Fertility and financial incentives in France

Guy Laroque* Bernard Salanié†

January 2003—Very preliminary.

Introduction

After the boom following the second world war, fertility has gone down in France at the beginning of the 70's, as Figure 1 shows. However, since 1995 the number of birth increases, a move that has drawn the attention of a number of commentators and of the media. This evolution often has been associated with various family policy measures which date from the same period, particularly with the extension of the 'Allocation Parentale d'Éducation' (APE) to the second born in July 1994. The APE provides one of the parents of a new born with a monthly benefit of around 500 US $ during the first three years following birth, provided the parent has held a job during two years in the past five years and stops working. It was aimed at families of three children or more before 1994, but extended to two children families then.

In fact, the policies towards families implemented in France at the end of the 1930's were in part based on the belief that family benefits increase fertility. In a number of other countries, this belief is not shared (see Gauthier (1996)), and family benefits are mostly designed as a way to ensure a minimum standard of living to families and children. Even in France, a recent widely quoted administrative report by Thélot et Villac (1998) barely mentions fertility in its analysis of family policies.

However it is natural for economists to presume of a link between family transfers and fertility. The standard model of Becker (1991) implies that the demand for children depends on their cost, which in turn depends on family transfers (see for instance Cigno (1986) for a theoretical study of the impact of taxes on fertility). A number of empirical studies, for instance Butz and Ward (1979), Rosenzweig and Schultz (1985), Hotz and Miller (1988), Heckman and Walker (1990),

*CREST-INSEE and CNRS URA 2200.

†CREST-INSEE, CNRS URA 2200 and CEPR. We have benefited from the help of Didier Blanchet, Olivia Ekert-Jaffé, Philippe Février, Dominique Goux, Thierry Magnac, Laurent Toulemon and Daniel Verger.

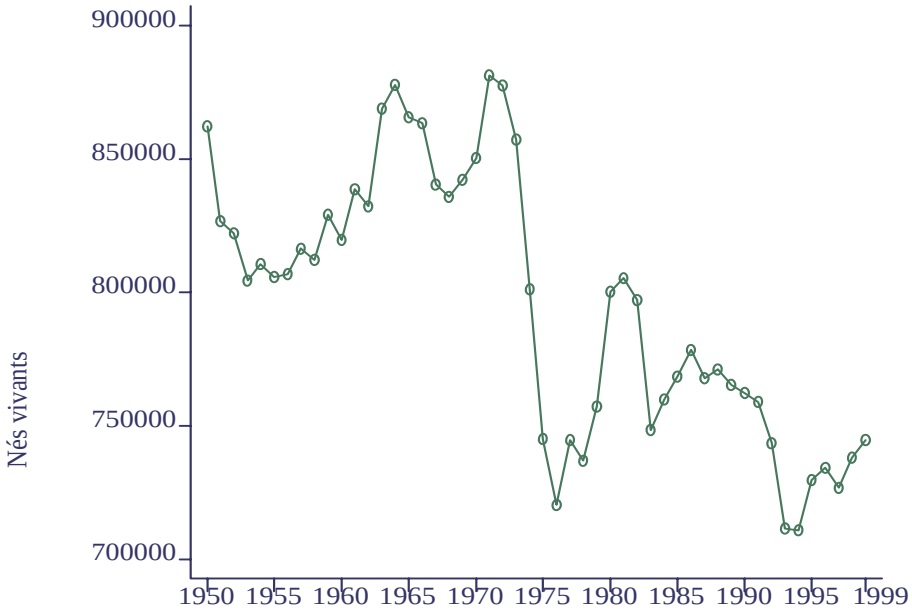

Figure 1: The annual number of births in France from 1950 to 1999

typically confirm the theoretical prediction that fertility decreases with the potential wage of the women, and increases with the other income of the household. The estimated effects nevertheless are small (see the survey of Hotz, Klerman and Willis (1997)). These studies rely on a very rough description of the family transfers.

The influence of family transfers on fertility does not seem to have been much studied on individual data (see the survey of d'Aubert (1999)). Gauthier and Hatzius (1997), for instance, use macroeconomic data on a panel of countries. Ekert-Jaffé (1986), Blanchet and Ekert-Jaffé (1994) are based on the same information. These works have lead to a consensus opinion that the family policies in France contribute to fertility of the order of 0.2 child per woman. But there are a number of methodological pitfalls, in particular on macro data, where it is difficult to measure the incentive effects of transfers towards a population which, in any case, would have given a number of births. On Canadian individual data, Lefebvre, Brouillette and Felteau (1994) adjust a nested logit of participation and fertility and get a weaker impact of financial incentives. On the other hand, the recent study of Milligan (2002) on a new born benefit in Québec between 1988 and 1997 finds a strong effect, using a natural experiment setup.

In order to measure the role of financial incentives on fertility at the individual level, one needs a careful and detailed model of the transfers accruing to the household. A number of transfers in France depend on the family composition, on top of the family transfers themselves: these include housing benefits and the income tax. Moreover, the schedules are linked to the employment status

of the parents. This fact is particularly clear in the case of the APE, which goes to a parent (typically the mother) who reduces her work time. One also notes that the unemployed women tend to delay their fertility decisions (Méron and Widmer (2002)). For all these reasons, it is important to describe in as much details as possible the full transfer system and to simultaneously model the fertility and participation decisions. We shall rely on some of our previous work (Laroque-Salanié (2000, 2002, 2003)). In our model, every woman is characterized with her productivity, her disutility for work and her net utility for a new child. If her productivity is smaller than the minimum wage, the woman cannot take a job but still choses or not to have a child. Otherwise, she can take a job paid at her productivity if she wishes to do so. She then jointly decides on participation and fertility, depending on her individual characteristics.

The paper undertakes to estimate and simulate a structural model on individual data. The model is presented in the first section. The likelihood function is somewhat complicated and described in section 2. The next section shows the estimation results, while section 4 simulates the impact on fertility and employment of a few representative policy measures.

The estimation of a structural model of the type which we are considering involves difficult choices. We have decided to give priority to the quality of the description of the transfer system, at the expense of the dynamical side of participation and fertility decisions. This goes against some of the recent advances in the literature (e.g. Francesconi (2002), Keane and Wolpin (2002a, 2002b)). In any case, a dynamic model would only make sense if we had a long enough panel, which is unavailable in France. For simplification, we also have ignored part time work in spite of the known links between giving birth and going part time. Finally, we have not taken into account some of the child-care measures, (AGED and AFEAMA), which are closer to consumption subsidies than income transfers, in spite of the fact that they are important both in theory (Apps et Rees (2001)) and in practice (del Boca (2002) and Choné, Leblanc and Robert-Bobée (2002)).

1 A model of labor supply and fertility

We posit a structural microeconomic model which jointly describes the decisions to participate in the labor market and to have a child. Since we observe women in a variety of situations, we may measure the effect of financial incentives on fertility: we expect more numerous births in households which, all other things equal, receive more money from a birth.

The financial gain associated with the birth of a child of course depends on the employment status of the members of the household. This is particularly striking in the case of the APE, which is conditional on reducing labor supply: but several other family benefits, and the RMI and housing benefits as well, jointly depend on the family composition and on income (therefore indirectly on employment). Our

identification strategy of the effects of financial incentives on fertility requires to jointly model the labor supply and fertility decisions. It also relies on a detailed representation of the transfers, and employment not only depends on labor supply but also on the level of the minimum wage as in (Laroque-Salanié (2002, 2003)).

We work on a sample of women, interviewed at the Enquête Emploi in January 1999. The endogenous variables are the employment status at the time of the survey, the wage in case of employment[1], and the occurrence of a birth during the year 1999, which is found using the March 2000 survey.

To know of the births planned at the beginning of 1999, we use the fact that the sample of the Enquête Emploi rotates by third very year. Our subsample is made of women interviewed both in January 1999 and March 2000[2].

The model is made of a wage equation and a discrete choice between four possibilities, matching the two possible states on the labor market (non employment or full time work) with the birth or non birth of a child. The model is used to describe labor supply in January 1999, given the family composition at that date. It is also used to describe the desired family composition and labor status in March 2000, from which the fertility decision in 1999 is inferred (we limit the horizon to 2000 for the family plan).

To write the wage equation, we compute a net monthly wage associated with a 39 hour work week, and apply the social contribution schedules to get a labor cost C. This labor cost is assumed to satisfy a standard Mincer equation:

$$\log C = X\beta + \sigma\varepsilon$$

where ε has a standard centered normal distribution and X contains the usual variables: number of school years and its square, experience and its square, diploma.

[1] We only consider two possible situations on the labor market: non employment or full time employment.

[2] The requirement that the same women are present at the two successive surveys creates some problems of representativity, as far as births are concerned. According to the 2000 survey, there are 700 000 children born during the civil year 1999. A bit more than 10% of the 2000 survey dwellings that ought to be present in 1999 are missing (the dwelling may be vacant, or there was no answer), but they correspond to more than 15% of the births. Moreover, even when the dwelling is present at both surveys, again more than 10% have different occupants. According to the surveys, around 30% of the households who have had a new born during 1999 have moved, and our study is restricted to 480 000 births out of the total 700 000.

The scope of our study is further reduced by the need to have a reliable measure of income and our desire to model participation while avoiding the end of studies margin. We only consider women less than 50 who have finished their studies for more than two years. We have excluded the civil servants. The survey does not contain information on pensions, nor on non wage income. Finally, as already mentioned, we let aside part time employees.

In sum, we work on 7 379 observations standing for 3,6 millions women, 5 785 femmes living with a partner and 1 594 alone. 48% hold a full time salaried job, the others do not work. Out of these 7 379 dwellings, 461 have seen a birth during 1999, standing for 230 000 births, approximately a third of the registered births.

The central feature of the model is the description of fertility. A priori, we would like to derive it from a dynamic program, where the woman would have thought of all future consequences, in terms of employment, wages and further births. This would involve expectations on the state of the labor market, family events, and changes in the benefits and taxes. Postulating such expectations without having, as a safeguard, long panel data is hazardous. Given the available data, we have assumed that the women make their fertility decision in 1999 in a rather myopic way:

- they forecast their income in 2000, in the various contingencies (work or no work, birth or no birth);
- their wages, their labor disutility, the job and wage of their partner and the tax-benefit system are supposed to stay unchanged between 1999 and 2000.

Let d be the labor disutility and v the net (of associated costs) benefit of a birth for a woman of the sample. We denote α_d, $\alpha_d > 0$, the sensitivity of labor supply to financial incentives and α_v, $\alpha_v > 0$, the sensitivity of fertility to financial incentives. Let R_{ij} be the net disposable incomes of the household in the four possible contingencies:

- R_{00} : non employment in March 2000 and no birth in 1999
- R_{01} : non employment in March 2000 and birth in 1999
- R_{10} : employment in March 2000 and no birth in 1999
- R_{11} : employment in March 2000 and birth in 1999.

These incomes are computed by applying the function R of our previous works, programmed for 1999 and left unchanged in 2000. This function gives the disposable income of the household after taxes and transfers, as a function of the labor costs of the members of the household (when they work) and of family composition. The labor supply decision changes wage income and the fertility decision modifies family composition, and consequently disposable income.

We normalize the utilities associated with the four states by assuming that the coefficient of the income variable always is equal to $\alpha_d\alpha_v$. Then the utilities to be compared are

$$\begin{cases} U_{00} &= \alpha_d\alpha_v R_{00} \\ U_{01} &= \alpha_d\alpha_v R_{01} + \alpha_d v \\ U_{10} &= \alpha_d\alpha_v R_{10} - \alpha_v d \\ U_{11} &= \alpha_d\alpha_v R_{11} - \alpha_v d + \alpha_d v \end{cases}$$

There remains to specify d and v. We assume that the labor disutility is

$$d = Z\gamma + \rho\varepsilon + \eta_d$$

where Z gathers variables describing non wage income, family composition (age and number of children) and possibly the matrimonial status. The variable ε allows for a correlation between the unobserved heterogeneities on wages and labor disutility. The random term η_d is assumed to have a centered standard normal distribution. supposé normal centré réduit. The net benefit of a birth is specified as

$$v = V\delta + \eta_v$$

where V includes variables describing the family composition, matrimonial status and the age of the woman, and η_v is centered standard normal.

The assumption of a unit variance of η_d and η_v is a normalization of utilities. At this stage, we have not allowed for a correlation between η_d and η_v, nor between ε and η_v. To illustrate, note that if Φ is the c.d.f. of the standard centered normal distribution, then conditionally on the decision of being unemployed, the probability of birth is

$$\Phi\left(V\delta + \alpha_v(R_{01} - R_{10})\right)$$

which justifies the interpretation of α_v as a measure of the sensitivity of fertility to financial incentives. Similarly, the probability of working given a birth is

$$\Phi\left(\alpha_d(R_{11} - R_{01}) - Z\gamma - \rho\varepsilon\right)$$

and α_d does measure the sensitivity of labor supply to financial incentives.

The model operates as follows. Every woman of the sample is characterized with some (C, d, v) which she knows, but is unobserved by the econometrician. In January 1999, she decides on her labor supply by comparing $\alpha_d R(C, F_{99})$ and $(\alpha_d R(0, F_{99}) + d)$, where F_{99} stands for the family composition of her household at that date. A woman who has decided to participate finds a job if her labor cost C exceeds the cost of the minimum wage $\underline{C}$. At the same time, the woman plans on possibly giving birth during 1999, by anticipating her situation in March 2000, comparing the utilities of the four possible states discussed above. A couple more remarks are in order:

- the less skilled women, for whom $C < \underline{C}$, in fact only compare the two situations of non employment, since the minimum wage excludes them form the labor force.

- the incomes R_{ij} account for the normal evolution of family composition between 1999 and 2000. Indeed,

$$\begin{cases} R_{00} &= R(0, F_{00}(0)) \\ R_{00} &= R(0, F_{00}(1)) \\ R_{10} &= R(C, F_{00}(0)) \\ R_{11} &= R(C, F_{00}(1)) \end{cases}$$

  where $F_{00}(0)$ (resp. $F_{00}(1)$) is the family composition "made older" by one year and taking into account 0 (resp. 1) birth in 1999.

Also, the decision to have a child is not necessarily followed by a birth, and a birth is not always voluntary. However, the data do not allow us to separate these circumstances. We therefore identify willingness to have a child with birth.

2 The likelihood function

We estimate the model by the maximum likelihood method. The endogenous variables are the employment statut, the wage if employed and a birth in 1999. The likelihood function is rather complicated and we shall only give a sketch of how it is derived.

Start with a woman employed in 1999. Given her labor cost C, we know the value of her ε, which contributes a term

$$\frac{1}{\sigma}\phi(\varepsilon)$$

to the likelihood function, where ϕ is the p.d.f. of the standard centered normal distribution. On the other hand, we have

$$d \leq A = \alpha_d(R(C, F_{99}) - R(0, F_{99}))$$

since this woman has decided to participate in 1999. There remains to compute the probabilities of fertility in 1999. For instance, the probability of giving birth is the sum of the probabilities that the preferred choice be U_{01} or U_{11}, i.e.

$$\begin{array}{l}\Pr(U_{01} \geq U_{00} \text{ and } U_{01} \geq U_{10} \text{ and } U_{01} \geq U_{11} \text{ and } d \leq A) + \\ \Pr(U_{11} \geq U_{00} \text{ and } U_{11} \geq U_{01} \text{ and } U_{11} \geq U_{10} \text{ and } d \leq A)\end{array}$$

As an illustration, consider the former of these two probabilities, which is

$$\Pr(v \geq \alpha_v(R_{00}-R_{01}) \text{ and } \alpha_d v+\alpha_v d \geq \alpha_d\alpha_v(R_{10}-R_{01}) \text{ and } d \leq \alpha_d(R_{11}-R_{01}) \text{ and } d \leq A)$$

These four inequalities delimit a trapeze in the plan (v, d). As (v, d) is distributed as a bivariate normal, it is not very difficult to compute the probability of this trapeze using the c.d.f. of the bivariate normal and the fact that a trapeze can be described as a combination of triangles and rectangles. This term indeed can be rewritten

$$\Pr(a_1 \leq d \leq a_2 \text{ and } \alpha_v d + \alpha_d v \geq a_3 \text{ and } v \geq a_4)$$

Suppose for example that $a_1 < a_2$ and

$$\alpha_v a_1 + \alpha_d a_4 < a_3 < \alpha_v a_2 + \alpha_d a_4$$

Then this term can be rewritten as

$$\Pr(v \geq a_4 \text{ and } \alpha_v d + \alpha_d v \geq a_3) - \Pr(d \leq a_1 \text{ and } \alpha_v d + \alpha_d v \geq a_3) - \Pr(d \geq a_2 \text{ and } v \geq a_4)$$

and each of the three terms is directly computed with the c.d.f. of the bivariate normal.

The other terms of the likelihood function for the employed women in 1999 are derived similarly. When the woman is not employed in 1999, things get more complicated since the econometrician does not observe her C, and therefore not her ε. For instance, if this woman has a child in 1999, the likelihood function is the joint probability of non employment and birth. It can be computed by deducting the joint probability of employment and birth from the probability of birth. The former is computed as above for fixed ε, by integrating with respect to the distribution of ε for all the values that ar compatible with employment (i.e. such as C is larger than the cost of the minimum wage). There remains to evaluate the probability of a birth. When ε is such that C is smaller than $\underline{C}$, it is simply $\Pr(U_{01} \geq U_{00})$, since the woman then is always unemployed. For larger ε's, it is given by

$$\begin{array}{l}\Pr(U_{01} \geq U_{00} \text{ and } U_{01} \geq U_{10} \text{ et } U_{01} \geq U_{11}) + \\ \Pr(U_{11} \geq U_{00} \text{ and } U_{11} \geq U_{01} \text{ et } U_{11} \geq U_{10})\end{array}$$

Again, one just than has to integrate these expressions according to the distribution of ε on the relevant domain. The case of a woman who does not give birth in 1999 is dealt with in a very similar way.

Each computation of the likelihood function takes about 10 CPU seconds on a 2 MHZ Pentium 4. To speed up the maximization algorithm, we have programmed a semi-analytical computation of the gradient. If, for instance, an equation contains a term $a = X\beta$, we numerically evaluate the derivative of the likelihood function L with respect to a and we use the identity

$$\frac{\partial L}{\partial \beta_i} = X_i \frac{\partial L}{\partial a}.$$

We have smoothed out the non-differentiabilities of the likelihood function which are in particular due to irregularities of the function R. The numerical integrals of the type

$$\int_a^b F(\varepsilon)\phi(\varepsilon)d\varepsilon$$

which appear when computing the likelihood function are evaluated as in our previous work (see for instance Laroque-Salanié (2002, p. 38).

3 Estimation results

The wage and disutility of labor equations have standard specifications. The explanatory variables X of the wage equation include the age at the end of studies and its square, experience[3] and its square, and indicator variables for the six

[3]Measured, by lack of better information, as the time since the end of studies.

levels of diplomas. The variables Z which explain the disutility of labor are the numbers of children less than one year old, less than three years old, between 3 and 6, and between 6 and 18, the age of the woman, an indicator of marital status, income when not working and its interactions with family composition and marital status. We also allow for a sensitivity of labor disutility with respect to financial incentives that varies with age by specifying α_d as a quadratic function of age.

Specifying the fertility equation is not as straightforward. The willingness to give birth certainly depends on several groups of variables, such as diplomas, matrimonial status, family composition and age. There is no obvious way to parsimoniously combine these variables, and experimenting is costly. Moreover, a number of these variables have some endogenous features. Finally, it is likely that the sensitivity of fertility to financial incentives, if it exists, varies with age.

For all these reasons, the specification which we currently discuss is highly provisional at this stage. After several trials, the explanatory variables V retained here include the number of children less than one year old, between 1 and 2, between 2 and 3, between 3 and 18, an indicator variable of presence of a partner, an indicator of matrimonial status and the age at end of studies. All these variables are included as such, as well as their products with A_{40} and its square, where A_{40} is the age of the woman, truncated at 40; furthermore, V also includes a variable equal to one when the woman is older than 40. As far as α_v is concerned, we have found that fertility is less sensitive to financial incentives the older the woman. We retained a linear decreasing function of age, which goes to zero at a limit age which is to be estimated.

Table 1 presents the estimates of the productivity equation, i.e. the coefficients β and the standard error σ. The fertility equation only marginally modifies the results of our previous studies.

The estimates of the disutility of labor coefficients γ and ρ are reported in Table 2. In this table, the variables are fixed at their observed value in the January 1999 survey. $R(0)$ is the household disposable income when the woman does not work, E_{-1} is the number of children less than one year old, E_{-3} the number of children less than three, E_{3-6} the number of children between three and six, E_{6-18} between six and eighteen, and M is an indicator variable equal to one when the woman is married. Most of the coefficients are significantly different from zero and have the expected sign: the presence of children increases the disutility for labor, the more so the younger the children. The disutility of labor also increases with the wage of the partner, through $R(0)$, and with age. The matrimonial status has the expected sign –the married women are less eager to get a job on the labor market– but is not significant. The estimated value of ρ implies that a high productivity is associated with a high labor disutility, everything else equal. All these results are in line with our previous work.

Table 3 presents the estimates δ of the fertility equation. The variables appearing in the Table and not previously defined are:

Table 1: Productivity equation

Variable	Coefficient	Standard error
Age at end of studies	0.114	0.014
Age at end of studies square	-0.002	0.000
Experience	0.034	0.003
Experience squared	-0.000	0.000
Graduate	0.752	0.028
Baccalauréat + 2 years	0.557	0.023
Baccalauréat, or equivalent	0.372	0.019
CAP, BEP or equiv	0.208	0.015
BEPC only	0.174	0.020
Constant	5.406	0.144
Standard error	0.293	0.004

Table 2: Labor disutility

Variable	Coefficient	Standard Error
$R(0)/1000$	0.273	0.068
$R(0) \times E_{-3}/1000$	-0.182	0.057
$R(0) \times E_{3-6}/1000$	-0.003	0.056
$R(0) \times E_{6-18}/1000$	0.076	0.025
$R(0) \times M/1000$	0.009	0.075
E_{-3}	0.861	0.130
E_{3-6}	0.447	0.113
E_{6-18}	0.143	0.053
Age	0.040	0.008
M	0.149	0.105
E_{-1}	0.136	0.087
Constant	-0.832	0.155
ρ	0.158	0.066

- E_{1-2} : number of children aged one
- E_{2-3} : number of children aged two
- E_{3-18} : number of children aged three to seventeen
- Co : indicator variable of presence of a partner
- D : age at end of studies
- A_{40} : age of the woman, truncated at forty
- A_+ : variable equal to one if age of woman larger than forty.

A number of these variables and of their interactions are not significantly different from zero. Moreover, the explanatory power of the equation is modest, as we shall see later. Finally, it is not easy to read the effects on fertility from the table, given the interactions with A_{40} and its square. A closer look at the estimates shows that

- As might have been expected, a new-born child, less than one year old, has large negative effects on fertility, at least while the women is less than 35 years old. Children aged one or between three and eighteen also reduce fertility but to a smaller extent. On the other hand, a child aged two increases fertility, which suggests that the women plan an interval of three years between two births.
- Being married increases fertility for younger women, reduces it for the older ones.
- Living with a partner always increases substantially fertility.
- Longer studies reduce fertility for younger women.

The most important coefficients for our purpose are the ones that measure the sensitivity of labor supply and fertility to financial incentives, α_d and α_v. Table 4 presents the estimates of the sensitivity of labor supply to financial incentives, and its variations with the age of the woman are depicted on Figure 2. It does not vary much with age and is maximal around thirty five. The value of α_d is in line with our previous results.

The main purpose of the paper is to estimate the sensitivity of fertility to financial incentives α_v. We have specified α_v as a truncated linear function of the woman's age, equal to α_v^0 at 20 and to zero for all women older than A_v, where A_v is to be estimated. The estimates of these two parameters are in Table 5 and the graph showing the resulting sensitivity as a function of the age of the woman is in Figure 3.

Table 3: Fertility

Variable	Coefficient	Standard error
E_{-1}	8.294	3.645
E_{1-2}	7.816	3.288
E_{2-3}	4.987	2.711
E_{3-18}	3.405	1.385
M	-4.052	2.490
Co	-2.105	3.463
D	-0.390	0.439
A_{40}	-0.334	0.530
$A_{40} \times E_{-1}$	-0.688	0.242
$A_{40} \times E_{1-2}$	-0.577	0.220
$A_{40} \times E_{2-3}$	-0.336	0.174
$A_{40} \times E_{3-18}$	-0.237	0.085
$A_{40} \times M$	0.336	0.161
$A_{40} \times$ Co	0.209	0.219
$A_{40} \times D$	0.020	0.027
A_{40}^2	0.003	0.008
$A_{40}^2 \times E_{-1}$	0.012	0.004
$A_{40}^2 \times E_{1-2}$	0.010	0.004
$A_{40}^2 \times E_{2-3}$	0.006	0.003
$A_{40}^2 \times E_{3-18}$	0.004	0.001
$A_{40}^2 \times M$	-0.006	0.003
$A_{40}^2 \times$ Co	-0.004	0.003
$A_{40}^2 \times D$	-0.000	0.000
A_+	-0.584	0.159
Constant	5.298	8.467

Table 4: $1000 \times \alpha_d$

Variable	Coefficient	Standard Error
Age	0.0732	0.0572
Age squared	-0.0011	0.0007
Constant	0.0325	0.1178

Table 5: $1000 \times \alpha_v$

Variable	Coefficient	Standard error
α_v^0	0.580	0.239
A_v	39.188	6.119

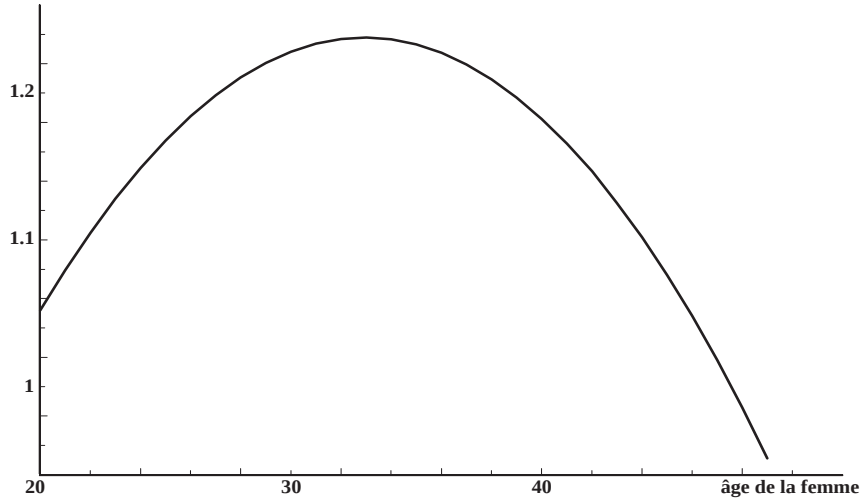

Figure 2: $1000 \times \alpha_d$

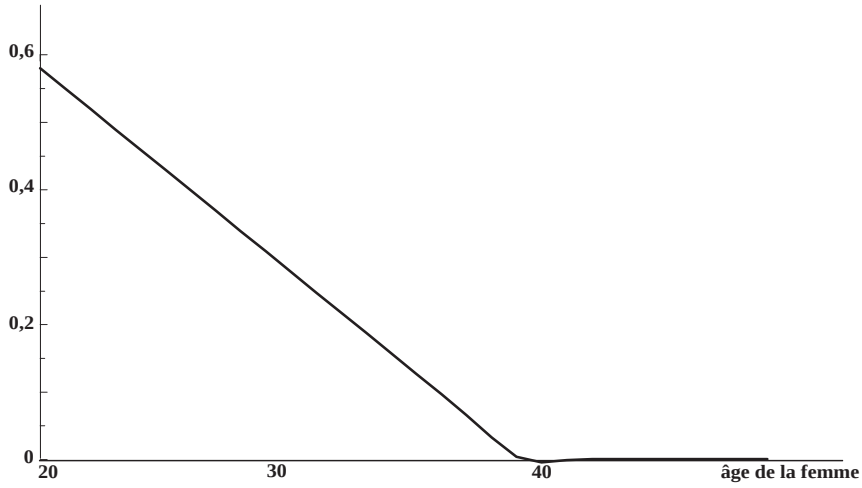

Figure 3: $1000 \times \alpha_v$

Table 6: The fit of fertility on the sample

Criterion	Observations	Fit	
	Number	Fertility rate	
All	234138	0.066	0.062
Family composition			
No child	71091	0.067	0.066
One child	89987	0.090	0.067
Two children	46799	0.048	0.060
Three or more	26262	0.051	0.045
$E_{-1} = 0$	224814	0.068	0.064
$E_{-1} > 0$	9324	0.033	0.031
Age of mother			
20-24	19530	0.195	0.194
25-26	30126	0.182	0.175
27-28	35529	0.145	0.141
29-30	41270	0.151	0.132
31-35	67554	0.085	0.086
36-40	34307	0.047	0.038
41-49	5823	0.005	0.004
Mother's diploma			
Graduate	16539	0.072	0.076
Bac. +2	36078	0.090	0.077
Bac or equiv.	44451	0.082	0.073
CAP, BEP or equiv	55325	0.056	0.061
BEPC only	17489	0.057	0.050
No diploma	64257	0.059	0.051
Partner and employment			
Alone	16994	0.023	0.024
With partner	217145	0.077	0.072
Salaried in 1999	104547	0.060	0.060
Unemployed	129591	0.071	0.063

There a number of ways to describe the quality of the fit of the model. We focus the attention on fertility. Given the estimated coefficients, it is easy to compute the probability of a birth in each dwelling of the sample, conditional on the exogenous variables and on the (endogenous) employment status and wage. This probability indeed is a by product of the computation of the likelihood function. The average of this probability on the dwellings that indeed saw a birth is 0.17, while it is equal to 0.05 on the other households. The pseudo R^2, ratio of the variance of the above probability to the variance of the birth indicator variable, is 0.11.

Table 6 compares the observed and above estimated fertility rates for the whole sample and for various subgroups. The fit seems of high quality as a function of the age of the mother and of employment status. It is fine by diploma, with some over fertility of the more skilled with respect to the less skilled. The fit is poor by birth rank: this should be the subject of further work.

It makes sense to compare the value of the log-likelihood function associated with birth with that of a simple probit model of birth, where the explanatory variables are those in V (age and family composition at the beginning of the year). The difference of the log-likelihood functions is 3.25, which is statistically significant but not large given the number of points and the efforts needed to set and estimate the full model!

4 Simulations of policy reforms

The best way to convince the reader of the importance of having a reliable estimate of the sensitivity of fertility to financial incentives may be to simulate some reforms of family benefits. In our previous works, we have studied in detail some policies aimed at labor supply or demand: here we shall focus on fertility. The computed impacts of policies are conditional on the explanatory variables, including in particular family composition at the start of the year. Our measures of the effects of policies are therefore static, by contrast with the dynamic effects which would take into account the temporal changes of family composition occurring over the years.

The first group of reforms that we analyze deals with the Allocation Parentale d'Éducation. We consider two reforms which amount to suppress the APE, or only its extension to second born in 1994. The results illustrate in negative how the introduction or the extension of APE stimulated fertility.

The second group of reforms describes a "child support" of 500 euros per month per child less than three years old, in four guises. First, this support comes on top of the existing legislation. In the second, the support is (partially?) financed by removing all the existing family benefits[4]. The third and fourth variants differ from the two foregoing ones in that the support is only granted to the third or

[4]We have not yet computed the likely financial outcome of this reform.

Table 7: Simulation of various reforms

Unit %

Reform	Fertility	Employment
Removal of APE	-4.8	+3.3
Removal of APE for second born	-1.9	+1.9
Child support	+18.4	-0.5
Child support financed	+7.4	+3.9
Child support (3rd born or more)	+5.6	-0.2
" financed	-3.7	+3.8

higher rank born, in line with the emphasis often seen in France on families with three or more children.

The results are summarized in Table 7. They are shown in percentage difference from the reference situation. Our sample represents 230 000 births in 1999 (approximately one third of total births in France) and 1 700 000 employees. As a consequence, a change of 1% of the number of births corresponds approximately to 2 300 births on our sample, and 7 500 if one dares to extrapolate proportionately to the whole of France[5]. A 1% change of employment corresponds to 18 000 jobs, and this cannot be extrapolated to the overall population, given the specifics of the female labor force.

We first note that the employment effects of the APE computed here are very close to earlier results: denying the APE to the two children family would create 30 000 jobs on this population. As far as fertility is concerned, we find that the extension of APE to second born in 1994 has increased the total annual number of births in France by around 15 000. This is a substantial impact, but it only accounts for a part of the fertility recovery (approximately 40 000 birth per year) of the past five years.

To be eligible to APE, a woman has to stop working (or at least to go part time for an APE at reduced rate). By contrast, the child support which we simulate here would not be conditional to any (non) work requirement, and would be given to women at work. This explains why its effects on fertility would be much larger than those of APE, even though it is calibrated at 500 euros per month, close to the level of the APE benefit. We find that such a child support, on top of the existing family benefits, would induce a major increase of fertility (of the order of 140 000 extra annual births in France), with a negligible impact on employment. Such a support however would be rather dear[6]. It is more realistic to assume

[5]This is very risky. The more mobile part of the population, the persons that moved at the time of a new birth, are absent from our sample. Also the students and civil servants are missing.

[6]We have not undertaken a precise estimation. With 800 000 births per year, the cost would amount to $800\,000 \times 3 \times 12 \times 500 = 14,4$ billions euros per year.

the substitution of family benefits with this support. The impact on fertility then would be three times smaller. Note however that replacing transfers that decrease with income (and therefore implicitly with employment) with a support independent of activity increases the employment level, as shown in the Table. This may not be as favorable, redistributionwise, and this should be the subject of further study.

The two bottom lines of the Table assume that the child support is only granted to children of birth rank at least equal to 3. As is natural, the impact on fertility is smaller. In fact, it turns out negative when the current family benefits are removed: it is likely that the overall balance would then be a reduction of transfers to families. The births of rank 3 or more are about 30% of the overall births in our sample: the cost of this restricted child support would be of around 30% of the generous measure of the preceding paragraph and its effect on fertility is three times less. Our computations therefore do not seem to confirm the idea that focusing policies towards families of three children or more is more effective than aiming at births of all ranks. Before being more definite on this issue, we however should allow the sensitivity of fertility to financial incentives α_v to depend on the size of the family.

Bibliography

Apps, P. and R. Rees (2001), "Fertility, Female Labour Supply and Public Policy", IZA Discussion Paper 409.

Aubert, J.-M. (1999), "Est-il efficace de soutenir la natalité ?", *Economie publique*, 1-2, 161-187.

Becker, G. (1991), *A Treatise on the Family*, Harvard University Press.

Blanchet, D. and O. Ekert-Jaffé (1994), "The Demographic Impact of Family Benefits: Evidence forma Micromodel and from Macrodata", in *The Family, the Market and the State in Ageing Societies*, J. Ermisch and N. Ogawa eds, Clarendon Press.

Butz, W. and M. Ward (1979), "The Emergence of Countercyclical US Fertility", *American Economic Review*, 69, 318-328.

Choné, P., D. Leblanc and I. Robert-Bobée (2002), "Offre de travail féminine et garde des enfants", INSEE-DESE Working Paper.

Cigno, A. (1986), "Fertility and the Tax-Benefit System: A Reconsideration of the Theory of Family Taxation", *Economic Journal*, 96, 1035-1051.

del Boca, D. (2002), "The Effect of Child Care and Part-time Opportunities on Participation and Fertility Decisions in Italy", IZA Discussion Paper 427.

Ekert-Jaffé, O. (1986), "Effets et limites des aides financières aux familles : une expérience, un modèle", *Population*, 2, 327-348.

Francesconi, M. (2002), "A Joint Dynamic Model of Fertility and Work of Married Women", *Journal of Labor Economics*, 20, 336-380.

Gauthier, A. (1996), *The State and the Family*, Oxford University Press.

Gauthier, A. and J. Hatzius (1997), "Family Benefits and Fertility: An Econometric Model", *Population Studies*, 51, 295-346.

Heckman, J. and J. Walker (1990), "The Relationship between Wages and Income and the Timing and Spacing of Births: Evidence from Swedish Longitudinal Data", *Econometrica*, 58, 1411-1441.

Hotz, J., R. Klerman and R. Willis (1997), "The Economics of Fertility in Developed Countries", in *Handbook of Population Economics*, M. Rosenzweig and O. Stark eds, North Holland.

Hotz, J. and R. Miller (1988), "An Empirical Model of Lifecycle Fertility and Female Labour Supply", *Econometrica*, 56, 91-118.

Keane, M. and K. Wolpin (2002a), "Estimating Welfare Effects Consistent with Forward-looking Behaviour, I: Lessons from a Simulation Exercise", forthcoming in the *Journal of Human Resources*.

Keane, M. and K. Wolpin (2002b), "Estimating Welfare Effects Consistent with Forward-looking Behaviour, II: Empirical Results", forthcoming in the *Journal of Human Resources*.

Laroque G. and B. Salanié (2000), "Une décomposition du non emploi en France", *Economie et Statistique*, 331, 47-66.

Laroque G. and B. Salanié (2003), "Labor Market Institutions and Employment in France", *Journal of Applied Econometrics*, 17, 25-48.

Laroque G. and B. Salanié (2003), *Institutions et emploi: le marché du travail des femmes en France*, Economica.

Lefebvre, P., L. Brouillette and C. Felteau (1994), "Les effets des impôts et des allocations familiales sur les comportements de fécondité et de travail des canadiennes : résultat d'un modèle de choix discrets", *Population*, 2, 415-456.

Méron, M. and I. Widmer (2002), "Les femmes au chômage retardent l'arrivée du premier enfant", *Population*, 57, 327-357.

Milligan, K. (2002), "Subsidizing the Stork: New Evidence on Tax Incentives and Fertility", NBER Working Paper 8845.

Rignols, E. (1996), "Incitation à l'interruption de l'activité professionnelle : effets sur l'emploi et la natalité", *Economie et prévision*, 122, 59-68.

Rosenzweig and T. P. Schultz (1985), "The Demand for and Supply of Births: Fertility and its Lifecycle Consequences", *American Economic Review*, 75, 992-1015.

Thélot, C. and M. Villac (1998), *Politique familiale : bilan et perspectives*, La Documentation Française.

Whittington, L., J. Alm and H. E. Peters (1990), "Fertility and the Personal Exemption: Implicit Pronatalist Policy in the United States", *American Economic Review*, 80, 545-556.