Becker vs. Easterlin

Education, Fertility and Growth in France after World War II

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Abstract: This article is aimed firstly at providing an empirical test of the causality link between fertility and education in France after World War II and subsequently at determining whether the underlying mechanism of the link was in agreement more with Becker's theory or that of Easterlin. It was found that the ideas of the two schools of thought are similar and complementary as the results show that a rise in the level of education causes a decrease in the fertility of couples and this link is triggered by an increase in opportunities and in the scope for investment in human capital. This follows a change in the situation on the labour market that means that women join the labour force in order to attain the desired standard of living. An accompanying effect is a decrease in child mortality, which also allows an increase in investment in education and hence a decrease in fertility.

Keywords: Education, Fertility, Granger's causality test, Value of time model, Relative income model.

JEL classification: C22, C32, N14, N34.

1 INTRODUCTION

One of the key determinants in population growth and structure in a society is its fertility behaviour. In 1956, Kingsley Davis and Judith Blake made a distinction between several types of variable that affect fertility, such as biological fecundity, sexual unions, socio-cultural influences and so on that they referred to as intermediate variables and through which the cultural factors exert their influence. Other influences have also been proposed, including the *socioeconomic variables* of persons which, through their effect on the intermediate variables, can account for different fertility levels. This category includes the level of education, occupation, income, etc (Leridon, 2002).

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The main aim of this article is to provide an empirical test of the relation between the level of education and fertility in order to determine whether a rise in the level of education can have 'caused' a significant decrease in fertility in France since 1950. This is followed by analysis of that among the other main determinants that underlies this link.

2 THEORETICAL AND EMPIRICAL BASES

2.1 Theoretical bases

Economists have developed two primary models to explain how fertility reacts to economic factors (Sanderson, 1976, Macunovich, 2003). Both are based on the common hypothesis that there is a link between income and fertility and both attempt to account for the post-war Baby Boom and Baby Bust. However, they differ fundamentally in the identification of the forces behind these movements, with Becker opting for the value of time and Easterlin for relative income (Macunovich, 2003).

Becker's model, more commonly known as the New Home Economics (the Chicago School), is based on the theory of consumer choice. This microeconomic approach includes the usual variables of income and expenditure and also the quality of children and constraints in terms of time and opportunity cost with regard to births. Opportunities include in particular the scope for better food, better education, for doing things with maternal time and buying more goods. As education is closely related to income and children are considered to be a time intensive occupation (especially for women), the value of female time increases with the level of education and has a negative effect on fertility. The model thus establishes a link between the decisions taken in questions of fertility and those concerning the other activities of the household, such as labour force participation and consumption. As Macunovich (2003) underlines it, Becker then completes the value of time model with a 'quantity-quality' argument in which potential parents can exchange quantity for quality. Parents want quality in addition to quantity of children, and when incomes increase, the demand for quality increases more rapidly than demand for quantity (Becker and Lewis, 1973). In fact, Becker considered that the notion of quality of children was one of the key factors in the inverse relation between income and number of children (De Bruijn, 2002). This approach was strongly questioned, with much of the criticism holding that it is too static as it does not allow for changes in preferences during lifetimes (De Bruijn, 1999).

As De Bruijn (2002) emphasis it, a number of economists then put forward a more dynamic perspective by accepting the possibility of changes in preferences. A second current of thought developed around Easterlin's model and thus completed the strictly demand-oriented model of new economics of the family. Unlike Becker's model, Easterlin's model incorporates variable preferences as fertility preferences are adapted to the achieving of a desired lifestyle conceived during adolescence in the family home. In fact, the theory has two major complementary parts (Brown and Norville, 2001):

- the effect of the relative number of young adults on the birth rate,
- the effect of wages and unemployment on the birth rate.

On the one hand, when there are few young workers their standard of living increases, resulting in an increase in marriages and births. This is followed 20 years later by an increasing abundance of young workers and hence a decrease in marriages and fertility. The relation can be explained by simple arguments of supply and demand. When the supply of young workers is large, there is fierce competition for a limited number of jobs requiring young workers, whereas when the supply is small, workers can choose their jobs and accept only those with high wages and potential for promotion. It also uses the 'relative income' theory, that is to say the effect of wages and unemployment on births, to account for this. It holds that the determinant of marriage and the fertility rate are the potential earnings of the couple, their material aspirations and social aspects (religion, education and environment). The relative income of the couple, consisting of the relation of their potential earnings to their material aspirations, is estimated by the ratio of the man's present income (earnings hoped for) to the past income of his parents (material aspirations). Easterlin then puts forward that when the relative income increases there is less economic pressure on the couple and they are then freer to marry and have children. He postulates in addition that relative income is also a yardstick of relative unemployment. Indeed, movements of fertility can be linked to a relative employment indicator consisting of the ratio of present average unemployment, reflecting the experience of young couples on the labour market, to average unemployment over a long period, reflecting the experience of parents on the labour market and showing the aspirations and expectations of young couples (Baird, 1987). This ratio, the relative comparison of situations, governs whether couples decide to have more or fewer children; with a more favourable situation indicating a larger number of children. In short, the desire for children takes shape following the effects of earnings that are governed by the entry of cohorts of

different sizes on the labour market. A small cohort allows better entry to the labour market, a better standard of living and hence higher fertility. This results 20 years later in a larger cohort, more difficult entry to the labour market and hence lower fertility.

However, education may also affect demand for children through a change in preferences and the supply of children may be changed by improved health and diet (Handa, 2000). Some demographers thus hold that the lowering of the death rate, including infant mortality, is the main determinant of the decrease in fertility because when death rates are high, the supply of surviving children often does not meet demand, even if fertility is high. But when survival increases, the supply of children exceeds demand unless there has been a decrease in fertility. In this case, the negative relation between education and deaths can help in the understanding of some of the effects of education on fertility, as investment in the education of children can increase (Basu, 2002), especially as investment in children's education can increase when child mortality decreases.

2.2 Empirical results

A strong empirical relation has been established with regard to the negative link between the level of education and the number of births. However, this is not as clear at the microeconomic level (Mougin, 2003).

Although the various empirical studies reveal certain contradictions in the results, especially because of the differences in the models used, the estimation methods or the choice of data, the methodology of these analyses has certain limits.

- The work is limited to visual inspection and/or transverse analysis. The conclusions are therefore mainly based on correlation, but correlations between the variables do not necessarily mean that there is a causal link (Alam, Ahmed and Butt, 2003). Demonstration of causal relations enables better addressing and understanding of the educational, demographic and economic phenomena and brings further information about the anteriority of the various events and hence makes it possible to establish an optimised educational, demographic or economic policy (Bourbonnais, 1998).

– These works theoretically recognise the dynamics of supply and demand in the determination of fertility rates but do not attempt to understand this dynamics between fertility and its determinants (Alam, Ahmed and Butt, 2003).

Furthermore, most of the regression studies (Michael, 1973, Easterlin, 1989, Becker, 1991, Sander, 1992) find that the level of education reduces fertility, but although these studies make significant contributions their weakness is that they attempt to make correlation equal causality. In addition, socioeconomic variables rarely have an instant effect (Cheng and Nwachukwu, 1997). A lag is often observed because couples cannot immediately adjust their level of fertility as soon as their financial situation changes. This is explained in particular by the time required for them to take the decision that they are financially ready to have a child, to conceive a child and to await the birth. It is also not unusual in socioeconomics for a variable to be affected by its own past behaviour. The determination of fertility should therefore be seen not only in a dynamic manner but also as an autoregressive process (Cheng and Nwachukwu, 1997).

Finally, from the empirical point of view, according to Schultz (1985/1986) it is important to correctly model the relations between education, participation in the labour market, individual wages and fertility decisions. Indeed, in the theory of human capital and in the economic theory of the family, wages and certain components of the cost of a child reflect decisions concerning participation in the labour market and investment in human capital. However, with regard to fertility these decisions may be linked to certain previous choices. As a result, when wages depend on couples' past decisions, bias in simultaneous equations may distort the relations observed.

For all these reasons, the effect of education on fertility must be examined by applying the VAR modelling technique of analysis of time series. For this, we first continue previous work (Doliger, forthcoming, Diebolt and Doliger, 2004) and attempt to relate education to fertility in a Granger type causality time framework. This is followed by determination of the mechanism/s through which this relation operates, by incorporating in the same framework the different socioeconomic variables proposed by Becker and Easterlin with regard to the decrease in fertility and the rate of infant mortality.

3 DATA

Within the framework of this article and in order to demonstrate both the educational structure in demographic dynamics and the underlying socioeconomic mechanism, we propose the choice of three types of variable: educational, demographic and socioeconomic. These different categories of variables are analysed in the case of France for the period 1950-1995 for two reasons. The first is that this period avoids problems of breaks in the series (in particular caused by wars) and so the results of analysis will be more solid, especially with regard to stationarisation tests. The second is that it makes it possible to determine the contemporary mechanism responsible for the dynamics between the educational and demographic spheres. The third is that, for the United States Easterlin himself has tested the causal relation of this theory on the period 1958-1984.

With regard to education variables, we propose use of the number of pupils in secondary education (SEC) and higher education (HIGH) as a relevant indicator of the level of education and school attendance (Cheng and Nwachukwu, 1997). It should be specified that no distinction is made between male and female school attendance since fertility over the period concerned can be considered as a joint decision by the household and not one made by one of the categories as could be the case at the beginning of the century. Furthermore, we do not include primary school attendance as the Ferry laws (1879 to 1892) made school attendance obligatory for children 6 to 13 years old. Including this category in the analysis would therefore not be relevant[3] for the period in question.

In demographic variables, we chose the total fertility rate[4] (TFR) to show the movement of fertility as this is used in most analyses of the latter (Macunovich, 1998). We also take into account the influence of deaths by using the infant mortality rate (IMR) (Shield and Tracy, 1986).

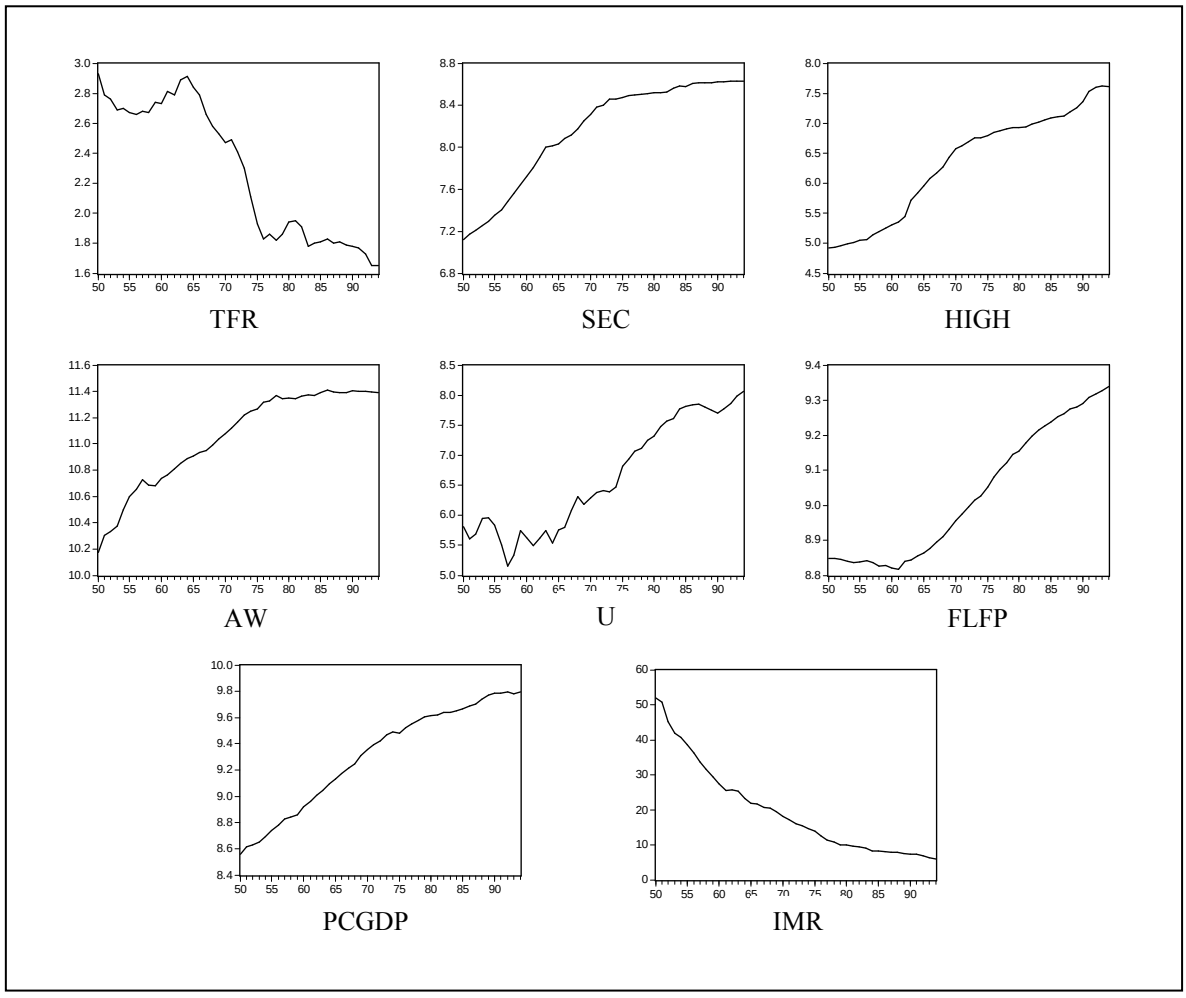
[3]However, this category is relevant in other cases, especially during periods or in countries where school attendance is not obligatory and above all in developing countries.

[4]This is the sum of the age-specific fertility rates, in other words it is the average number of children that would be born to a woman in her lifetime, if she were to pass through her childbearing years experiencing the age specific fertility rates for that period.

Finally, the socioeconomic variables chosen are the average wage (AW) and unemployment (U) as indicators of the situation perceived by persons on the labour market and hence the evolution of material aspirations (Shield and Tracy, 1986, Easterlin and Macunovich, 1988). The per capita gross domestic product (PCGDP) is used for the wealth available per person and hence the potential for investment in human capital. Female labour force participation (FLFP) is used to appraise the behaviour of women with regard to the labour market (Butz and Ward, 1979).

All these data are drawn from the statistical yearbooks for France published by the *Institut National de la Statistique et des Etudes Economiques* (INSEE), with the exception of per capita GDP which is from Angus Maddison's database (1995).

FIGURE 1: SERIES CHOSEN



4 METHODOLOGY

4.1 Unit root tests and order of integration

It is essential to analyse the stationarity properties of the data series chosen before analysing causality. We therefore used standard unit root tests (Dickey and Fuller, 1981, Phillips and Perron, 1988) and efficient unit root tests (Elliott, Rothenberg and Stock, 1996, Ng and Perron, 2001) to determine the order of integration of the variables and to stationarise the series (interested readers can also see Darné and Diebolt, 2004).

4.2 Analysis of cointegration and Granger's causality test

The analysis of cointegration proposed by Engle and Granger (1987) makes it possible to identify the true relation between two variables by seeking the possible existence of an integration vector and eliminating its effect. Two data series X_t and Y_t are said to be cointegrated, that is to say $(X_t,Y_t) \rightarrow CI(d,b)$ if:

- they have the same order of integration, 'd';
- a linear combination of these series makes it possible to go to a series with a lower order of integration, that is to say $X_t \rightarrow I(d)$ and $Y_t \rightarrow I(d)$, in such a way that $(aX_t + bY_t) \rightarrow I(d-b)$, where $d \geq b \geq 0$.

The Johansen test (1988) was chosen for analysing the possible cointegration relations between the variables. If this stage showed such relations, the study was performed using a VEC[5] model; if not, analysis was continued with a VAR model[6].

Granger's causality test was chosen from among the possible methods in the light of the favourable results presented by Guilkey and Salemi (1982) and by Geweke, Meese and Dent (1983) for small samples (fewer than 200 observations). Thus, according to Granger (1969), variable y_{1t} causes variable y_{2t} if the forecasting of the latter is improved by including in the analysis information concerning y_{1t} and its past. The test can then be conducted applying a classic Fisher test of nullity of the coefficients to the estimated model (VAR or

[5]Vector Error Correction model.

[6]Vector Auto Regressive model.

VEC), equation by equation. A causal relation is accepted in the statistical treatment if the probability calculated is less than the type 1 risk (10%).

4.3 Determination of the causality sign

In case of a causality relation, its general sign can be determined. Whence the regression equation on which the causality test is based:

$$y_{2t} = \sum_{k=1}^{L} \alpha_k y_{2t-k} + \sum_{k=1}^{L} \beta_k y_{1t-n-k} + \varepsilon_t$$

If this causal link exists between y_{1t} and y_{2t}, the sign is determined by:

$$\eta = \beta_1 + \beta_2 + ... + \beta_k$$

But this is not always an optimal method of determining the sign of effect since it can be sensitive to the inclusion or exclusion of lags. In that case, the impulse response functions help to determine or to confirm the sign of the effect more conclusively (Easterlin and Macunovich, 1988).

4.4 Impulse response functions and the breakdown of variance

However, causality in the VAR or VEC models does not provide any indication of the dynamic properties of the system and does not make it possible to judge the relative strength of the causality chain or to make quantitative measurements of the dynamic interactions between the different variables. The breakdown of variance and the impulse response functions will therefore provide some of this information (Alam, Ahmed and Butt, 2003):

- *analysis of the impulse response functions* makes it possible to measure the impact of a shock on the variables and trace the effect of the shock of an innovation on the present and future values of the variables;

– *the breakdown of the variance of the forecasting error* of each variable with regard to a shock decomposes the variance of a variable into the shock components of the variables of the system, thus providing information about the relative importance of each variable of the model.

5 RESULTS

5.1 The relation between fertility and education

We first examine the relation between education and fertility using the total fertility rate TFR and the numbers of pupils and students in secondary and higher education, noted SEC and HIGH respectively.

The stationarisation of the variables by means of unit root tests (standard and efficient) shows that the total fertility rate is a DS process whereas the numbers in secondary and higher education are TS processes. As a necessary condition for cointegration is that the variables are integrated of the same order, the risk of the existence of a cointegration relation between the series is ruled out and analysis of causality can be performed by modelling using an optimal VAR model[7]. Application of the causality test then can be represented by a causality channel (Easterlin and Macunovich, 1988, Diebolt and Jaoul, 2004), and in that case, we obtain the following causality channel[8]:

FIGURE 2: CAUSALITY CHANNEL

This channel shows that on the one hand secondary and higher education have a direct influence on the fertility of couples, and on the other that this is a negative causality relation ($\eta < 0$), that is to say that education has a negative effect on fertility. This negative influence is all the more significant when the level of education is high.

[7]That minimises the entropy criteria, that is to say the AIC and SBC criteria.

The causality channel provides an indication of the direction of causality between the variables but does not provide information about the relative strength of causality or a quantitative measurement of the dynamic interactions between the variables. The breakdown of variance can then provide a preliminary indication.

TABLE 1: DECOMPOSITION OF VARIANCE

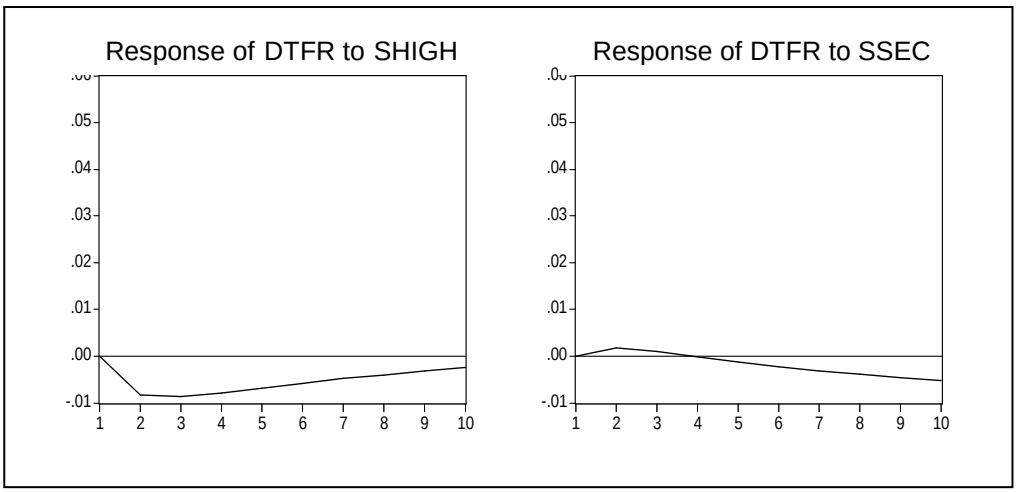
Variance Decomposition of DTFR:

Period	DTFR	SHIGH	SSEC
3	95.53489	4.331642	0.133470
15	83.49241	9.036171	7.471424

By distinguish a decomposition of variance in short and long term (Alam, Ahmed and Butt, 2003), it is seen that a limited proportion of the variance of the total fertility rate (4%) is accounted for by the shock in higher education in the short term (3 years), whereas in the long term (15 years), the shock in higher education accounts for 9% of the innovations in the fertility rate. The results for secondary education are significant but less so. Education thus has dynamic interactions with the fertility rate in the long and short term and this interaction is all the more significant when the level of interaction is high.

Finally, the impulse response functions provide other information about the relative forces and the causality sign that may exist between education and fertility:

FIGURE 3: IMPULSE RESPONSE FUNCTIONS



[8]Similar results are obtained by considering the gross or net reproduction rate rather than the total fertility rate.

These confirm the preceding results as a shock in secondary or higher education has a significant, negative impact on fertility.

Different proposals may account for the fact that the rise in the level of education can cause a decrease in the fertility of couples:

- firstly, as Macunovich underlines it, education raises the marrying age and hence the age at which couples conceive their first child (Brown and Norville, 2001);
- it facilitates the acquisition and use of information on modern contraceptive and family planning methods and hence enables couples to better control their fertility (Handa, 2003);
- education (especially of women) also has a positive effect on the female labour force participation and thus has a negative effect on the size of family desired (Holsinger and Kasarda, 1976, Easterlin, 1989, Cochrane et al., 1990);
- increased numbers in education can also cause congestion in education, that is to say a large cohort, causing more difficult entry to the labour market, a lower standard of living and hence lower fertility (Easterlin, 1968);
- a rise in the education level may result in pressure on fertility through an increase in wages which both increases the value of time and hence the opportunity cost of the time devoted to children (Becker, 1965) and may have a 'quality-quantity' substitution effect (Becker, 1976);
- infant mortality may also contribute to a decrease in fertility, with, in the one hand the behavioural responses from mother (replacement and anticipatory responses) (Handa, 2003), and in the other hand the increase of the investment of human capital in each child when mortality decreases.

Dominance of the effect of higher education on the fertility behaviour of households in comparison with secondary education, both in the causality channel and in the decomposition of variance, can be explained mainly by the opportunity cost, that is to say the value of the time devoted to children. This increases when the couple has been in higher education (its income is higher) and tends to support Becker's theory.

The various mechanisms seen above that may account for the role of education in the fall in fertility in France since the 1950s should therefore be integrated to see whether the result is confirmed and, if not, find out what is the causal mechanism. We therefore draw up a new framework of analysis that integrates the aspects of both Becker and Easterlin.

5.2 Mechanism(s) underlying the relation

The variables used above are conserved for this second analysis, that is to say the total fertility rate and the numbers in secondary and higher education. To these are added different variables for the various possible underlying mechanisms.

The first variable to be considered at the level of the household, from both Becker's and Easterlin's points of view, is the female labour force participation (noted FLFP). Indeed, the 'value of time' model assumes that as the attention paid to children is traditionally under the responsibility of women, men's incomes have only an income effect on fertility whereas women's incomes have a price effect and so the negative relation between education and fertility involves the incorporation of women in the labour force. On the other hand, although Easterlin assumes that women play a passive role, Macunovich (1996) recognises the active role of women in the face of changes in men's relative earnings. She holds in particular that women have material aspirations but in the past, to conform to the point of view of society, considered only the possibility of men's earnings. However, in the post-war period women saw that the probability of attaining the standard of living that they desired through the possible earnings of men had little chance of increasing. They anticipated that they needed to join the workforce and started to reach higher levels of education. Butz and Ward (1977) also support that the variables which affect the female participation in the labour force, affect also the decisions of the women to have children (Brown and Norville, 2001).

It is then important to consider wages (AW) and unemployment (U) to take into account the situation perceived by persons on the labour market, as proposed in Easterlin's theory (Shield and Tracy, 1986, Easterlin and Macunovich, 1988). The per capita gross domestic product (PCGDP), representing individual wealth and the possibility of investment in human capital, is used to take into account the opportunities and quality-quantity substitution possibilities of Becker's model.

Finally, as the study of Shield and Tracy (1986), the infant mortality rate (IMR) is used (Macunovich, 1998). As has been seen above, this factor can also be considered as a mechanism by which education can account for the decrease in fertility, especially through the negative relation between education and mortality. The increase in investment in human capital can be larger when mortality rate is lower.

The different stationarisation tests show that among the variables selected, only infant mortality (IMR) and female labour force participation (FLFP) are TS processes. There is therefore a risk of cointegration between the figures for TFR, AW, U and PCGDP that is analysed with Johansen's test (1988).

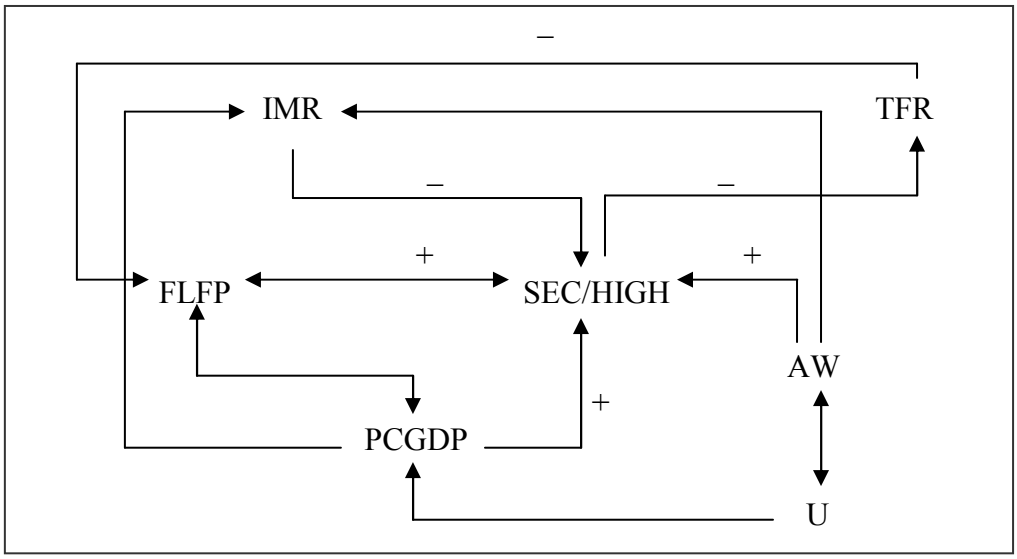
TABLE 2: JOHANSEN'S COINTEGRATION TEST

Hypothesized			5 Percent	1 Percent
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Critical Value
None	0.428922	24.08989	27.07	32.24
At most 1	0.377806	20.40362	20.97	25.52
At most 2	0.226279	11.03141	14.07	18.63
At most 3 *	0.097060	4.390273	3.76	6.65

Test indicates no cointegration at both 5% and 1% levels

This shows that the null hypothesis can be accepted at thresholds of 1% and 5% and so there is no cointegration relation between the integrated data series of order one. This new framework of analysis gives the following causality channel[9]:

FIGURE 4: CAUSALITY CHANNEL



[9]Only the causality signs for fertility and education are shown in order to make it easier to see the causality channel.

We first observe that the education level is directly, positively influenced by the wage increase rate and indirectly influenced through wages by the rate of increase of unemployment. Fertility is thus indirectly, negatively influenced via education by the situation perceived by persons on the labour market and hence by their situation in comparison with their material aspirations, confirming Easterlin's theory.

A feedback effect also occurs between education and female labour force participation. That is to say that on the one hand education facilitates women's access to the labour force and on the other the desire for access to the labour market is via education. This relation between education and the incorporation of women in the labour force also involves fertility, that is to say that the decrease in fertility in return also allows women to enter the labour market. In fact, low birth rates are the result of the increase in the numbers of women in the labour force, but as fertility is falling women are also freer to join the labour force.

Another important feature shown by this causality channel is the strong impact of the per capita GDP on both education and the female labour force participation. This effect shows that the improvement of individual wealth, that is to say of the opportunities for and possibilities of investment in human capital leads to a change in the level of education of women and their labour force participation. This leads again through education to an indirect negative effect on fertility that supports the hypotheses of Becker's model. It is nevertheless interesting to note that per capita GDP and hence Becker's hypotheses are directly influenced by the situation perceived by persons on the labour market (AW and U).

Finally, the involvement of infant mortality[10] as a mechanism explaining the interaction between fertility and education shows that the decrease in infant mortality leads to an increase in investment in human capital and hence in education, which here again results in a decrease in fertility. As this decrease in mortality results from the improvement of living conditions and health following the improvement of the economic situation of households, this is therefore an accompanying effect of the female labour force participation and in education. Whence the direct causal effects of AW and PCGDP and the indirect effects of FLFP and education via PCGDP on the IMR.

[10]Similar results were obtained using the mortality rate.

It is therefore necessary to analyse among these mechanisms—that is to say the situation on the labour market (the evolution of material aspirations), the possibilities of investment in human capital (the effect of a quality-quantity trade-off), and the decrease in infant mortality—the one that is most marked in France in the period in question. Particular use is made here of the decomposition of the variance of education as the latter is the variable through which the different mechanisms operate.

TABLE 3: DECOMPOSITION OF VARIANCE

Variance Decomposition of SSEC:

Period	DTFR	SSEC	SHIGH	DAW	DU	DPCGDP	SFLFP	SIMR
3	1.405522	68.86204	0.222682	7.940626	5.562932	9.657714	2.701676	3.646810
15	1.135080	29.28568	0.126060	7.900863	14.25481	22.60068	15.43932	9.257510

Variance Decomposition of SHIGH:

Period	DTFR	SSEC	SHIGH	DAW	DU	DPCGDP	SFLFP	SIMR
3	1.137413	13.42495	78.08066	0.087862	0.036195	1.083426	0.519657	5.629833
15	0.862800	14.04390	27.24702	0.755220	1.393280	15.30608	36.04878	4.342921

Variance Decomposition of DPCGDP:

Period	DTFR	SSEC	SHIGH	DAW	DU	DPCGDP	SFLFP	SIMR
3	1.712787	9.877584	0.148332	22.00791	23.01419	41.64965	1.027680	0.561864
15	1.965286	11.63221	0.308548	19.80136	22.25580	39.10844	3.090508	1.837855

Variance Decomposition of SIMR:

Period	DTFR	SSEC	SHIGH	DAW	DU	DPCGDP	SFLFP	SIMR
3	0.152589	24.06135	2.811974	9.507111	6.285024	13.82203	10.24954	33.11038
15	0.419142	20.34819	1.156771	8.900926	15.26954	20.78130	11.49543	21.62870

It emerges that the variance of education is accounted for (secondary and higher respectively) to 9% and 1% in the short term against 22% and 15% in the long term, by the evolution of the possibilities for investment in human capital (PCGDP), to some 8% and 0.1% in the short term against 8% and 1% in the long term by the situation on the labour market (AW), and finally to 3.5% and 5.5% in the short term against 9% and 4% in the long term by the infant mortality rate. It therefore appears that the main mechanism affecting education is that of Becker. However, we can see that more than 40% of the variance of per capita GDP is accounted for in the long and short term by the movement of wages and unemployment, that is to say by the situation on the labour market. In other words, the opportunities that lead persons to pursue their education are explained mainly by the situation on the labour market and are thus partially affected by the evolution of material aspirations. Finally, the effect of

the infant mortality rate on fertility is indirect as it is in fact the result of the evolution of the mechanisms noted above, that is to say the evolution of the level of education and mainly secondary education (24% of the variance of IMR in the short term against 20% in the long term is accounted for by SEC) and the evolution of wages (9.5% against 8.9%), economic improvement (13% against 20% for PCGDP) and the female labour force participation (10% against 11%).

In short, it seems that the mechanism that initiated the decrease in fertility was the evolution of the situation on the labour market that meant that women entered the labour market to achieve the standard of living that they desired and that the level of education rose (Macunovich, 2003). An accompanying effect is a decrease in infant mortality, also allowing an increase in the level of education and hence a decrease in fertility.

Thus although Easterlin's school concentrates on attitude via the material comfort of the modern existence and that of Becker focuses on the increasing cost of children and adolescents, there is no reason not to consider that the two notions are part of a single explanation (Sanderson, 1976). In fact, the arguments of the two schools of thought can be considered as the components of a full explanation of variations in fertility, as was underlined by Banks in 1954 in *Prosperity and Parenthood.*

6 CONCLUSION

This study using Granger's causality analysis test shows first the significant role of education in accounting for the decrease in fertility in France since 1950. We then focused on determining the mechanisms involved in the relation. It appears that the low fertility rates result from the increase in female labour force participation, with this being achieved by an increase in the level of education. The question is then one of why women change their behaviour. The reply that emerges from our analysis is that the possibilities of investment and opportunities encourage women to pursue their education and join the labour force, and that these possibilities of investment and opportunities depend in the situation perceived by couples on the labour market.

Furthermore, these changes in the economic role of women should help to perpetuate a low fertility rate. Indeed, as women's participation in the labour force helps to maintain or increase the family standard of living, it intensifies the relative difficulties of young couples attempting to attain the standard of living that they desire by means of the husband's income alone. Young couples compensate for this by not having children and by the wives joining the workforce and this type of behaviour is tending to become lasting (Oppenheimer, 1976). Ermish (1990) also observed the inter-generation effects of the female labour force and held that the daughters of working women also tend to work.

However, an interesting angle is that the negative effects of women's qualifications in the economic models of fertility depend on the allocation of the time of the members of the household between children's education, leisure, household tasks and the labour market. It is therefore possible that the increase in the value of female time may contribute to a redistribution of roles within the household and transfer of the care and education of the family's child to the market (Schultz, 1986). It is therefore possible that in time such adjustments may help to reduce the negative effect of female qualifications on fertility. The latter may then have the same effect as male qualifications, that is to say a positive effect on fertility through the income effect (Mougin, 2003).

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