the included child status variables. Two basic approaches to this problem are discussed.

The instrumental variables (IV) approach involves trying to purge the child status variable(s) of those components correlated with the true error(s) term for the labour supply relationship(s). Studies taking this approach by Schultz (1978) and Rosenzweig and Schultz (1985) are discussed in some detail. An experimentally oriented approach due to Rosenzweig and Wolpin (1980) is also reviewed.

The other approach to dealing with coefficient bias problems is to try to remove from the error term(s) of the labour supply relationship(s) the components that are correlated with the included child status variables. Methodologies which could accomplish this purpose by Heckman and MaCurdy (1980, 1982) and by Nakamura and Nakamura (1985b) are briefly discussed.

Our hope is that this review article will help to clarify basic issues concerning the estimation of child-related effects on female labour supply. In turn, we hope this will encourage further and more fruitful empirical studies on this important research topic.

13

HOW ECONOMICS, PSYCHOLOGY, AND SOCIOLOGY MIGHT PRODUCE A UNIFIED THEORY OF FERTILITY AND LABOUR FORCE PARTICIPATION[1]

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13.1. Introduction

As a result of the sharp declines of the past two decades, aggregate fertility rates in many industrial countries are so low that the twenty-first century will bring negative rates of population growth to those nations of the kind already experienced by, for example, the Federal Republic of Germany. Along with this fertility decline has come a marked increase in labour force participation by married women, especially those with children. In the United States, for example, the labour force participation rate for married women with children under age six rose from 11.9 per cent in 1950 to 49.9 per cent in 1983. Women with school-age children increased their participation rate over the same period from 28.3 per cent to 63.8 per cent (Lehrer and Nerlove, 1986, p. 201).

It would appear that these two trends should be intimately related; however, the causal relationships between fertility and married women's labour force participation remain poorly understood. Many cross-sectional studies of sample survey data have shown that *current family size and structure* and labour force participation are strongly and negatively related, and many researchers have tried to demonstrate that these cross-section associations can be interpreted in causal terms.[2] However, the association of *past* fertility behaviour with *current* labour force participation offers at best only a partial insight into the fertility-labour force participation nexus. The importance of these two behaviours has made them popular objects of study in a number of disciplines including economics, sociology, and psychology, but the research has generally retained its narrow disciplinary focus. A totally successful

[1] Thanks to David Claris for producing one of the figures, Lynn Igoe for checking references and Cheryl Ward for updating reference data base.

[2] See Cramer (1980) for a careful analysis of the fertility-labour force participation relationship in the sociological literature.

integration of the insights and emphases of the various disciplines has yet to emerge.

This essay presents a theoretical framework for the analysis of fertility and labour force participation that allows the rigorous and consistent incorporation of insights from a diversity of disciplinary viewpoints. It capitalizes on the fact that both fertility and labour force participation are behaviours that are demonstrably the result of purposeful decision making, and it organizes the framework around an explicit decision theoretic model which serves as the core of the analysis. Use of the constrained utility maximization model to analyse the fertility-labour force participation relationship is certainly not new among economists.[3] What is new here is the attempt to bring sociological and psychological analyses systematically into the utility maximization framework in order to generalize and unify the study of fertility and labour force participation.

The fertility-labour force participation relationship brings many difficulties for the analyst, primarily because it embodies a complex mix of long- and short-run goals and behaviours. Actions today may be designed to bring benefits today or they may be part of a plan that may take two or three decades to complete. In particular, because parenthood is a long-range commitment that requires time (i.e., the sequential arrival and rearing of children) to achieve, an analysis of fertility and labour force participation in the short run must be placed in the context of longer range family size goals. Consequently, this analysis treats the fertility-labour force participation relationship as a special case of the more general demand for children.

Although the micro-economic analysis of fertility dates at least from Gary Becker's seminal piece (1960), many critics of the approach still exist, not least among non-economists. Therefore, the next section provides a brief summary of the criticisms that accompany the use of micro-economic theory to study reproductive behaviour. This review also highlights the areas in which a truly interdisciplinary synthesis can make contributions.

Section 3 sketches a static, long-run, individual-level micro-economic theory of the demand for children. This model provides the framework that allows normative, psychological, and economic influences to interact in determining target family size. Beginning from the traditional individual-level

[3] Lehrer and Nerlove (1986) provide a comprehensive review of much of the economics literature and some of the sociological literature.

theoretical perspective, we expand the narrow micro model into a fully-fledged interdisciplinary model by showing how norms and preferences, the subject matter of sociology and psychology, can easily be incorporated into the basic model.

Finally, section 4 addresses one aspect of the fertility-labour force participation relationship by outlining a short-run, sequential model that is contingent upon long-range fertility goals. Fertility and labour force participation can be characterized as an exclusively short-range relationship or as a life-cycle plan or as a mixed set of long-term objectives and short-run sequential behaviour. The approach taken here chooses the latter as a basis for analysis.

13.2. Critiques of the micro-economic approach to reproductive behaviour

In the thirty years since publication of Gary Becker's (1960) application of micro-economic theory to fertility,[4] its role in the analysis of reproductive behaviour has grown steadily. The initial rationale for the use of micro-economic models has remained valid: human reproductive behaviour involves conscious choice in order to keep family size below the biological maximum, it involves significant resource allocation commitments by parents, and it is potentially very much subject to the influence of changing economic conditions.

While the micro-economic fertility literature has grown quite large, it has not convinced skeptics of the ultimate benefit of the approach. Criticisms range from the suitability of the basic assumptions underlying the model to the empirical implementations and, ultimately, the generality and relevance of its insights.[5]

13.2.1. Rationality

Many critics, among them a number of economists, argue that the standard assumption of consistent rational behaviour on the part of husbands and wives

[4] Leibenstein (1957) is another early and significant contributor to the economic analysis of fertility.

[5] Thornton and Kim (1980), for example, argue that while people pay lip service to the importance of financial considerations in fertility decision making, few actually make reproductive decisions based upon them.

cannot be supported. Herbert Simon (1978) suggests that the standard rationality assumptions of micro-economic theory can be relaxed with little loss. Leibenstein (1979) believes that the neoclassical optimization postulate is inappropriate for fertility analysis and he proposes the *notion of selective rationality* as an alternative. Supporting that view is Kiser (1979) who cites results from his own research suggesting that rational choice is exhibited by only a small proportion of married couples. Other critics suggest that, while couples may act rationally, micro-economic theory postulates an incorrect preference structure governing their decisions. Both Namboodiri (1979, p. 292) and Canlas (1981) argue that wants are governed by a hierarchy of needs that must be represented by vector-valued utility functions exhibiting lexicographic preference orderings.

While these objections to consumer theory's rationality assumption have their force, they are not decisive. As Boland (1981) argues, it is futile to criticize the neoclassical maximization hypothesis either on logical or empirical grounds. The maximization hypothesis, he argues, serves as a metaphysical basis for neoclassical analysis of problems:

> "The research program of neoclassical economics is the challenge of finding a neoclassical explanation for any given phenomenon - that is, whether it is possible to show that the phenomenon can be seen as a logical consequence of maximizing behavior - thus, maximization is beyond question for the purpose of accepting the challenge ... Since maximization is part of the metaphysics, neoclassical theorists too often employ ad hoc methodology in order to deflect possible criticism; thus any criticism or defence of neoclassical maximization must deal with neoclassical methodology rather than the truth of the assumption ... There is nothing intrinsically wrong with the maximization hypothesis. The only problem, if there is a problem, resides in the methodological attitude of most neoclassical economists. " (Boland, 1981, pp. 1035-1036).

More widespread is the view that it is not sufficient simply to model the preconditions and the outcomes of decisions in order to explain reproductive behaviour. Rather, it is fundamentally important to model the dynamics of decision making in order to assess the degree of rationality of the process itself (Bagozzi and Van Loo, 1978a, 1979; Leibenstein, 1980). Scanzoni (1979) criticizes the "outcome rationality" of the micro-economic analyses for failing to study the dynamics of husband/wife negotiating processes in determining fertility outcomes. Implicit in these views is the notion that decision-making processes themselves influence the outcomes. If the process were neutral with

respect to the relationship between causes and outcomes then identical sets of causal factors ought to lead to similar outcomes, no matter how decisions are reached (Turchi, 1979).

There is considerable merit to the view that reproductive decision processes are worthy of more careful study (Turchi, 1975, pp. 26-27). However, the decision process may be non-neutral with respect to outcomes without necessarily invalidating the "outcome rationality" approach of consumer theory. If, for example, decision processes do affect outcomes, but they do so randomly and independently of the other factors that determine those outcomes, then the rationality assumption may still be fruitfully used in empirical research (Turchi, 1979, p. 294). Ultimately this issue is empirical, and the results to date do not support the abandonment of the rationality assumptions of the micro-economic models.

13.2.2. Statics versus dynamics

Most couples in the United States reach their completed family size well before the onset of biological subfecundity, and this fact has justified the use of static models in many economic analyses of fertility. Static models assume that decision makers' preferences are constant over the reproductive life cycle and that the factors that determine decisions are likewise constant. The decision problem to be modelled is, then, the determination of long-term equilibrium family size.

There are a number of objections to this approach. Children must be acquired sequentially over time, and there is no guarantee that the factors determining fertility decisions will remain constant. Moreover, as individuals gain experience with parenthood, it is reasonable to expect that their relative preferences for it and for other activities will change. Becker (1960) and others[6] have been criticized for assuming that couples at the onset of marriage make deterministic plans for the life course that include number of children, labour force participation, education decisions, and so on (Bagozzi and Van Loo, 1978a). Namboodiri (1974, 1972, 1979, 1983) has long argued that economic models of fertility should be explicitly sequential and should focus on the short-run determination of the next birth.

[6] For example, Willis (1973).

Even though a case[7] can be made for the utility of static models they clearly "... cannot address some of the most important empirical questions in current debates regarding future trends of birthrates, such as whether recent declines in fertility are the result of changes in the timing of births or in desired completed fertility" (Moffitt, 1984a, p. 30). Furthermore, the use of static theory to model the fertility-labour force participation nexus is compromized by the inherently dynamic and sequential nature of that behavioural relationship.

13.2.3. Measurement issues: theory versus data

The data used by economists to test their models are rarely entirely suitable to the task. Instead, the literature exhibits a widespread use of inappropriate proxies for theoretical variables with little attempt to justify either their use or relevance (Bulatao, 1986; Bagozzi and Van Loo, 1979). Moreover, even when appropriate "objective" variables such as wages, incomes, or prices are available, they may not be truly appropriate. Easterlin *et al.* (1980) among others[8] have argued that couples make decisions based on *perceived* or *expected* values rather than on actual market values.

Many potentially important variables are ignored because they are not routinely available. For example, reproductive decisions have long-range costs and benefits that must be adequately characterized and measured. Not only are these costs and benefits not usually measured, but the implicit *discount rates* that individuals apply to them are ignored even though evidence exists of systematic differences among individuals.[9] Likewise, reproductive behaviour involves significant risks and uncertainty with respect to contraception and the outcome of pregnancies; however, micro-economic analyses of fertility rarely try to incorporate analyses of risk-taking behaviour and attitudes toward uncertainty (Canlas, 1981).

Perhaps most controversial is the issue of the direct measurement of preferences. Economists have traditionally been reluctant to rely on preferences to explain behaviour because they have no theory of taste formation (Michael and Becker, 1973); moreover, economic research is often argued to "reveal" preferences through the analysis of differential behaviour without

[7] See, Turchi (1975, pp. 7-8).
[8] See, Bagozzi and Van Loo (1978a, 1979).
[9] See, Hausman (1979), Thaler and Shefrin (1981), and Fuchs (1986).

recourse to the direct (and unreliable) measurement of preferences. Critics point out that omission of measured preferences from empirical analyses reduces explanatory power and richness at a minimum[10] but can, if preferences vary systematically with wages and income, lead to biased estimates of taste parameters (Turchi, 1984).

Finally, because of the lack of appropriate data, the economic models are often estimated with proxies for economic variables such as education, occupation, or race that are likely to reflect taste differentials also. The reliability of interpretation of estimated parameters is, therefore, questionable.[11] Although economists have traditionally been reluctant to measure and incorporate preferences directly, the reluctance is not well grounded, and the experience of other disciplines, social psychology, political science, and sociology suggests that it is both desirable and feasible to measure preferences directly (Sen, 1973).

13.2.4. Contextual and non-economic factors

Commenting on Becker and Barro's "radically atomistic conception of society" (1986), Paul David (1986, p. 78) characterizes their view of the economy "... as a large sea surrounding many family islands ..." and society "... as the aggregation of individuals who, being stuck on these islands, remain forever isolated from the effects of actions taken by anyone other than the forebears of their lineage." David's concern for the individualistic nature of the micro-economic models of fertility is shared by many commentators. Leibenstein (1974, 1979) argues that micro-economic models of fertility often give short shrift to the non-economic motivations that affect behaviour and ignore the social constraints that limit parents' behaviour in rearing their children. Bagozzi and Van Loo (1979) complain that because theories of fertility have tended to develop in separate disciplines, they are narrow in scope and explanatory power when applied to actual behaviour. They note that fertility is a behaviour that overlaps disciplines and needs a multi-disciplinary focus.[12]

[10] See, Bagozzi and Van Loo (1978a), Easterlin *et al.* (1980, esp. p. 85).
[11] Even when variables such as income are available, they often do not have the expected effect on fertility. Thornton (1978) demonstrates that a simple model of the income effect will not suffice. Becker and Lewis (1973) propose one explanation for the complicated effect of income upon fertility.
[12] See also, Bulatao (1986).

Research on reproductive behaviour should concentrate on the ways in which individual decisions are influenced by the social and economic environment. Micro-economic fertility models too often focus exclusively on the impact of the economic environment to the exclusion of other external influences.[13] Although there are important differences between the sociological and economic approaches to fertility research (Namboodiri, 1978), their roles are essentially complementary (Oberschall and Leifer, 1986). Perhaps the most important feature of the micro-economic model is its untapped potential as an integrative framework for fertility analysis.[14] The following sections will present a micro-economic model that illustrates how social-demographic and social-psychological insights can be included in a resource allocation model. Moreover, the model's usefulness in linking individuals to the wider socio-economic context will be explored.

13.2.5. Simplicity versus complexity

Many students of reproductive behaviour see it as a very complex process and criticize the micro-economic models for making it too simple. For example, normative constraints on fertility and child-rearing practises are too often ignored which leads to an unrealistic picture of the choices available and behaviour exhibited.[15] Some economists avoid dealing with differential norms and preferences by "... incorporating socioeconomic variables in the technology of household production [of child quality] ... ",[16] but what is the "technology" of child-rearing but the set of norm-influenced preferences that guide parental behaviour ?

Micro-economic theory offers many advantages in the study of human fertility:

1. it emphasizes that parenthood involves a significant reallocation of life-cycle resources;

[13] Their success, however, is limited even with respect to this narrower focus. Because of the data problems and inadequate specification of models mentioned previously, interpretation of empirical results as the effects of the *economic* environment is often problematic.

[14] Namboodiri (1972a, 1972b, 1978) and Turchi (1975, 1981, 1984) examine and exhibit this potential.

[15] Kiser (1979, p. 284), Leibenstein (1980), Duesenberry (1960), Canlas (1981).

[16] Keeley (1975).

2. it identifies the *immediate decision* factors such as income, wages, prices, and preferences that must directly affect the demand for children;
3. it delineates the causal paths through which these decision factors must be influenced by the social and economic environment;
4. it offers the possibility of rigorously derived testable hypotheses concerning reproductive behaviour.

Economists often focus on the mathematical derivation of hypotheses at the expense of the other benefits of the theory, and this typically involves simplification of the models to gain analytical tractability. Simplification often involves loss of correspondence with reality,[17] and the tendency to assume away the messiness of behaviour to achieve analytical tidiness may have fatal consequences when the subject is fertility. In any case, micro-economic theory has a potentially more important function as a starting point for selecting interesting variables for analysis (Larsson, 1977), and the approach described below uses it as a framework to integrate the social and psychological, as well as economic, dimensions into a more comprehensive analysis of reproductive behaviour and female labour force participation.

13.3. The demand for completed family size

Reproductive behaviour is a complex process that occurs over a significant part of a couple's life course. Achieving an equilibrium completed family size by necessity involves a series of decisions that, over an extended period, lead to the long-term result; however, for couples who actively limit their family size below the biologically attainable maximum, long-term goals likely influence short-term behaviour. The micro-economic model is potentially very useful in understanding the factors that determine long-term family size targets; moreover, it can be used to understand short-term sequential behaviours that occur at least partly in response to longer term goals.

[17] See, for example, Georgescu-Roegen (1970) and David (1986, p. 79).

13.3.1 asurement of family size preferences

The concept of "demand" is central to the micro-economic analysis of fertility. Economists from Adam Smith on have emphasized the difference between *desire* for an economic commodity and the *demand* for it. The latter refers, of course, to the amount of the commodity that a person would actually purchase given its price, the prices of substitutes, and his or her income. "Demand" usually refers to a behaviour that is *observed* as opposed to an attitude that is not. Moreover, the preference functions that economists use are usually assumed to be continuous and differentiable and to have a single global maximum so that solutions in the neighbourhood of the maximum tend to be more preferred than solutions far from it.

Measurement of the quantity of children demanded at a point during a woman's reproductive life cycle is complicated by a number of features of human reproduction. First, because children generally can only be acquired sequentially over an extended period of time, the target family size that a woman chooses at any point before the end of her fecund period is in essence a "notional demand", that is, a demand incapable of being instantaneously realized.[18] The notional demand for children is itself worthy of study because (1) it is often stable over the reproductive life cycle, and (2) it may guide the short-run reproductive behaviours that lead eventually to completed family size.

Second, family size preference functions cannot necessarily be assumed to be well behaved in the sense just described. One woman who prefers three children may prefer two as a second best alternative while another who prefers three may prefer four as a second best alternative. In terms of the demand for completed family size, the two women are the same; however, in terms of the *fertility control behaviour* they exhibit during the reproductive life cycle, they may differ considerably. Another woman may prefer no children, but two children if she has any. If she experiences a contraceptive failure she may then opt for two children, not one child. It is, therefore, important to

[18] The concept of "notional demand" is borrowed from disequilibrium theory in macro-economics, where it implies a quantity that would be demanded at a given price in a certain market if there were not some constraint to market clearing in that or related markets. "Notional demand" as used here implies that a woman may demand a certain number of children at a point in her reproductive life cycle but for biological reasons she is unable to achieve it instantaneously.

understand the structure of preferences for family size in order better to understand short-range demand behaviour and the contraceptive behaviour practised by women.[19]

13.3.2. A notional demand model

Picture a married woman at some age (a) in her reproductive life cycle. Because children arrive sequentially in a biologically delimited period of years, a woman who seeks actively to choose her completed family size needs to engage in some planning well before the onset of subfecundity. Planning is necessary to avoid exceeding the target family size or to allow sufficient time to achieve it.

What factors determine a woman's target or notional demand for children ? The micro-economic model reflects the economist's view that, because children require large amounts of economic resources, the choice of family size must be treated as a resource allocation decision. Because children in industrial countries are generally not expected to provide economic support to their parents, the family size decision is broadly analogous to other consumption decisions, and the same set of factors should determine the outcome of those decisions.[20] These factors are the decision maker's relative preferences for parenthood versus alternative consumption and work activities, the prices of those activities and the level of resources available to consume over the life cycle.

The objective function

Formally, the wife is represented as maximizing a utility function which represents the preference weightings she gives to alternative activities at that particular point in her reproductive life cycle:

$$U_a = U_a(K,N;PR^S_{k:n}).$$

[19] See, McClelland (1983) for a review of the issues surrounding demand for children measures. See also Coombs (1974) and Terhune and Kaufman (1973).

[20] The analogy between fertility and consumption is not perfect: (1) children arrive sequentially over an extended period of time and the demand for them cannot instantaneously be realized; (2) children may be "purchased" as the unintended outcome of another activity; (3) fertility decisions, unlike most consumer durable purchases, cannot be reversed.

U_a is the woman's perceived utility level at age a, K is the total number of children she might choose over the reproductive life cycle, N is an indicator of the level of all non-child-rearing-related activities, and $PR^s_{k:n}$ is an indicator of her relative preferences for child-rearing versus all other activities.[21]

The decision maker's problem is to find the pair (K^*,N^*), K = 0, ..., MAX, that will maximize the utility function and then to undertake behaviour that will lead to the optimal family size, K^*. N does not represent an alternate commodity as much as it does a share of life-cycle resources. Couples must make their final long-range fertility decisions long before much of the cost of child-rearing is actually paid and alternative activities are undertaken. Consequently, early determinations of the notional demand for children really involve dividing life-cycle family resources into a child-rearing and a non-child-rearing component. The mix of commodities in the second component does not have to be known or specified in order to make that division; indeed, it cannot since fertility decisions must be finalized relatively early in the life cycle.[22]

The preference indicator is normally not included in the utility function since the functional operator stands for it; however, it is included here specifically to emphasize (1) that relative preferences may systematically change over the reproductive life cycle, and (2) that they may differ systematically among women of varying socioeconomic characteristics.

Economists often ignore these two features of preferences and assume that constant and uniform[23] preference structures will be revealed by actual

[21] "All other activities" includes preferences for work and career at this stage. Distinction between work and other non-market activities is not necessary at this level of analysis. Section 4 illustrates the short-run situation in which a woman actually has to choose between work, child-rearing, and other non-market activities.

[22] The budgeting problem here is similar to a two-stage budgeting procedure in which households first allocate income optimally between two commodity groups based upon aggregate price indices and then optimally allocate each budget allotment among commodities in that specific group (Blackorby *et al.*, 1970; Blackorby *et al.*, 1978, ch. 5; Gorman, 1959; Strotz, 1957, 1959); however, in the present case many of the same market commodities are contained in each group, and it is not clear that the same necessary and sufficient conditions for price aggregation obtain.

[23] For econometric purposes, all that is required is that variations in the preference structure are randomly and independently distributed with respect to the specified determinants of demand.

behaviour even if they are not measured directly. Empirical work performed under this assumption will, if it is incorrect, lead to biased inferences about the factors that determine completed family size. Moreover, although psychological factors in the form of relative preferences clearly play a central role in resource allocation decision making, their importance is often understated because economists deal with them only indirectly through the restrictive assumptions just mentioned. Integrative and multi-disciplinary research should relax the constancy and uniformity of preference assumptions in order to understand more fully the complex relationship among preferences, prices, wages, and social status.

The long-range budget constraint

The budget share devoted to child-rearing is constrained by the life-time economic resources available to the couple. The life-cycle resource constraint is:

$$P^s_k K + P_n N = I = V + W_w \cdot T_w + W_h \cdot T_h,$$

where P^s_k is a scalar representing the discounted present value of expected expenditures on market goods and parental time made on one child over the child's life in the family:

$$P^s_k = \int_0^{r(s)} p^s(\alpha) \cdot e^{-\rho(s)\alpha}\, d\alpha.$$

Its value depends upon the value of annual expenditures, $p^s(\alpha)$; the length of time, α ranging from 0 to $r(s)$, that the parents support the child; the discount rate, $\rho(s)$, at which the decision maker discounts future expenditures; and the time shape of the stream of expenditures.[24] The indicator, s, marks those components of the price of a child that might be expected to vary systematically with the social status of the parents. It provides a link with society's restrictions on parental behaviour that sociologists commonly call norms, and its significance to the theory will be described below.

[24] In the United States actual parental money expenditures on children are concentrated in the ages twelve and over (Turchi, 1983, ch. 4), and parental time contributions are concentrated at the early ages (Turchi, 1986, ch. 5).

The quantity, P_nN, represents the share of potential income that is tentatively allocated to non-child-rearing activities. The decision maker acts as if she is making a preliminary division of potential income between child-rearing and all other activities. Once children start arriving in the family, the composition of the child-rearing share becomes more defined; however, the composition of alternative expenditures can be expected to remain relatively fluid, with great possibilities for substitution among activities so early in the life cycle. Consequently, P_n can be expected to play a much less prominent role in determining the notional demand for children than P_k^s, the price of a child.

The right-hand side of the budget constraint describes the potential income, I, of the family. It is the woman's expectation of the maximum discounted value of economic resources available over the life cycle. V is the present value of expected life-time family wealth from previous work and from previous and expected future non-labour sources. T_w and T_h represent vectors of time available to the wife and husband, respectively, over the life cycle, and W_w and W_h are corresponding discounted expected wage vectors.

The budget constraint emphasizes the necessity of parents' making fertility decisions (1) well before desired family size is achieved, and (2) well before the bulk of the costs of child-rearing are incurred. Thus, the decision maker must look into the future and weigh the future costs and benefits of parenthood. Often the discount rate, $\rho(s)$, is assumed to be uniform across individuals; however, evidence[25] suggests that it varies systematically. If it does, parents facing identical streams of future income and expenditures will perceive them to be different, and their family size decisions and reproductive behaviour may also diverge systematically.

The demand function

A formal characterization of the woman's choice of target family size involves the maximization of the utility function subject to the life-time budget constraint.[26] The decision problem is to

[25] See, Hausman (1979), Thaler and Shefrin (1981), and Fuchs (1986).

[26] As is common, the discrete nature of the choice is ignored here for expositional purposes; however, the econometrics of demand function estimation require that the discreteness of family size options be considered.

Maximize: $U_a = U_a(K,N;PR_{k:n})$

Subject to: $P_k^s K + P_n N = I = V + W_w \cdot T_w + W_h \cdot T_h$.

Forming the Lagrangean function and differentiating leads to the first-order conditions:[27]

$$\partial U_a/\partial K - \lambda P_K^s = 0$$

$$\partial U_a/\partial N - \lambda P^n = 0$$

$$- P_k^s - P_n N + I = 0.$$

With an explicit functional form for the utility function, it is possible to solve for the optimum number of children in terms of the price of a child, a price index for alternative activities, and potential income. In its absence we have the general form of the demand function:

$$K^D = f(P_k^s, P_n, I; PR_{k:n}^s).$$

The demand for children, K^D, is a function of four "proximate decision factors": (1) P_k^s, the perceived price of a child; (2) P_n, the price index of alternative activities; (3) I, potential income; and (4) $PR_{k:n}^s$, relative preferences for child-rearing versus a composite alternative. Each of these proximate decision factors relates directly to the choice problem of a single and specific decision maker. They are all psychological variables, being expectations or perceptions, but three of the four are actually perceptions of economic variables. Economic models often substitute actual market prices for perceived prices, but this appears to be especially problematic with respect to the notional demand for children.

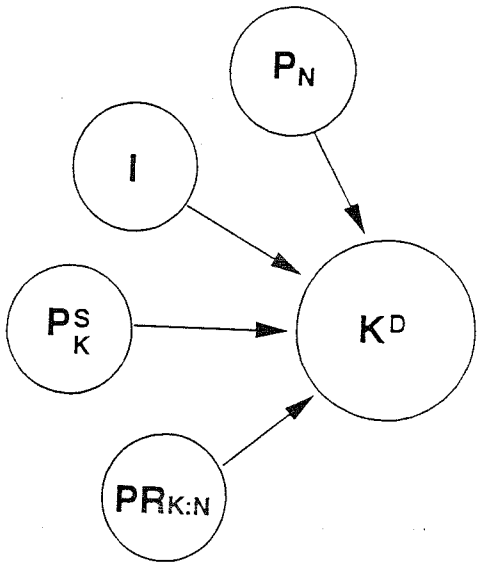
Under this economic model the proximate decision factors represent the only paths through which variables external to the decision maker can affect her free choice of target family size. Figure 1 shows how the micro-economic model forces all external influences to operate through the budget constraint

[27] Ignore for the moment the possible dependence of the perceived price of a child upon the number of children chosen.

via prices and potential income or through relative preferences. Almost invariably analyses of the demand for children, lacking measures of these appropriate theoretical variables, resort to proxies such as race, education, religion, occupation, etc., to explain the decisions. However, use of these proxies can lead to conflicting interpretations of empirical results. A negative coefficient on "education", for example, may signify "wage effects" to an economist or "taste effects" to a sociologist, when it is in fact indirectly influencing both wages and tastes.[28]

The basic demand model of figure 1 provides the framework through which the analysis can be expanded to incorporate a variety of influences from the commodity and labour markets and from the normative environment within which the decision maker resides. After the origin of P_k^s is explored further, the demand model will be expanded to serve as a more comprehensive vehicle for the analysis of fertility decisions.

Figure 1. Basic notional demand model illustrating the effect of "proximate decision factors"



[28] Cochrane (1979) provides a comprehensive survey of the complexities of the education-fertility link.

13.3.3. Production technology and the price of a child

The notional demand model specifies that the demand for children is determined in part by the perceived or expected price of a child. This formulation reflects the view that parental child-rearing inputs are significantly determined by social norms and standards which vary systematically across the status hierarchy. Since social status is related to education and occupation, which also are important determinants of potential income it is likely that the perceived price of a child is systematically related to potential income.

The notional demand model differs from the more common "quantity-quality" model[29] in that it views the price of a child as a determinant of the demand for children, while the latter approach assumes that the quantity and "quality" of children are chosen simultaneously.[30] This assumption, along with the assumption of uniform preferences and child-quality production technology across households, means that the demand for children can be estimated without any direct reference to the resources required for child-rearing.

The view embodied here is that parents base their demand for children on a previously determined price of a child which is systematically related both to the economic environment (labour and commodity markets) and to the social normative environment. This approach must, consequently, pay much more attention to the measurement and specification of child-rearing behaviour, but it also offers a richer set of paths connecting individuals to the economic and social environments. Since a primary purpose of the study of reproductive decision making is, or should be, the analysis of how individuals respond to the environment in which they live, the approach proposed here offers attractive possibilities for extending our knowledge along these lines.

The household technology of child production

Let us characterize the "technology" by which a woman expects to raise her children as a perceived "production function" that relates the quantities of market goods and services and parental time required to raise children:

[29] See, for example, Becker (1960), Willis (1973), and Schultz (1976).

[30] Assume "quality" is an indicator of expenditure per child and therefore is analogous to the "price" of a child. The literature is not clear about just what the quality of a child is.

$$\phi^s(K,x,t) = 0.$$

K is the number of children, x is a vector of market goods and services (e.g., food, clothing, housing, education, etc.) over the entire period of child-rearing, and t is a vector of parental time inputs over the child-rearing period. The production function determines the quantities of each input used to produce a given number of children and it also specifies a decision maker's perceptions regarding the degree of substitutability among inputs in the child-rearing process.

Where does this production function (or the production function for child quality) come from ? For families at minimum levels of subsistence the required inputs are *biologically determined*; however, for most children living in the industrial world, the technology is *socially determined*. The production function sets minimum acceptable standards for child-rearing and these standards are likely to be a function of social status.[31] The theoretical approach proposed here offers a linkage among the social and economic environment and important proximate determinants of fertility.

The perceived price of a child

Given the minimum standards implicit in the production function, assume that a decision maker will produce children in a least costly manner:

$$\text{Minimize:} \quad C = p \cdot x + w \cdot t$$

$$\text{Subject to:} \quad \phi^s(\underline{K},x,t) = 0,$$

where, p is a vector of discounted expected market prices, w is a vector of expected wages[32] and $\underline{K}$ indicates that the minimization is for a particular family size.

Minimization of costs implies a cost function that depends on family size, prices, and wages,

[31] See, Becker (1981, p. 107) for an implicit recognition that even in the quantity-quality model there is some floor on the expenditures that parents make on their children.

[32] Actually, these are expected *shadow* wages since the time used in child-rearing is non-market time.

$$C = C^s(K,p,w),$$

and the perceived price of a child would be

$$P_K^s = C/K = F^s(K,p,w) \qquad \text{or} \qquad = F^s(p,w),$$

if the decision maker believes there are economies of scale in child-rearing.[33]

The perceived price of a child is, therefore, a function of expected market prices, shadow wages which are in turn related to market wages, and the normative standards that parents bring to child-rearing. The perceived price of a child may or may not be a function of target family size. Turchi (1983, 1986) has shown that *actual* child-rearing expenses per child are a function of family size;[34] however, individual expectations may diverge from actuality.

13.3.4. Notional demand in an economic, social, and psychological context

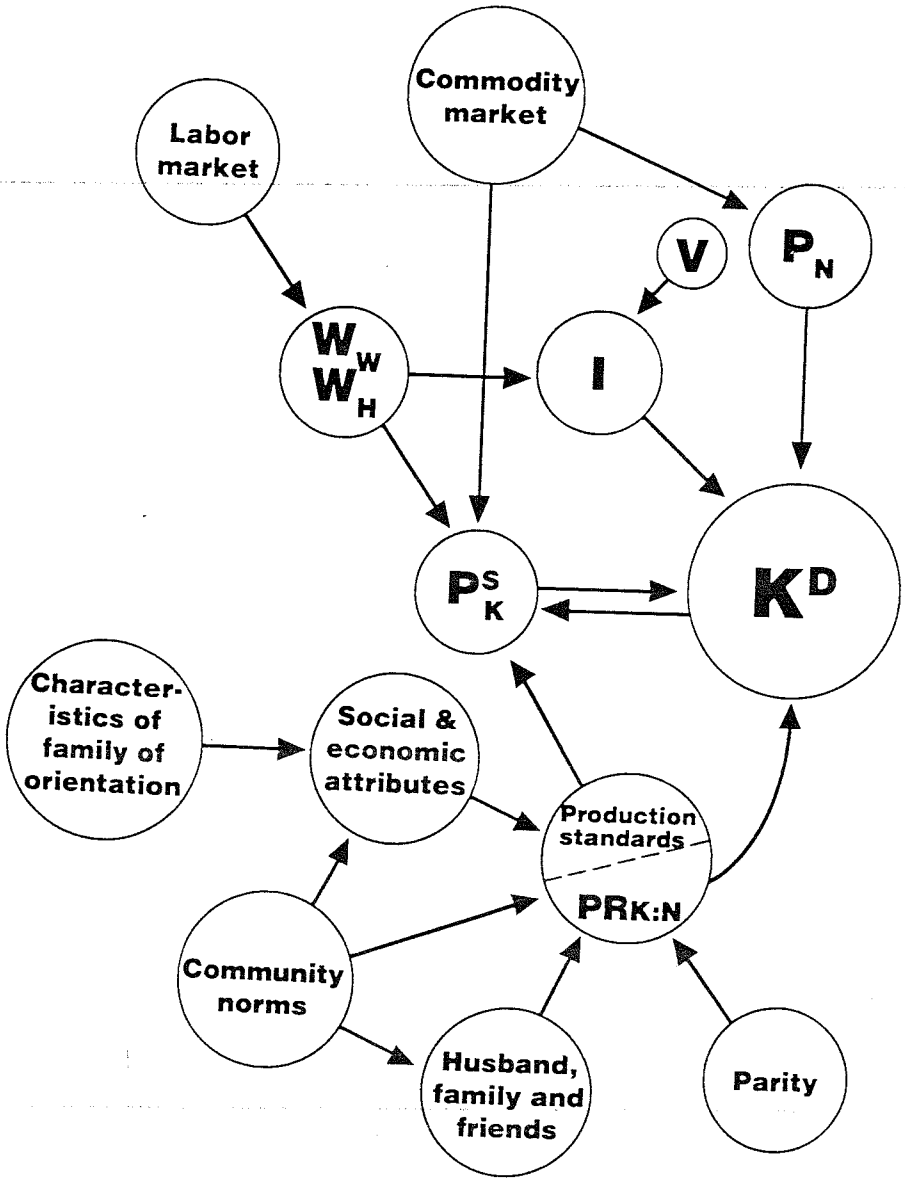
The micro-economic demand model might to many seem to be excessively individualistic, since external forces - markets, social norms, peer group preferences, laws and regulations, etc. - appear to play no role in the selection of the woman's target family size; however, nothing could be further from the case. This model actually is capable of specifying an exhaustive set of paths through which contextual factors influence individual-level decisions. Figure 2 illustrates the linkages between an individual's decision problem and her economic, social, political, and natural environment.

Space allows only a brief survey of the paths through which an individual's decisions are influenced by the various communities within which she resides; however, it will be clear from this survey that the potential environmental constraints affecting an individual's "free" fertility decision can be multi-faceted indeed.

[33] A national survey conducted by me asked respondents to report whether they believe that child-rearing is a constant, increasing, or decreasing returns to scale activity: 25.6 per cent believed costs per child would remain constant with increasing family size, 31.5 per cent thought costs would fall to some degree, and 42.9 per cent thought costs would rise.

[34] See also, Lazear and Michael (1988).

Figure 2. Contextual model of a woman's notional demand for children



I have already argued that a woman's relative preferences for children can be systematically related to her social attributes and through them to the larger social context. This assertion certainly does not trouble most non-economists, but the vast majority of micro-level decision theoretic research in economics ignores this possibility by assuming preferences in a population to be uniform and fixed,[35] thereby foreclosing *a priori* a major source of influence from society and culture operating through decision makers' preferences.

Figure 2 suggests that a woman's preferences for children versus other activities, $PR_{k:n}$, may be systematically linked to her own social attributes, as well as to the normative pressure exerted by husband, family, friends, and the social community of which she is a member. Moreover, another part of her preference structure which plays an important role in fertility decisions is the set of preferences she brings to the child-rearing role ("Production Standards"). These preferences can also be normatively influenced in the same manner as her preferences for children versus other activities.

Models that ignore the systematic variation in the demand for children which stems from membership in different groups suffer, at a minimum, loss of explanatory power. More importantly, however, they run the risk of simply being wrong because of the misspecification bias that is inherent in their incompletely specified view of the determinants of demand. In figure 2, social factors affect not only preferences but also such economic variables as the price of a child, P^S_k, and household potential income, I, operating through wage rates. Omission of direct measures of preferences and child-rearing standards leads directly to bias in the coefficients of those variables that *are* included in the model.

Many students of fertility have used social attributes such as race, education, occupation, or religious affiliation as explanatory variables in their empirical models. These attributes do not directly determine reproductive decisions, but they influence variables that do. Unfortunately, without a well-specified decision theory, interpretation of such analyses is problematic. For economists these social attributes are proxies for (missing) wages or prices, but for sociologists they may represent normative influences on behaviour operating through preferences.

[35] Or, perhaps, randomly and independently distributed with respect to the other proximate decision factors.

The micro-economic model makes clear the sorts of variables that directly affect allocative decisions such as fertility, and it (or another explicitly decision theoretic model) is essential for a proper understanding of the determinants and outcomes of decision processes. In addition, the micro-economic model offers the (generally unexploited) advantage of pinpointing the sources of external influence for individual decisions. After all, social scientists are generally interested in how the wider society and economy affect the individual, and an individual-level theory is a prerequisite for constructing the network of relationships that determines a person's place in the economic and social system.

Finally, figure 2 makes it clear that an individual is not affected simply by a single "community." Rather, her decisions are affected simultaneously by a number of different communities. On the economic side, both the labour and commodity markets, which do not need to be coterminous, have separate effects on the decision process. The social pressures that shape preferences and child-rearing standards also emanate from the various social, religious, or racial communities of which she is a member. Consequently, the demand for children is considered to be the result of a complex interaction of forces emerging from a number of different contexts, both social and economic, that probably cannot be studied effectively in isolation.

13.4. Fertility and labour force participation

The biologically mandated sequentiality of fertility prohibits instantaneous achievement of target family size and complicates the fertility-labour force participation relationship. A woman makes labour force participation decisions continually throughout her reproductive age span, and her long-range fertility goals are contingent upon them as are the more immediate economic and social conditions that change continually. Students of the fertility-labour force participation relationship have approached it from a number of different perspectives: (1) current (or cumulative) labour force participation versus current family size,[36] (2) life-cycle fertility versus life-cycle labour force participation,[37] (3) optimal control models of fertility and labour force participation,[38] and (4) multi-period sequential models.[39]

[36] See, for example, Smith-Lovin and Tickamyer (1978), Cain and Dooley (1976), and Dooley (1982).

Of course the appropriate time frame for analysis depends somewhat upon the specific objectives of the particular research; however, three different aspects of time are potentially relevant:

1. *Age of Woman*. There is a "typical" age profile of a married woman's labour force participation and fertility that is arguably stable across cohorts. This age profile is determined significantly by the biological course of fecundity between ages fifteen to forty-four, but it can be modified by trends in preferences for the timing of births and labour force participation.
2. *Cohort Effects*. Preferences might vary systematically by cohort so as to distort the age profile of reproduction and work. Use of data from many cohorts, as is often done in cross-sectional statistical analyses, may lead to biases in estimation if care is not taken to account for these cohort effects. An example of cohort effects might be the apparent trend toward later childbearing and earlier establishment of careers among American women in post-1960 cohorts.
3. *Period Effects*. The forces that determine *actual behaviour* in a given period are often exogenous to the decision maker and serve to distort the (preference modified) "typical" age profile of fertility and labour force participation. For example, recessions that lead to a husband's unemployment may force a wife to stay at work although both she and her husband desire for her to quit work and begin a family. Namboodiri (1972a) has long argued forcefully that the "life cycle" is actually a series of short-run episodes that must be modelled as such.

The model presented in figure 3 reflects my choice to emphasize the interplay of period effects and the long-range or notional demand for children in producing a woman's short-run supply of hours to the labour market and the intensity of demand for a pregnancy in the current time period. The model

[37] Waite and Stolzenberg (1973), Stolzenberg and Waite (1977), Willis (1973), Carliner *et al.* (1984), Fleisher and Rhodes (1979), Rosenzweig and Wolpin (1980).

[38] Moffitt (1984a).

[39] Namboodiri (1972a), Rosenzweig and Schultz (1985), and Hotz and Miller (1988).

reflects my conviction that the fertility-labour force participation relationship must be treated as a short-run behaviour contingent upon long-range plans.[40] Again, this model's purpose is to emphasize the opportunities for an interdisciplinary approach to a comprehensive explanation of the fertility-work interaction.

The model contains two dependent variables: the wife's supply of hours during time period t, and the intensity of her demand for a pregnancy during the same period.[41] These two endogenous variables[42] are specified as being jointly determined by a nexus of *current* social and economic variables, and in the case of pregnancy intentions by the notional (or long-range) demand for children. In this sense both labour force participation and short-run fertility intentions are mutually determined but do not mutually determine each other.[43]

The woman's supply of hours to the labour market has three direct determinants: current exogenous income, the woman's current wage rate, and the current shadow value of her time. Exogenous current income includes income from non-human assets (financial and real) as well as the husband's labour income.[44] It depends fundamentally upon current economic conditions in the labour market (unemployment rate), the financial market (stock and bond prices), the housing market (real estate income), etc. The woman's current wage rate also depends upon current labour market conditions and it depends also upon the social and economic attributes that determine her productivity at work.

The shadow value of a wife's time is a latent psychological measure of the value she places on her time at home. Its value depends upon her *current* preferences for work versus pregnancy, which may be quite different from her life-cycle preferences, the current number, age, and sex of children in the family, and on the availability and quality of child care from outside the

[40] See Hill and Stafford (1985a) for empirical support for the notion that long-range fertility plans affect the short-run relationship between fertility and labour force behaviour.

[41] The latter variable might be measured as a dichotomous one in the data (e.g, "Are you intending to become pregnant this year ?") requiring use of a probit equation in a systems context.

[42] A third supply of hours to non-market, non-parental activities could have been added but is omitted here for simplicity.

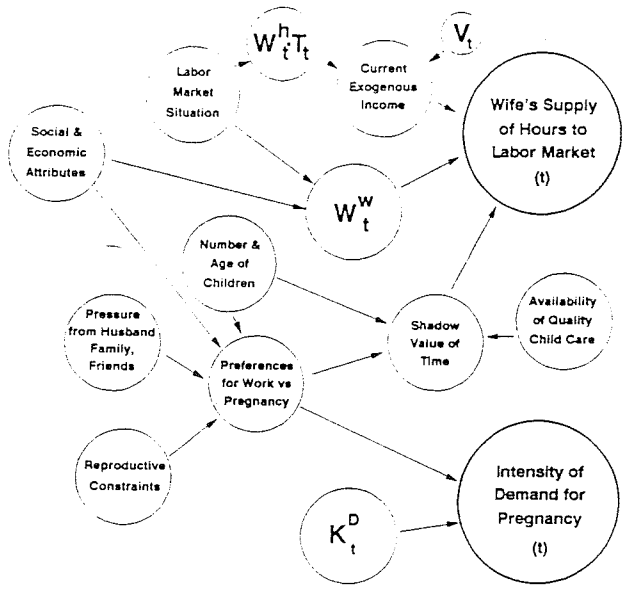
[43] Support for this view of the relationship comes in papers by Bagozzi and Van Loo (1982, 1988), Van Loo and Bagozzi (1984), and Moffitt (1984).

[44] In the United States numerous studies have demonstrated that husband's labour income is independent of wife's work effort.

home.[45] Figure 3 shows how normative pressure emanating from the husband, family and friends, and other sources can differentially affect women in varying social milieus.

The wife's demand for a pregnancy depends directly upon her current preferences for work versus parenthood which depend in turn upon the biological factors that influence reproduction (age, fecundity), the number, age, and sex of her children, and the normative pressure for work or pregnancy that she receives from husband, family, and friends. In addition, of course, the notional demand for children influences her current demand for a pregnancy which implies that this current behaviour is also influenced by that complex network of influences pictured in figure 2.

Figure 3. Wife's supply of labour market hours and demand for a pregnancy in year t



[45] Many empirical studies of female labour force participation ignore this variable completely or use incomplete measures such as "number of children under age five" as proxies.

13.5. Co. .asions

This essay has argued that utility maximization theory can serve a potentially valuable role as an integrating framework for the interdisciplinary study of fertility and labour force participation behaviour. In the industrial world, both fertility and work are generally undertaken as the consequence of deliberate decisions; each involves the expenditure of economic resources and leads to psychic and/or economic returns. The micro-economic model as normally used focusses on decision makers' responses to the economic environment - labour and commodity markets - but it also offers the opportunity to integrate social, psychological and normative variables to produce a comprehensive model. Figures 2 and 3 offer suggestions for how this integration might take place.

Although not discussed here, it should be clear that a comprehensive model of fertility and labour force participation makes significantly greater data demands than analyses with a narrower disciplinary focus. The integrative model pays much more attention to *measurement* of commonly unmeasured theoretical variables. Economists tend to stand back from the measurement of preferences, a reticence that sociologists and psychologists find unwarranted. On the other hand, the model also suggests that behavioural models that fail to measure and include in analysis the economic constraints that accompany allocative behaviours such as fertility and labour force participation are, in their own ways, equally open to bias arising from specification error. The data collection tasks implied by the integrative models of this essay are not insignificant, but they offer the possibility of a significantly richer understanding of two of society's most fundamental socioeconomic processes.

Part V
Towards a Better Understanding of the Relationship between Female Labour Market Behaviour and Fertility