and female activity and to be able to assess to what extent the rising levels of unemployment have been responsible for the dramatic decline in fertility in Italy during the last decades.

Given the problems related to the quality and availability of time-series for Italy and the fact that the picture emerging from the tests for cointegration is very mixed, it is rather difficult to reach a clear conclusion on the effect of unemployment on fertility and female participation for this country. We believe, however, that the results obtained for Great Britain provide sufficient information to assess the successes and failures of our model.

It is possible to maintain that this simple, static model of fertility and female participation might be appropriate to estimate the effect of wages and unemployment on fertility for women in their entire fertile age span, while it is less adequate in explaining the fertility behaviour of women across different age groups. On the other hand, the participation equations for different age groups seem to be better specified than the aggregate regression. This might indicate that participation decisions are more flexible with respect to fertility decisions and that a static model is able to capture the contemporaneous influence of wages and unemployment variables on age specific activity rates while is less adequate in explaining age specific fertility behaviour.

Looking at the results of the fertility equations for Italy in Table 9 we see, for example, that unemployment exerts a negative and significant effect on the fertility rates of women aged 15-44 and women 25-34, but this effect is very different for women in the youngest age group. In this case the problem might also arise in the first stage regression where we fail to correctly explain unemployment (see Table 6) and this variable is shown to be positively correlated to male educational levels. In the corresponding fertility equation for Great Britain in Table 7 - where the first stage regression for unemployment does not present particular problems -

unemployment exerts a negative and significant effect on the fertility rate of the youngest age group.

This suggests that we need to explore more carefully the interaction between fertility, unemployment and education for this group of women in particular. The choice to participate in full-time education beyond compulsory schooling is likely to be affected by the conditions prevailing in the labour market. If unemployment encourages further investment in human capital, its influence on fertility maybe indirectly captured by the variables representing the trend towards higher levels of schooling (TFTED15-19). But, in order to verify this hypothesis and to separate the direct and indirect (through educational variables) effect of unemployment on this group of women, we need to proceed using micro data and adopting a more appropriate dynamic approach.

However, even this simple model captures some interesting effects which we believe can be confirmed by future work. In almost all the specifications of the model for both Great Britain and Italy, unemployment is a statistically significant variable in the fertility equation. This seems in line with what suggested by Ahn and Mira (2001) and casts severe doubts on the work of those who have tried to explore the causal relationship between fertility and participation excluding unemployment from the fertility equation as an identifying restriction.[24]

As we saw in Tables 9 and 10, the total rate of unemployment is one of the most important variables in explaining the dramatic decline in period fertility in Italy and is shown to exhibit a strong "discouragement effect" on women's activity rates. If this effect measures the influence of unemployment in the whole Mediterranean area, it is possible to infer that rising levels of unemployment in Europe might be responsible for the reversal of the correlation between fertility and female participation across the EU-15 area, as initially hypothesised.

As for the magnitude of the effect of unemployment, we consider that Total Fertility Rates in Italy decreased from 1.54 children per woman in 1983 to 1.2 children per woman in 1996, falling by 28.3 per cent and that total unemployment rates increased from 8.5 per cent in 1983 to 12.1 per cent in 1996, contributing to almost a quarter of the actual decline. Moreover, since the pattern of unemployment rates greatly differed among the Italian regions over the

[24] See Poot and Siegers (1992) and Carrasco (1999).

period considered, this varible is also a key element in describing some of the differences between geographical areas.

In fact, we notice that in Campania, one of the regions mostly hit by unemployment, the decrease in period fertility for women aged 15-44 was of about 0.54 children per woman. Rocketing unemployment rates, which increased from 13 per cent in 1983 to 25.5 per cent in 1996, contribute to explain almost 28 per cent of the actual decline, predicting a decrease in age-specific levels of about 0.15 children per woman. On the other hand, in Lombardia, one of the most successful regions of the North, fertility rates of women aged 15-44 declined by only 0.141 children per woman, and the estimated effect of unemployment, which has risen slightly from 5.8 per cent in 1983 to 6.3 per cent in 1996, was about 0.018 children, approximately 13 per cent of the actual variation.

The magnitude of the effect of unemployment on fertility and its importance in explaining variations across regional aggregates confirm our initial hypothesis and suggest that in order to understand current fertility trends in some European countries it is important to explore the relationship between unemployment and fertility. The comparison between Great Britain and Italy gives us the opportunity to test the specification of our model in countries characterised by different *levels* and *patterns* of fertility and female labour force participation and analyse to what extent the scarce availability and reliability of data for Italy affects our results.

From the evidence provided in the preceding sections, it emerges that the effect of unemployment on fertility is significant and of non-negligible magnitude. Our static model, however, is able to indicate the overall effect of unemployment on period fertility but not to explain the way in which the timing of fertility decisions is affected by economic considerations.

As it is very important to understand the life-cycle behaviour of fertility in response to changing labour market conditions, our analysis need to be further developed and we should analyse the interaction between fertility and participation decisions using a more appropriate dynamic model. Our results indicate that participation behaviour might be assumed to be more flexible with respect to fertility behaviour and this suggests how we can try to explore the causal link between the two endogenous variables. This analysis, however, is left to future work and will be carried out only when longitudinal micro data for Italy will become available.

References

Ahn, N., (1995): "Measuring the Value of Children by Sex and Age Using a Dynamic Programming Model", *Review of Economic Studies*, Vol. 62, pp. 361-379

Ahn, N. and Mira, P. (2001): "A Note on the Changing Relationship Between Fertility and Female Employment Rates in Developed Countries", *Journal of Population Economics,* forthcoming

Banca d'Italia, (2000): *The Bank of Italy Survey of Italian Households' Income and Wealth (SHIW)*, CdRom version, May, Roma

Banca d'Italia, (2000): "I bilanci delle famiglie italiane nell'anno 1998", *Supplementi al Bollettino Statistico*, Roma

Becker, G., (1960): "An Economic Analysis of Fertility", in: *Demographic and Economic Change in Developing Countries,* Universities-National Bureau of Economic Research Conference Series 11, pp. 209-231

Becker, G., (1965): "A Theory of the Allocation of Time", *The Economic Journal*, Vol. 75, pp. 493-517

Becker, G. and Lewis, H.G., (1973): "On the Interaction between Quantity and Quality of Children", *Journal of Political Economy*, Vol. 81, pp. S279-S288

Bettio, F. and Villa, P., (1998): "A Mediterranean perspective on the break-down of the relationship between female participation and fertility", *Cambridge Journal of Economics*, Vol. 22, pp. 137- 171

Brandolini, A. and Cannari, L., (1994): "Methodological Appendix: The Bank of Italy's Survey of Hopusehold Income and Wealth, Saving and the Accumulation of Wealth", in Ando ,A., Guiso, L. and Visco, I. (eds.), *Saving and the Accumulation of Wealth*, pp.369-401

Browning, M., (1992): "Children and Household Economic Behaviour", *Journal of Economic Literature*, pp. 1434-1475

Butz, W.P. and Ward, M.P., (1979): "The emergence of countercyclical US fertility", *American Economic Review*, Vol. 69, pp. 318-28

Carrasco, R. (1999): "Binary Choice with Binary Endogenous Regressors in Panel Data: Estimating the Effect of Fertility on Female Labour Force Participation", *Working Paper Series*, Universidad Carlos III de Madrid

Chiuri M.C., (2000): "Quality and Demand of Child Care and Female Labour Supply in Italy", *Labour*, Vol. 14(1), pp. 97-118

Deaton, A., (1985): “Panel Data from Time Series of Cross-Sections”, *Journal of Econometrics*, vol. 30, pp. 109-126

Del Boca, D., (2001): “Participation and Fertility Behaviour of Italian Women: the Role of Market Rigidities”, *Journal of Population Economics*, forthcoming

Eckstein, Z. and Wolpin, K.I., (1989): “The Specification and Estimation of Dynamic Stochastic Discrete Choice Models: a Survey”, *Journal of Human Resources*, Vol. 24, pp. 562-598

Erickson, C.L. and Ichino, A., (1995): “Wage Differentials in Italy: Market Forces, Institutions, and Inflation”, in Freeman, R.B., and Katz, L.F. (eds), *Differences and Changes in Wage Structure*, The University of Chicago Press, Chicago

Ermish, J.F., (1989): “Purchased Child Care, optimal Family Size and Mother’s Employment”, *Journal of Population Economics*, Vol. 2, pp. 79-102

Eurostat, various years, *Labour Force Sample Survey*, Luxembourg

Eurostat, various years, *Regions: Statistical Yearbook*, Luxembourg

Eurostat, (1996): *Social Portrait of Europe*, Luxembourg

Eurostat, (1998): *Social Portrait of Europe*, Luxembourg

Eurostat, various years, *Statistics in Focus*, Luxembourg

Francesconi, M. (2001): “A Joint Dynamic Model of Fertility and Work of Married Women”, *Journal of Labour Economics*, forthcoming

Heckman, J.J. and Willis, R., (1975): “Estimation of a Stochastic Model of Reproduction: an Econometric Approach”, in Terleckyj, N., (ed.), *Household Production and Consumption*, Columbia University Press, New York

Hotz, V.J., Klerman, J.A. and Willis, R.J., (1997): “The Economics of Fertility in Developed Countries”, in: Rosenzweig, M.R. and Stark, O. (eds.), *Handbook of Population and Family Economics*, pp. 275-347

Hotz, V.J. and Miller, R.A., (1988): “An Empirical Analysis of Life Cycle Fertility and Female Labour Supply”, *Econometrica*, Vol. 56, n. 1, pp. 91-118

Hotz, V.J. and Miller, R.A., (1993): “Conditional Choice Probabilities and the Estimation of Dynamic Models”, *Review of Economic Studies*, Vol. 60, pp. 497-530

ILO, (1985): *Yearbook of Labour Statistics*, Geneva: International Labour Office

Im, K.S., Pesaran, M.H.and Y. Shin (1997): “Testing for Unit Roots in Heterogeneous Panels”, Department of Applied Economics, University of Cambridge, mimeo

ISTAT, various years, *Rilevazione Trimestrale delle Forze Lavoro*, Roma

ISTAT, (1998a): “Indicatori provinciali di fecondita’. Anni 1975-1994”, *Informazioni*, n.84, Roma

ISTAT, (1998b):”La fecondita’ regionale nel 1994”, *Informazioni*, n. 66, Roma

ISTAT, (1998c): “La fecondita’ regionale nel 1995”, *Informazioni*, n. 97, Roma

ISTAT, (1999): “Conti economici regionali”, *Informazioni*, n. 1, Roma

ISTAT, (2000): “La fecondita’ regionale nel 1996”, *Informazioni*, n. 11, Roma

Kalwij, A.S., (1999): *Household Consumption, Female Employment and Fertility Decisions: a Microeconometric Analysis*, PhD. dissertation, CentER for Economic Research, Tilburg University

Lesthaeghe R. (1983), “A Century of Demographic and Cultural Change in Western Europe”, *Population and Development Review*, Vol. 9, No. 3, pp. 411-435

Maddala, G. S. and S. Wu (1999): “A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test”, *Oxford Bulletin of Economics and Statistics*, special issue, pp. 631-652

Manacorda, M. and Petrongolo, B., (1998): “Regional Imbalances and Aggregate Performance in a Leading Sector Model of the Labour Market: an Analysis on Italian Data 1977-1991”, *Centre for Economic Performance*, DP0402, September 1998

Mincer, J., (1963): “Market Prices, Opportunity Costs and Income Effects”, in: Christ, C. et al. (eds.) *Measurements in Economics: Studies in Mathematical Economics in honour of Yehuda Grunfeld*, Stanford University Press

Moffitt, R., (1984): “Profiles of Fertility, Labour Supply and Wages of Married Women: A Complete Life-Cycle Model”, *Review of Economic Studies*, pp. 263-278

Montgomery, M., (1988): “A Dynamic Model of Contraceptive Choice”, Population Council, New York (unpublished)

Newman, J., (1988): “A Stochastic Dynamic Model of Fertility”, *Research in Population Economics*, Vol. 6, pp. 41-68

Poot, J. and J.J. Siegers (1992): “An Economic Analysis of Fertility and Female Labour Force Participation in New Zealand”, *New Zealand Economic Papers*, pp. 219-248

Rosenzweig, M.R. and Schultz, T.P., (1985): "The Demand for and Supply of Births: Fertility and its Life-Cycle Consequences", *American Economic Review*, Vol. 75, pp. 55-76

Rosenzweig, M.R. and Wolpin, K.I., (1980a): "Testing the Quantity-Quality Fertility Model: the Use of Twins as a Natural Experiment", *Econometrica*, Vol. 48, No. 1, pp. 227-240

Rosenzweig, M.R., and Wolpin, K.I., (1980b): "Life-Cycle Labor Supply and Fertility: Causal Inferences from Household Models", *Journal of political Economy*, Vol. 88, No. 2, pp. 328-348.

Schultz, T.P., (1978): "The Influence of Fertility on Labor Supply of Married Women: Simultaneous Equation Estimates", in Ehrenberg, R. (ed.), *Research in Labor Economics*, JAI Press, Vol. 2, pp. 273-351

Schultz, T.P., (1980): "Estimating Labor Supply Functions for Married Women" in Smith, J.P. (ed.), *Female Labor Supply*, Princeton University Press, pp. 25-89

Van de Kaa D. (1987), "Europe's Second Demographic Transition", *Population Bulletin*, No. 42

Willis, J.R., (1973): "A New Approach to the Economic Theory of Fertility Behaviour", *Journal of Political Economy* , Vol. 81, pp. S14 - S64

Wolpin, K., (1984): "An Estimable Dynamic Stochastic Model of Fertility and Child Mortality", *Journal of Political Economy*, Vol. 92, pp. 852-874

Table 1

Description of variables for Great Britain

Each variable is specific to the age group considered unless otherwise indicated

Variable	
TFR	fertility rates
FPR	female activity rates
LMWAGE	logarithm of male net hourly wage rate
LFWAGE	logarithm of female net hourly wage rate
LTUNEM14+	logarithm of total unemployment rate (%)
LTUNEM<25	logarithm of total unemployment rate (%) of those aged less than 25
LTUNEM>25	logarithm of total unemployment rate (%) of those aged more than 25
FIND	women employees working in industry (%)
FSOCLOW	women employees in lower-skills occupational groups (personal and protective services, sales, plant and machine operatives, other) (%)
FSOCINT	women employees in intermediate-skills occupational groups (clerical and secretarial, craft and related) (%)
FFTED15-24	women aged 15-24 in full time education (%)
FLEV2	women with educational qualification corresponding to NVQ2 (%)
FLEV3	women with educational qualification corresponding to NVQ3 (%)
FLEV4	women with educational qualification corresponding to NVQ4 (%)
L(GDP/POP)_1	logarithm of the ratio between GDP and population lagged one period
OVERT	average number of overtime hours
WOMEN15-24	women aged 15-24 on women aged 15-44 (%)
WOMEN25-34	women aged 25-34 on women aged 15-44 (%)
WOMEN15-19	women aged 15-19 on women aged 15-24 (%)
WOMEN25-29	women aged 25-29 on women aged 25-34 (%)
WOMEN35-39	women aged 35-39 on women aged 35-44 (%)

PERIOD	1983-1997 for all regions
REGIONS	North, Yorkshire and Humberside, East Midlands, East Anglia, South East (incl. Greater London), South West, West Midlands, North West, Wales and Scotland

Table 2

Description of variables for Italy

Each variable is specific to the age group considered unless otherwise indicated

Variable	
TFR	fertility rates
FPR	female activity rates
LMWAGE	logarithm of the male net hourly wage rate
LFWAGE	logarithm of the female net hourly wage rate
LNTUNEM14+	logarithm of the total unemployment rate (%)
LNTUNEM<25	logarithm of the total unemployment rate (%) of those aged less than 25
LNTUNEM>25	logarithm of the total unemployment rate (%) of those aged more than 25
FIND	women employees working in industry (%)
FPUBLIC	women employees working in the Public Administration or public services (%)
FBLUE	women employees in blue collar occupations (%)
TFTED15-19	pupils in secondary school as a percentage of population aged 15-19
MLSEC	male income recipients with a lower secondary diploma (%)
MHSEC	male income recipients with a higher secondary diploma (%)
MTER	male income recipients with a degree (%)
L(GDP/LU)_1	logarithm of the ratio between GDP and labour units lagged one period
WOMEN15-24	women aged 15-24 on women aged 15-44 (%)
WOMEN25-34	women aged 25-34 on women aged 15-44 (%)
WOMEN15-19	women aged 15-19 on women aged 15-24 (%)
WOMEN25-29	women aged 25-29 on women aged 25-34 (%)
WOMEN35-39	women aged 35-39 on women aged 35-44 (%)
PERIOD	1983-1996 for all regions
REGIONS	Piemonte-Val d'Aosta, Lombardia, Trentino, Veneto, Friuli, Ligura, Emilia Romagna, Toscana, Umbria-Marche, Lazio, Abruzzi-Molise, Campania, Puglia-Basilicata-Calabria, Sicilia-Sardegna

Table 3

GREAT BRITAIN

First Stage - Fixed-Effects Regression

Dependent variable: logarithm of female net hourly wage rate
Group variable: 10 regions; number of periods: 15 years, from 1983 to 1997

	LFWAGE	LFWAGE	LFWAGE	LFWAGE
Age group	**15-44**	**15-24**	**25-34**	**35-44**
LMWAGE	**0.451****	**0.300****	**0.313****	**0.451****
	(8.564)	(4.411)	(3.777)	(6.081)
FIND	**0.033**	**-0.106**	**-0.101**	**0.115**
	(0.342)	(-1.485)	(-1.048)	(1.237)
FSOCLOW	**-0.865****	**-0.654****	**-0.811****	**-1.049****
	(-6.764)	(-5.589)	(-7.204)	(-9.764)
FSOCINT	**-0.695****	**-0.334****	**-0.595****	**-1.000****
	(-6.766)	(-3.155)	(-6.296)	(-8.829)
FFTED15-24	-	**-0.028**	-	-
		(-0.454)		
FLEV2	**0.019**	**0.034**	**0.046**	**-0.077**
	(0.231)	(0.566)	(0.612)	(-0.839)
FLEV3	**0.197***	**-0.076**	**0.214****	**0.257****
	(1.859)	(-0.935)	(2.160)	(2.089)
FLEV4	**0.048**	**-0.207****	**0.036**	**-0.106**
	(0.600)	(-1.859)	(0.336)	(-1.198)
L(GDP/POP)_1	**-0.007**	**0.022**	**0.151***	**-0.091**
	(-0.119)	(0.259)	(1.719)	(-1.204)
OVERTIME	**-0.044****	**-0.031****	**-0.042****	**-0.040****
	(-3.668)	(-2.325)	(-2.769)	(-2.020)
WOMEN15-24	**-0.595**	-	-	-
	(-1.450)			
WOMEN25-34	**-0.157**	-	-	-
	(-0.540)			
WOMEN15-19	-	**0.324**	-	-
		(0.918)		
WOMEN25-29	-	-	**-0.322**	-
			(-1.209)	
WOMEN35-39	-	-	-	**0.222**
				(1.017)
Year Dummies	✓	✓	✓	✓
R-sq (within)	0.9954	0.9752	0.9828	0.9913
Significance	0.0000	0.0000	0.0000	0.0000
Observations	150	150	150	150

t-values based robust standard errors in parentheses. (*) significant at 10% significance level, (**) significant at 5% significance level.

Table 4

GREAT BRITAIN

First Stage - Fixed-Effects Regression

Dependent variable: logarithm of total unemployment rate
Group variable: 10 regions; number of periods: 15 years, from 1983 to 1997

	LTUNEM14+	LTUNEM<25	LTUNEM>25	LTUNEM>25
Age group	**15-44**	**15-24**	**25-34**	**35-44**
LMWAGE	**-0.173**	**-0.687**	**-0.761***	**-0.158**
	(-0.348)	(-1.502)	(-1.876)	(-0.352)
FIND	**0.481**	**0.185**	**0.263**	**0.115****
	(0.950)	(0.428)	(0.556)	(1.994)
FSOCLOW	**0.230**	**-0.448**	**-1.736****	**1.019****
	(0.259)	(-0.569)	(-3.578)	(2.178)
FSOCINT	**-1.423***	**-1.370****	**-1.135****	**-0.037**
	(-1.948)	(-2.396)	(-2.469)	(-0.077)
FFTED15-24	-	**0.755***	-	-
		(1.870)		
FLEV2	**-2.186****	**-0.805***	**-0.697**	**-1.092****
	(-3.325)	(-1.681)	(-1.625)	(-2.347)
FLEV3	**-1.961****	**-0.848**	**-0.786**	**-2.303****
	(-1.988)	(-1.458)	(-1.349)	(-3.525)
FLEV4	**-2.110****	**-0.795**	**-1.277****	**-0.604**
	(-3.025)	(-0.984)	(-2.652)	(-1.134)
L(GDP/POP)_1	**-0.640**	**-0.798**	**-0.726***	**-0.328**
	(-1.405)	(-1.486)	(-1.722)	(-0.773)
OVERTIME	**-0.507****	**-0.597****	**-0.544****	**-0.588****
	(-5.885)	(-6.467)	(-6.844)	(-6.631)
WOMEN15-24	**-3.169**	-	-	-
	(-1.124)			
WOMEN25-34	**-0.207**	-	-	-
	(-0.090)			
WOMEN15-19	-	**1.424**	-	-
		(0.621)		
WOMEN25-29	-	-	**2.950****	-
			(2.343)	
WOMEN35-39	-	-	-	**-0.728**
				(-0.600)
Year Dummies	✓	✓	✓	✓
R-sq (within)	0.8877	0.8649	0.8731	0.8623
Significance	0.0000	0.0000	0.0000	0.0000
Observations	150	150	150	150

t-values based robust standard errors in parentheses. (*) significant at 10% significance level, (**) significant at 5% significance level.

Table 5

ITALY

First Stage - Fixed-Effects Regression

Dependent variable: logarithm of female net hourly wage rate
Group variable: 14 regions; number of periods: 14 years, from 1983 to 1996

	LFWAGE	LFWAGE	LFWAGE	LFWAGE
Age group	**15-44**	**15-24**	**25-34**	**35-44**
LMWAGE	**0.297****	**0.346***	**0.309****	**0.108**
	(2.763)	(1.820)	(2.078)	(1.290)
FIND	**0.174****	**-0.097**	**0.356***	**0.067**
	(2.096)	(-1.044)	(1.809)	(0.839)
FPUBLIC	**0.004**	**-0.330****	**0.226****	**-0.004**
	(0.050)	(-3.122)	(1.991)	(-0.049)
FBLUE	**-0.327****	**-0.276****	**-0.172****	**-0.451****
	(-3.531)	(-3.148)	(-2.256)	(-7.056)
TFTED15-19	**-0.048**	**-2.124****	**-0.424**	**0.143**
	(-0.166)	(-2.662)	(-1.472)	(0.462)
MLSEC	**0.260**	**1.157****	**-0.035**	**0.225***
	(0.839)	(3.570)	(-0.187)	(1.912)
MHSEC [(a)]	**0.094**	**1.011****	**0.008**	**0.064**
	(0.481)	(3.682)	(0.047)	(0.701)
MTER	**-0.183**	-	**-0.242**	**0.105**
	(-0.757)		(-0.899)	(0.742)
L(GDP/LU)_1	**-0.360***	**-0.748**	**-0.032**	**-0.407***
	(-1.693)	(-1.557)	(-0.135)	(-1.708)
WOMEN15-24	**-0.732**	-	-	
	(-0.446)			
WOMEN25-34	**1.370**	-	-	-
	(0.845)			
WOMEN15-19	-	**2.203**	-	-
		(1.278)		
WOMEN25-29	-	-	**-1.537**	-
			(-1.403)	
WOMEN35-39	-	-	-	**0.543**
				(0.732)
Year Dummies	✓	✓	✓	✓
R-sq (within)	0.7558	0.5630	0.5414	0.8238
Significance	0.0000	0.0000	0.0000	0.0000
Observations	196	196	196	196

t-values based robust standard errors in parentheses. (*) significant at 10% significance level, (**) significant at 5% significance level. (a) For the age group 15-24 we include in MHSEC also men with a degree since there are too few observations related to men with tertiary education in this age group to consider them in a separate variable.

Table 6

ITALY

First Stage - Fixed-Effects Regression

Dependent variable: logarithm of total unemployment rate
Group variable: 14 regions; number of periods: 14 years, from 1983 to 1996

	LTUNEM14+	LTUNEM<25	LTUNEM>25	LTUNEM>25
Age group	**15-44**	**15-24**	**25-34**	**35-44**
LMWAGE	**0.330**	**0.352****	**-0.121**	**-0.005**
	(1.130)	(3.521)	(-0.419)	(-0.016)
FIND	**0.259**	**-0.014**	**0.266**	**0.408***
	(1.083)	(-0.138)	(1.220)	(1.692)
FPUBLIC	**0.478***	**0.139**	**0.278**	**-0.014**
	(1.862)	(1.651)	(1.545)	(-0.053)
FBLUE	**0.063**	**0.133**	**-0.475****	**0.064**
	(0.279)	(1.644)	(-2.272)	(0.272)
TFTED15-19	**-4.611****	**-3.921****	**-4.103****	**-3.243****
	(-4.828)	(-4.281)	(-4.847)	(-2.935)
MLSEC	**-0.138**	**0.588****	**0.282**	**-0.043**
	(-0.316)	(2.503)	(0.814)	(-0.114)
MHSEC [(a)]	**-1.509****	**0.533****	**-0.855****	**-0.750****
	(-3.983)	(2.094)	(-2.484)	(-2.092)
MTER	**-1.051***	-	**-0.477**	**-0.939***
	(-1.839)		(-1.217)	(-1.712)
L(GDP/LU)_1	**-0.754**	**-1.178****	**-2.332****	**-2.194****
	(-1.322)	(-2.313)	(-4.193)	(-3.211)
WOMEN15-24	**-15.580****	-	-	-
	(-5.211)			
WOMEN25-34	**-12.711****	-	-	-
	(-4.817)			
WOMEN15-19	-	**9.658****	-	-
		(4.668)		
WOMEN25-29	-	-	**-14.182****	-
			(-5.892)	
WOMEN35-39	-	-	-	**-1.516**
				(-0.587)
Year Dummies	✓	✓	✓	✓
R-sq (within)	0.6670	0.6500	0.7352	0.6816
Significance	0.0000	0.0000	0.0000	0.0000
Observations	196	196	196	196

t-values based robust standard errors in parentheses. (*) significant at 10% significance level, (**) significant at 5% significance level. (a) For the age group 15-24 we include in MHSEC also men with a degree since there are too few observations related to men with tertiary education in this age group to consider them in a separate variable.

Table 7

GREAT BRITAIN

Second Stage - Fixed-Effects Regression

Dependent variable: age specific fertility rate
Group variable: 10 regions; number of periods: 15 years, from 1983 to 1997

	FR	FR	FR	FR
Age group	**15-44**	**15-24**	**25-34**	**35-44**
LMWAGE	**0.096**	**-0.198****	**0.302****	**0.051***
	(0.385)	(-3.027)	(2.200)	(1.798)
Lfwage	**0.360**	**0.244***	**-0.035**	**0.100****
	(1.154)	(1.965)	(-0.194)	(3.121)
Ltunem	**-0.140****	**-0.042***	**-0.015**	**0.029****
	(-2.841)	(-1.933)	(-0.371)	(2.876)
FFTED15-24	**-**	**0.013**	**-**	**-**
		0.272		
FEDLEV2	**-1.113****	**-0.154****	**0.112**	**-0.071****
	(-5.758)	(-2.373)	(1.040)	(-2.195)
FEDLEV3	**-0.822****	**-0.166****	**0.274****	**-0.065**
	(-3.094)	(-2.441)	(2.053)	(-1.296)
FEDLEV4	**-0.840****	**-0.288****	**-0.087**	**0.031**
	(-3.716)	(-2.673)	(-0.715)	(0.939)
WOMEN15-24	**1.151**	**-**	**-**	**-**
	(1.601)			
WOMEN25-34	**-1.756****	**-**	**-**	**-**
	(-2.798)			
WOMEN15-19	**-**	**0.776****	**-**	**-**
		(3.455)		
WOMEN25-29	**-**	**-**	**-0.133**	**-**
			(-0.434)	
WOMEN35-39	**-**	**-**	**-**	**-0.048**
				(-0.526)
Year Dummies	✓	✓	✓	✓
R-sq (within)	0.8188	0.9297	0.5999	0.9670
Significance	0.0000	0.0000	0.0000	0.0000
Observations	150	150	150	150

t-values based robust standard errors in parentheses. (*) significant at 10% significance level, (**) significant at 5% significance level. The variables in italics have been instrumented.

Table 8

GREAT BRITAIN

Second Stage - Fixed-Effects Regression

Dependent variable: age specific activity rate
Group variable: 10 regions; number of periods: 15 years, from 1983 to 1997

	FPR	**FPR**	**FPR**	**FPR**
Age group	**15-44**	**15-24**	**25-34**	**35-44**
LMWAGE	**-0.113**	**0.064**	**-0.064**	**-0.225****
	(-1.250)	(0.632)	(-0.571)	(-2.924)
Lfwage	**0.243****	**-0.039**	**0.119**	**0.093**
	(2.042)	(-0.199)	(0.807)	(1.103)
Ltunem	**-0.062****	**-0.037**	**-0.053**	**0.002**
	(-2.312)	(-1.241)	(-1.418)	(0.088)
FFTED15-24	**-**	**-0.200***	**-**	**-**
		(-1.911)		
FEDLEV2	**-0.020**	**0.252****	**0.272****	**-0.004**
	(-0.158)	(3.130)	(2.612)	(-0.036)
FEDLEV3	**0.108**	**0.363****	**0.134**	**0.339****
	(0.718)	(4.315)	(0.935)	(2.525)
FEDLEV4	**0.260***	**0.411****	**0.256****	**0.339****
	(1.950)	(3.142)	(2.048)	(3.511)
WOMEN15-24	**-0.215**	**-**	**-**	**-**
	(-0.692)			
WOMEN25-34	**-0.785****	**-**	**-**	**-**
	(-2.921)			
WOMEN15-19	**-**	**-0.281**	**-**	**-**
		(-0.828)		
WOMEN25-29	**-**	**-**	**0.202**	**-**
			(0.765)	
WOMEN35-39	**-**	**-**	**-**	**-0.977****
				(-3.869)
Year Dummies	✓	✓	✓	✓
R-sq (within)	0.9355	0.7640	0.9165	0.8500
Significance	0.0000	0.0000	0.0000	0.0000
Observations	150	150	150	150

t-values based robust standard errors in parentheses. (*) significant at 10% significance level, (**) significant at 5% significance level. The variables in italics have been instrumented.

Table 9

ITALY

Second Stage - Fixed-Effects Regression

Dependent variable: age specific fertility rate
Group variable: 14 regions; number of periods: 14 years, from 1983 to 1996

	FR	FR	FR	FR
Age group	**15-44**	**15-24**	**25-34**	**35-44**
LMWAGE	**0.083**	**-0.029****	**-0.060**	**0.025**
	(0.804)	(-2.063)	(-1.131)	(1.139)
Lfwage	**0.106**	**0.027**	**0.166****	**-0.088****
	(0.659)	(1.469)	(2.348)	(-2.065)
Ltunem	**-0.221****	**0.025**	**-0.136****	**-0.047****
	(-3.733)	(0.893)	(-4.931)	(-3.142)
TFTED15-19	**-1.538****	**-0.357****	**-0.988****	**-0.457****
	(-3.320)	(-2.674)	(-4.898)	(-5.075)
WOMEN15-24	**1.321**	-	-	-
	(1.096)			
WOMEN25-34	**4.993****	-	-	-
	(3.901)			
WOMEN15-19	-	**-2.725****	-	-
		(-8.575)		
WOMEN25-29	-	-	**0.016**	-
			(0.025)	
WOMEN35-39	-	-	-	**0.480****
				(2.322)
Year Dummies	✓	✓	✓	✓
R-sq (within)	0.8624	0.9761	0.5913	0.7285
Significance	0.0000	0.0000	0.0000	0.0000
Observations	196	196	196	196

t-values based robust standard errors in parentheses. (*) significant at 10% significance level, (**) significant at 5% significance level. The variables in italics have been instrumented.

Table 10

ITALY

Second Stage - Fixed-Effects Regression

Dependent variable: age specific activity rate
Group variable: 14 regions; number of periods: 14 years, from 1983 to 1996

	FPR	FPR	FPR	FPR
Age group	**15-44**	**15-24**	**25-34**	**35-44**
LMWAGE	**0.087****	**0.026**	**-0.100***	**0.083***
	(2.115)	(1.002)	(-1.933)	(1.865)
Lfwage	**-0.105**	**0.083****	**0.102**	**-0.190****
	(-1.385)	(2.887)	(1.243)	(-3.377)
Ltunem	**0.003**	**-0.020**	**-0.090****	**-0.040***
	(0.150)	(-0.404)	(-3.101)	(-1.765)
TFTED15-19	**0.070**	**-0.079**	**-0.257**	**-0.406****
	(0.425)	(-0.329)	(-1.639)	(-2.605)
WOMEN15-24	**-0.836****	-	-	-
	(-2.003)			
WOMEN25-34	**2.292****	-	-	-
	(4.322)			
WOMEN15-19	-	**-0.225**	-	-
		(-0.378)		
WOMEN25-29	-	-	**-0.893**	-
			(-1.422)	
WOMEN35-39	-	-	-	**2.043****
				(6.926)
Year Dummies	✓	✓	✓	✓
R-sq (within)	0.7525	0.5618	0.5148	0.8495
Significance	0.0000	0.0000	0.0000	0.0000
Observations	196	196	196	196

t-values based robust standard errors in parentheses. (*) significant at 10% significance level, (**) significant at 5% significance level. The variables in italics have been instrumented.

Table 11

Great Britain

T=15 and N=10

	MW (1999) H_0: Unit Root (no trend) Prob>chi2 reported						
Age Group 15-44	**ADF(1)**	**ADF(2)**	**ADF(3)**	**Age Group 25-34**	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.80970	0.95260	0.15560	TFR	0.72960	0.80730	0.12690
FPR	0.00000	0.00450	0.00000	FPR	0.00050	0.03580	0.00020
LFWAGE	0.98910	0.72410	0.93500	LFWAGE	0.78910	0.35070	0.44580
LTTUN	0.01480	0.62310	0.73400	LTAUN	0.01070	0.37620	0.99200
LWAGEM	0.96590	0.20190	0.45590	LWAGEM	0.78640	0.07220	0.47240
FIND	0.99990	0.99980	0.99140	FIND	0.95140	0.99510	0.99999
FSOCLOW	0.97070	0.80330	0.69970	FSOCLOW	0.45070	0.19260	0.68080
FSOCINT	0.99999	0.99999	0.98480	FSOCINT	0.95470	0.92960	0.84670
FLEV2	0.95710	0.96400	0.77190	FLEV2	0.10040	0.03030	0.00000
FLEV3	0.99999	0.99999	0.99999	FLEV3	0.99999	0.99999	0.99999
FLEV4	0.99999	0.99999	0.99999	FLEV4	0.99540	0.99990	0.99999
L(GDP/POP)	0.00000	0.28340	0.68380	L(GDP/POP)	0.00000	0.28340	0.68380
OVERT	0.14680	0.92000	0.97350	OVERT	0.14680	0.92000	0.97350
WOMEN15-24	0.99999	0.97770	0.05260	WOMEN25-29	0.60300	0.70600	0.15260
WOMEN25-34	0.96850	0.00280	0.00400				
Age Group 15-24	**ADF(1)**	**ADF(2)**	**ADF(3)**	**Age Group 35-44**	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.99999	0.99990	0.99630	TFR	0.99999	0.99999	0.99970
FPR	0.00000	0.06530	0.02810	FPR	0.00000	0.00000	0.01120
LFWAGE	0.85460	0.09070	0.01810	LFWAGE	0.98710	0.55970	0.97420
LTYUN	0.00110	0.20980	0.00000	LTAUN	0.01070	0.37620	0.99200
LWAGEM	0.84130	0.72870	0.16840	LWAGEM	0.39920	0.00050	0.00890
FIND	0.99970	0.99999	0.99740	FIND	0.99890	0.99999	0.99990
FSOCLOW	0.99999	0.99999	0.99980	FSOCLOW	0.29500	0.32350	0.01280
FSOCINT	0.99999	0.99999	0.99999	FSOCINT	0.63590	0.43830	0.93680
FFTED15-24	0.99999	0.99999	0.99999	FLEV2	0.99980	0.99999	0.99999
FLEV2	0.02660	0.33770	0.04470	FLEV3	0.99999	0.99999	0.99999
FLEV3	0.96830	0.98810	0.28920	FLEV4	0.99980	0.99999	0.99999
FLEV4	0.99999	0.99999	0.99999	L(GDP/POP)	0.00000	0.28340	0.68380
L(GDP/POP)	0.00000	0.28340	0.68380	OVERT	0.14680	0.92000	0.97350
OVERT	0.14680	0.92000	0.97350	WOMEN35-39	0.00020	0.00000	0.00000
WOMEN15-19	0.97710	0.99910	0.98300				

Table 12

Italy

T=14 and N=14

	MW (1999) H_0: Unit Root (no trend) Prob>chi2 reported						
Age Group 15-44	**ADF(1)**	**ADF(2)**	**ADF(3)**	**Age Group 25-34**	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.70370	0.20000	0.99200	TFR	0.98310	0.96240	0.95700
FPR	0.97700	0.04420	0.00080	FPR	0.58310	0.31200	0.05250
LFWAGE	0.15900	0.00950	0.00000	LFWAGE	0.24640	0.00840	0.00000
LTTUN	0.53610	0.12290	0.51070	LTAUN	0.94150	0.61190	0.42120
LMWAGE	0.07780	0.01260	0.00000	LMWAGE	0.03980	0.08850	0.00000
FIND	0.00000	0.00070	0.00110	FIND	0.00000	0.03920	0.00010
FPUBLIC	0.00020	0.11700	0.00000	FPUBLIC	0.00080	0.06330	0.01130
FBLUE	0.00020	0.31390	0.28770	FBLUE	0.00110	0.48740	0.00880
TFTED15-19	0.99999	0.99999	0.99999	TFTED15-19	0.99999	0.99999	0.99999
MLSEC	0.03680	0.23920	0.59810	MLSEC	0.00010	0.08800	0.00460
MHSEC	0.12140	0.34450	0.25620	MHSEC	0.00000	0.00000	0.04780
MTER	0.00000	0.00000	0.00000	MTER	0.00000	0.00000	0.00020
L(GDP/UL)	0.99999	0.99999	0.99999	L(GDP/UL)	0.99999	0.99999	0.99999
WOMEN15-24	0.99999	0.99999	0.99999	WOMEN25-29	0.99999	0.70890	0.30720
WOMEN25-34	0.99999	0.96370	0.04680				
Age Group 15-24	**ADF(1)**	**ADF(2)**	**ADF(3)**	**Age Group 35-44**	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.00340	0.00840	0.98950	TFR	0.98860	0.99999	0.99999
FPR	0.60980	0.71060	0.01280	FPR	0.00330	0.00040	0.73300
LFWAGE	0.01750	0.01270	0.00000	LFWAGE	0.23490	0.24590	0.00000
LTYUN	0.20540	0.03600	0.01210	LTAUN	0.94150	0.61190	0.42120
LMWAGE	0.11900	0.06230	0.00000	LMWAGE	0.00910	0.10690	0.00000
FIND	0.00000	0.00010	0.04270	FIND	0.00000	0.85810	0.14350
FPUBLIC	0.00020	0.00070	0.13390	FPUBLIC	0.00090	0.02150	0.07870
FBLUE	0.00000	0.00000	0.00460	FBLUE	0.00000	0.00000	0.00000
TFTED15-19	0.99999	0.99999	0.99999	TFTED15-19	0.99999	0.99999	0.99999
MLSEC	0.00010	0.03130	0.02270	MLSEC	0.00240	0.00010	0.00870
MHTER	0.00920	0.00930	0.00000	MHSEC	0.00010	0.00180	0.69850
L(GDP/UL)	0.99999	0.99999	0.99999	MTER	0.00010	0.02590	0.00000
WOMEN15-19	0.99999	0.99999	0.99999	L(GDP/UL)	0.99999	0.99999	0.99999
				WOMEN35-39	0.00000	0.00000	0.00000

Table 13

Great Britain

T=15 and N=10

	MW (1999) H_0: No cointegration Prob>chi2 reported		
Age Group 15-44	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.0006	0.2520	0.4502
FPR	01418	0.6199	0.0017
LFWAGE	0.0620	0.6444	0.4698
LTTUN	0.0020	0.0885	0.0046
Age Group 15-24	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.0289	0.0818	0.1413
FPR	0.0002	0.0028	0.3015
LFWAGE	0.0768	0.2989	0.6709
LTYUN	0.0025	0.2238	0.1651
Age Group 25-34	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.7767	0.2473	0.0511
FPR	0.0307	0.0110	0.3014
LFWAGE	0.0010	0.0212	0.0557
LTAUN	0.0389	0.0410	0.0000
Age Group 35-44	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.1455	0.4597	0.6624
FPR	0.0000	0.0062	0.0120
LFWAGE	0.0199	0.2303	0.3343
LTAUN	0.0063	0.0505	0.2207

Table 14

Italy

T=14 and N=14

	MW (1999) H_0: No cointegration Prob>chi2 reported		
Age Group 15-44	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.5769	0.7633	0.0066
FPR	0.0000	0.0000	0.7038
LFWAGE	0.0002	0.0000	0.0000
LTTUN	0.0033	0.0714	0.1154
Age Group 15-24	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.9690	0.9937	0.8524
FPR	0.0012	0.0185	0.0879
LFWAGE	0.0011	0.0371	0.0000
LTYUN	0.2803	0.2345	0.3539
Age Group 25-34	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.9882	0.9992	0.4891
FPR	0.1283	0.9481	0.9775
LFWAGE	0.0000	0.0250	0.3834
LTAUN	0.0591	0.1681	0.1343
Age Group 35-44	**ADF(1)**	**ADF(2)**	**ADF(3)**
TFR	0.2051	0.9375	0.6884
FPR	0.0327	0.5558	0.4779
LFWAGE	0.0000	0.0117	0.0032
LTAUN	0.2114	0.0945	0.0189

Table 11

Actual change in fertility rates and estimated effect of unemployment

Italy, 1983 to 1996

	WOMEN 15-44[(a)]					
Regional aggregates	TFR 1983	TFR 1996	**Actual change in TFR**	Unempl. 1983	Unempl. 1996	**Effect of Unempl.**
Piemonte-Val d'Aosta	1.19	1.08	**-0.111**	7.3	7.5	**-0.008**
Lombardia	1.27	1.12	**-0.141**	5.8	6.3	**-0.018**
Trentino	1.51	1.42	**-0.092**	4.7	3.4	**0.072**
Veneto	1.28	1.13	**-0.150**	7.3	5.4	**0.067**
Friuli	1.10	1.00	**-0.096**	7.7	6.3	**0.044**
Liguria	1.04	0.96	**-0.078**	5.8	11.6	**-0.153**
Emilia	1.11	1.03	**-0.077**	6.7	5.3	**0.052**
Toscana	1.17	1.02	**-0.152**	8.3	8.5	**-0.005**
Umbria-Marche	1.38	1.10	**-0.286**	6.7	7.5	**-0.023**
Lazio	1.43	1.15	**-0.283**	7.7	13.2	**-0.119**
Abruzzi-Molise	1.63	1.21	**-0.420**	8.1	11.5	**-0.076**
Campania	2.14	1.60	**-0.540**	13.0	25.5	**-0.149**
Puglia-Basilicata-Calabria	1.96	1.37	**-0.589**	11.5	20.2	**-0.125**
Sicilia-Sardegna	1.90	1.38	**-0.524**	12.8	23.4	**-0.134**
Italy	1.54	1.20	**-0.342**	8.5	12.1	**-0.078**

(a) Using the coefficient estimated in Table 9