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ECONOMICS OF ABORTION DEMAND BY PREGNANT MARRIED WOMEN: THE ULTIMATE FERTILITY CHOICE

University of Hawaii

Ph.D.

1979

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ECONOMICS OF ABORTION DEMAND
BY PREGNANT MARRIED WOMEN:
THE ULTIMATE FERTILITY CHOICE

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE
UNIVERSITY OF HAWAII IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN ECONOMICS
AUGUST 1979

By
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Special thanks must also be accorded to Dr. Mohab Ghali and my fellow students in the Workshops in Applied Economics (Economics 724) during Spring 1978 and Spring 1979. Their comments, criticisms, and encouragement of the econometric aspects of this study were invaluable. Any errors remaining are, of course, my own.
ABSTRACT

ECONOMICS OF ABORTION DEMAND
BY PREGNANT MARRIED WOMEN:
THE ULTIMATE FERTILITY CHOICE
by Douglas Ward Mardfin

A dissertation submitted to the Graduate Division
of the University of Hawaii in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy.

As an extension of previous studies on the economics of
fertility, this dissertation estimates the demand for
abortions by married women with unplanned pregnancies who
conceived during the 1970-72 period after elective abortions
on request became legal in Hawaii. In so doing, it provides
evidence that economic models are relevant in explaining the
demographic choices of people. Moreover, it avoids some of
the problems of earlier studies of total family size since a
choice is clearly made whether to have an additional child
or to have an abortion when confronted with an unplanned
pregnancy.
Cross sectional data on women who had conceived during the 1970-72 period were generously provided by the Hawaii Pregnancy, Birth Control and Abortion Study at the University of Hawaii. For each woman, the data were collected while she was in the hospital for a maternal delivery or an abortion. Hospital records plus questionnaires filled out by the woman provided a wide variety of demographic and sociological variables. Since data on the price of the hospital procedure which would be paid by the woman and the opportunity cost of the woman's time were not solicited, they are calculated for use in this study from the data which are available. The price of an abortion and a delivery paid by the woman is a function of the hospital she went to, the island where she lived, and whether the hospital and doctor bills were partially or wholly paid by health insurance or some public agency. The opportunity cost of a woman's time is estimated as a function of her ethnicity, education, and experience (where experience is computed as age minus years of education minus 6).

Because the choice of an abortion is dichotomous, it is inappropriate to use an ordinary least square regression to estimate the demand for abortions. A probit maximum likelihood procedure is used to estimate the demand function.
As hypothesized in the theory section, the price of an abortion is inversely related and the price of a maternal delivery is directly related to the probability of choosing an abortion. For women with three or more children, the opportunity cost of her time, which is intended to proxy the cost of an additional child, is also positively associated with the abortion choice. Abortion demand is inversely related to family income. Taken individually and as a group, these economic variables are statistically significant at the 5% level in the abortion demand equation.

The effects of varying the independent variables (including the number of children the woman already has, family income, age, religion, ethnicity, employment status, use of contraception prior to conceiving, and opportunity cost of the woman's time) on the demand for abortions are presented. Finally, there is a brief discussion of the effect of government subsidization of maternal deliveries and/or abortions on the abortion demand of pregnant married women who had not planned to conceive. The practice of paying the full cost of whichever procedure the woman chooses is shown to have the net effect of reducing the demand for abortions. Moreover, the government would save little in direct expenditures by only subsidizing maternities but not abortions. These conclusions must be tempered by the observation that they apply only to the women in the data set from the 1970-72 period. Since that
time, menstrual aspiration has come into widespread use and
the demand for abortions may well have changed.
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CHAPTER I
INTRODUCTION

Since the early 1960s, economists have tried to use price theory to explain the observed fertility outcomes of, primarily, married couples. The main thrust of this has been to treat children as consumption goods yielding utility to their parents and produced in the home by combining parents' time and market purchased goods. This approach raises some potential problems, however. An implicit or explicit assumption underlying most of these endeavors has been that couples are, in fact, choosing the number of children they have (as opposed to children being merely a by-product of sexual intercourse). While this assumption becomes more tenable as birth control techniques become more effective, more inexpensive, more acceptable, and more widely known and available, there may well be a sufficient number of "unchosen" children to confound the empirical results of the economists.

A second aspect of most of the work done is that it focuses on total family size as the dependent variable with economic (and non-economic) variables as the independent variables. One implication of this is that the independent variables are presumed to directly influence the observed
number of children rather than to influence the desired number of children, the amount and timing of intercourse, and the choice and use of contraception and/or abortion. Another implication of this is that couples are assumed to make a once and for all decision about the number of children they want rather than making sequential decisions about having an additional child or not.

This study was undertaken to circumvent these possible problems by examining the choices made by married women not planning to become pregnant to have an abortion or to carry the fetus to term. Regardless of whether a woman was choosing to have another child or whether she became pregnant without consciously choosing to, once pregnant, it is clear she can choose either to have the baby or to have an abortion. It is also clear that abortions have a direct effect on the fertility outcome and so it is appropriate to investigate the variables which affect the abortion choice. Furthermore, the focus is on whether the couple will or will not have an additional child rather than on the total family size.

Like previous studies on the economics of fertility, one of the purposes of this study is to demonstrate the relevance of economic models in explaining the demographic choices of people. To the extent that economic variables statistically account for some of the variance in the
abortion choice of pregnant married women, it may be asserted that an economic model of choice is not irrelevant.

Specifically, this study is an attempt to estimate the demand for abortions for married women in Hawaii who had unplanned pregnancies conceived during the 1970-72 period after elective abortions on request became legal. The focus is primarily on the signs, statistical significances, and implications of selected economic variables in the demand equation. The variables of special concern are the price of an abortion, family income, and proxies for the opportunity cost of raising an additional child. It is assumed that, at the established price, the supply of abortions (and maternal delivery services) by physicians and hospitals is perfectly elastic. But the price paid by the woman depends on whether she is covered by health insurance, whether some outside

1By restricting the analysis to married women who had not planned to become pregnant, the sample is much more homogenous than if all pregnant women had been included. Using multiple classification analysis, Palmore et al. (1976, especially p. 17) used religion, ethnicity, parity, occupation, marital status at conception, whether or not the pregnancy was planned, and a variable combining age and educational attainment as independent variables in explaining the variance in each of the conception cohorts with all women included. They found that the planning variable, the marital status variable, and their joint interaction net of all other variables accounts for between 50% and 54% of the variance explained (explained variance ranges from 35% to 40% of total variance) for Cohorts 3 through 6. When interaction with the other variables is allowed, they account for 75% to 81% of explained variance. On the other side of the coin, religion, ethnicity, parity, occupation, and age with education individually and jointly net of marital status and the planning variable accounts for only 19% to 24% of the explained variance.
agency such as the military or welfare is paying the cost, and which hospital she uses. It is assumed that the price paid by the woman (not the price received by the hospital) is a variable in her demand for abortions. There is thus some variance in the prices paid by groups of women (equivalent to vertical shifts in an perfectly elastic supply curve) so a demand for abortions can be estimated for the selected population. It may be noted in passing that, for a sample of pregnant women, estimating the demand for abortions is equivalent to estimating the demand for additional children except that the signs of the coefficients of all the variables will be reversed and the intercept term will be decreased by 1.0 and the sign reversed.

Cross sectional data from the 1970 to 1972 period, collected and made available by the Hawaii Pregnancy, Birth Control and Abortion Study, form the data base for this study of abortion demand. Only data on married women who had not planned to become pregnant are used, however. The restriction to married women is to maintain compatibility with previous studies on the economics of fertility. Restriction to women who had not planned to become pregnant limits the study to those women for whom the pregnancy was a by-product of sexual intercourse. If the economic model "works" for these women, it is suggestive, a fortiori, that fertility behavior of all women is subject to influence by
economic considerations. Moreover, since abortion is the choice under investigation, it seems inappropriate to include women who planned to become pregnant because they would be extremely unlikely to want an abortion unless their circumstances had changed drastically since conception.

No explicit data on the price of an abortion, the price of a maternal delivery, or the opportunity cost of a woman's time were collected by the Hawaii Pregnancy, Birth Control and Abortion Study. Since these are considered potentially important variables in the economics of abortion choice, they were estimated for each woman based on other data collected.

A pregnant woman either has an abortion or she does not, and the observed outcome is thus dichotomous. In estimating the relationship between a dichotomous dependent variable and various independent variables, it is inappropriate to use ordinary least squares regression. Consequently a probit maximum likelihood estimation procedure is used for this study. The results of this study indicate that, in conformance with expectations, the difference between the price of an abortion and the price of a maternal delivery is inversely related to the decision to have an abortion. Family income is also inversely related to the choosing of an abortion. The opportunity cost of a woman's time (which is used as a proxy for the cost of an
additional child), given that a couple already has three or more children, is positively associated with the demand for abortions.

Some of the limitations of this study must be pointed out from the very beginning. For one thing, the abortion demand for single women is not estimated. Thus the full demand for abortions is not investigated but only a portion of the total demand. But even the estimation of abortion demand for married women who had not planned to become pregnant must be interpreted with caution. For example, the fact that the 1970-72 period was one characterized by inflationary expectations limits the applicability of the estimated demand equation to periods of similar inflationary expectations. The net effect of inflationary expectations on abortion demand cannot be empirically estimated because data are not available from other periods and there are theoretical considerations which make it impossible, a priori, to determine the net effect of inflationary expectations on abortion demand.

A much more important limitation is due to the increasing use of menstrual aspiration since 1972. Menstrual aspiration is an inexpensive technique which can be performed in a physician's office if a woman misses or has a delayed menstrual period. If a woman had conceived at the time, the technique would terminate her pregnancy but
would not be reported as an abortion (in fact, the woman is not usually told whether or not she had conceived). This tends to make menstrual aspiration a back-up for contraception and a substitute for abortions. Since menstrual aspiration is less expensive than an abortion and probably entails less psychic disutility because the woman does not know whether or not a fetus was removed, the demand for abortions has probably changed considerably since the data for this study were collected.

In Chapter II there is an expanded discussion of the theoretical literature on the economics of fertility and contraception. In addition a brief theory of abortions is suggested. Chapter III more fully describes the data used and how and why the particular subsample was selected. Chapter IV sets forth the procedure used to generate the price variable and the cost of a woman's time variable. Chapter V elaborates on the probit procedure used and on the particular variables included in the demand for abortions equation. It also presents the quantitative results of the probit estimation of the demand equation. Chapter VI provides an interpretation of the results and draws conclusions based on the results. There is also a brief discussion on the policy of subsidization of abortions and maternities.
CHAPTER II
THEORETICAL BACKGROUND

Now it is easy to see that the art of household management is not identical with the art of getting wealth, for the one uses the material which the other provides.

Aristotle Politics Book I, Chap. 8

DEMAND FOR CHILDREN

Excluding Malthus, the first major step toward developing an economic choice theoretic model of family fertility behavior was expounded by Gary Becker in 1960.

To simplify the analysis of this problem I assume initially that each family has perfect control over both the number and spacing of its births.

For most parents, children are a source of psychic income or satisfaction, and, in the economist's terminology, children would be considered a consumption good. Children may sometimes provide money income and are then a production good as well. Moreover, neither the outlays on children nor the income yielded by them are fixed but vary in amount with the child's age, making children a durable consumption and production good. (Becker, 1960, p. 210)

With children considered as consumer durables yielding utility over time, Becker was able to employ conventional economic concepts to explain the demand for children by parents. The variables in such demand analysis include tastes (exogenously determined), the quality of the children
(more expenditures implying higher quality children who presumably yield more utility to the parents), real income (children are assumed not to be "inferior goods" hence a rise in income, ceteris paribus, leads to more expenditures on children and possibly an increased number of children), and cost ("...the present the parents' services, minus the present value of the expected money return plus the imputed value of the child's services" (Becker, 1960, pp. 211-213)). Becker also recognized that children were "produced" as well as "consumed" by the family and that the supply of children was subject to uncertainty and affected by the degree of contraception knowledge possessed. In trying to explain the fact that per capita incomes in the United States had risen over time while fertility had fallen, Becker pointed to offsetting changes in other factors such as "...a decline in child mortality; an increase in contraceptive knowledge; and a rise in the cost of children" (Becker, 1960, p. 227) of a given quality.

In a comment on Becker's paper, James Duesenberry (1960, p. 234) foreshadowed some of the later theoretical development by suggesting that the time parents spent on their children is an important element especially in determining child quality. Also, Jacob Mincer (1963, p. 76) emphasized that even with cross sectional data the opportunity cost of child care (primarily represented by the wage foregone by the mother by not participating in the
labor market) could differ among families. Mincer concluded that the family choices of fertility and labor-force participation were "...simultaneously determined by the same basic economic variables. The higher the female wage rate and the lower the husbands' earning power, the higher the labor-force rate and the smaller the fertility rate." (Mincer, 1963, p. 78) Not taking opportunity costs into account results in biased empirical estimates of the relationship between income and fertility. (Mincer, 1963, p. 78)

Becker (1965) elaborated on this concept by explicitly setting forth a generalized theory of household decision-making which includes the (opportunity) cost of time as well as the cost of market goods. According to the theory, a household maximizes utility from basic commodities produced by combining time and market goods subject to a basic resource "full income" constraint ("...the maximum money income achievable ... by devoting all the time and other resources of a household to earning income, with no regard for consumption" (Becker, 1965, pp. 497-498)). "The basic resource constraint states that full income is spent either directly on market goods or indirectly through the forgoing of money income." (Becker, 1965, p. 499) When applied to household decisions about bearing and rearing children, Becker (as in his earlier paper) suggested that the income elasticity of demand for child quality is greater
than the income elasticity of demand for the number of children. But the measured elasticity of demand for the quantity of children might well be underestimated, if child care is "...a time-intensive activity that is not 'productive' (in terms of earnings) and uses many hours that could be used at work. Consequently, it would be an earnings-intensive activity, and our analysis predicts that its relative price would be higher to higher-income families." (Becker, 1965, p. 510) Since high-income families have a higher price than low-income families for the same quality of children, these high-income families would be expected to have fewer children than would have occurred if the price was the same as for the low-income families. Thus the observed income effect compared to the "true" income effect is offset somewhat by a price change so the measured income elasticity of demand for child quantity is biased downward.

The next major contribution and the beginning of a major branch in the theory was made by Richard Easterlin (1969) when he synthesized and refined much of the work described above, but gave a much more prominent role to the idea of a potential income flow through time, to the formation of tastes, and to birth control knowledge and usage as they affect fertility behavior.
While Becker had recognized the advantages of using the "full income" concept, Easterlin also incorporated Milton Friedman's "permanent income" ideas (Friedman, 1957, pp. 20-37) into a concept he called "potential income".

The relation of observed to permanent income varies with the shape of the prospective income stream and because cyclical or irregular factors occasion deviations from the prospective path.

The permanent income concept can be viewed as emphasizing that it is the potential income flow through time that is pertinent to household decision-making, and that observed income may be an unreliable proxy for this. To minimize multiplication of concepts, I propose to embrace the permanent income notion in that of 'potential' income. There is a second dimension to potential income, however. Even if there were no difference between prospective annual income and that currently observed, the potential income of a household would exceed its observed income, for the simple reason that typically money income is foregone in order to have time for other pursuits. Observed income may be an unreliable index of potential income because it inadequately reflects not only prospective earnings through time, but foregone earnings at a point in time as well.

The income concept relevant to the decision-making process is potential income. Moreover, this magnitude together with the relevant price and taste variables, determines not only fertility but also the amount of market labor done by the household members and even observed income itself. (Easterlin, 1969, p. 129)

Easterlin acknowledged Deborah Freedman's work on relative income. Freedman suggested that

It is also important to consider not only the husband's actual income but how his income compares with the average attained by men of his age, occupation, and educational status. Is he earning what is expected for a man in the socioeconomic group to which he is compared by himself and others? We shall use the term 'relative income' to refer to the ratio between a man's actual income and the income customary in his socioeconomic reference group.
Why should relative income affect fertility independently of actual income? The reason is that the costs of rearing children are related to the socioeconomic reference group of the parents. Given the social status of a family, it has only limited control over the costs of its children... Certain expenditures for each child, for example food and housing, are set by the scale of living of the parents, and this in turn depends on the family's social status. Many of the variable costs of child rearing also will be determined by the social standards of the family. Furthermore, while a consumer can choose to own both a cheap and an expensive car, this choice is not equally possible in determining the cost of his children. In fact, if the expenditures for a child do not conform to the socioeconomic standards of his family, he may be a source of disutility. Therefore, a couple whose income is low relative to the group with which it is identified may restrict its family growth so the desired standard can be furnished to a smaller number of children. (Freedman, 1969, pp. 415-416)

But Easterlin thought that "the 'relative income' hypothesis may best be viewed as combining a resource variable, actual income, and a taste variable, an empirical proxy for the living aspirations of the household." (Easterlin, 1969, p. 145) Proceeding along this line, Easterlin still stressed the importance of "potential income" as the most relevant income constraint to family fertility decisions.

Because he was advancing a socioeconomic theory, Easterlin explicitly considered the formation of tastes rather than assume that tastes were "given".

In general, one's preference system at any given time may be viewed as molded by heredity and past and current environment. ...

Because of the important role of cumulative experience in the formation of tastes, it is probably correct that typically tastes change rather slowly over time. For some analytical
purposes, this may justify the economist's usual assumption of constant tastes. But in areas of behavior such as fertility, which involve a substantial time period or where cross-section differences among classes are of interest, such an assumption seems dubious. Nor can the economist dismiss taste phenomena as non-economic in nature, for it is clear that economic variables enter into the shaping of tastes and affect behavior through this channel as well as via the resource and price constraints traditionally emphasized. (Easterlin, 1969, p. 135)

This emphasis marked the major branching point between the Easterlin school of thought and the Becker school of thought. While Easterlin saw a central role for differential tastes and the formation of tastes, Becker and his followers essentially assumed tastes were given, stable over time, and, for the most part, identical for all individuals. While Easterlin engaged in an attempt to explain how and why tastes would differ among individuals in different circumstances, Becker tried to explain differential behavior on the basis of individuals with identical tastes facing different incomes and shadow prices in the production of children. (Becker, 1960, pp. 218-220, and Easterlin, 1969, pp. 128, 136-137)

Easterlin briefly discussed the distinction between the total number of children a family had and the spacing of those children throughout the reproductive years. He concluded, however, that "...experience in the U.S. since 1917 shows that timing and number changes have, in fact, been reinforcing." (Easterlin, 1969, p. 139) While the
relationships were not clearly spelled out, Easterlin seemed to be saying that smaller completed family size is accompanied by childbearing in the later reproductive years and, presumably, with longer periods between births. Thus lifetime anticipations of income were expected to be most relevant to decisions about completed family size while the business cycle would have more affect on the timing (spacing) of births from one year to another within the lifetime of the woman. This was intended to be a shift in emphasis rather than a mutually exclusive dichotomy. Certainly child postponement due to period economic conditions might result in a smaller completed family size.

Easterlin's basic model boils down to the following:

At any given time, a household (or a couple contemplating union) has, on the one hand, a structure of preferences relating to goods, children, leisure, and fertility control practices, shaped largely by prior experience. The household has also certain income potentials, taking account of the earnings possibilities of husband, wife, and other family members as well as any non-labor income. There are, in addition, various price constraints, such as the prices of child care and of various fertility control methods relative to those of goods in general. Out of the balancing of preferences and constraints, decisions are reached on marriage, fertility control practices, fertility, wife's labor force participation, and perhaps even husband's hours of work. In the course of the reproductive years preferences are modified by ongoing experience, and income potentials, prices, and available fertility control methods may change with consequent appropriate changes in these decisions. The fertility record of a given household reflects this balancing of preferences against constraints over the course of the full reproductive age span. (Easterlin, 1969, p. 138)
During the 1970's there was an explosion of empirical and theoretical studies dealing with the economics of fertility behavior. One of the most valuable from the standpoint of formalizing the theoretical structure was presented by Robert J. Willis (1973) at a conference in June 1972 which basically followed the Becker tradition.

According to this formulation, "...the family combines time supplied by family members with goods and services purchased in the market to produce within the household the more basic 'commodities' which are the true objects of utility."

(Willis, 1973, p. S17)

By a number of simplifying assumptions, Willis expressed the total family utility as a function of the number of children, the quality per child (in turn a function of the time per child and market goods per child devoted to children over the parents' lifetime), and the satisfaction derived from all other non-child related sources (a function of time and goods devoted to the production of those sources of utility). The product of the number of children times the quality per child yielded the total amount of child quality or "child commodities".

Utility, however, is subject to time and money budget constraints of the parents. The amount of money spent on purchased goods is limited by lifetime money income which is the sum of non-labor wealth and the total market earnings of
the parents. For each marriage partner, the total amount of available time is allocated to work, child activities, and non-child activities. Willis went on to view the family's capacity to "produce" child and non-child commodities as limited by the state of its consumption technology and the family is thought of as having an implicit production possibility function which represents output combinations of child and non-child commodities if the family optimally allocates its time and goods resources.

Willis was able to formally derive demand functions for the number of children, child quality, and non-child commodities where the independent variables for each demand function were the shadow price (marginal opportunity cost) of child commodities, the shadow price of non-child commodities, and the value of the family's real lifetime consumption (or "full wealth"). (Willis, 1973, pp. S24-S25)

It has proven somewhat difficult to empirically test the competing theories of Becker and Willis against those of Easterlin due, in large part, to problems of defining in an operational sense and of measuring the appropriate variables. Nevertheless, Marcel Fulop recently did a review of the published empirical evidence and concluded that a "positive income elasticity is found in time-series studies, while income elasticity in cross-sectional studies has had an uncertain sign. On the other hand, a negative price
elasticity has been found in both types of studies." (Fulop, 1977, p. 21)

One problem with these studies, however, is that these theories of the demand for children were tested by actual fertility outcomes as the dependent variable and the actual number and spacing of children can diverge from that which would occur if children were purchased in the marketplace.
Demand for Coitus and Fertility Control

The demand for children is not expected to be independent of the demand for the good, coitus. For many couples, the unconstrained quantity and timing of their sexual activities would produce more births or shorter birth intervals than they desired. In order to mediate this situation, a couple can either accept whatever pattern of births "naturally" occurred or could engage in some form of fertility control which would alter the childbearing pattern. Such fertility control can take many forms. The couple can change the amount or timing of their coital activity. They can use some technique, device or medication to reduce the probability of conception. Given conception, they can engage in some action to reduce the number of viable births. Or they can employ some combination of these strategies.

In a classic article, Kingsley Davis and Judith Blake (1956) clearly categorized the several variables which directly affect the reproductive outcome. They pointed out that

The process of reproduction involves three necessary steps sufficiently obvious to be generally recognized in human culture: (1) intercourse, (2) conception, and (3) gestation and parturition. In analyzing cultural influences on fertility, one may well start with the factors directly connected with these three steps. Such factors would be those through which, and only through which, cultural conditions can affect fertility. For this reason, by way of convenience, they can be called the "intermediate variables" and can be presented schematically as follows:
I. Factors Affecting Exposure to Intercourse ("Intercourse Variables")

A. Those governing the formation and dissolution of unions in the reproductive period.

1. Age of entry into sexual unions.

2. Permanent celibacy: proportion of women never entering sexual unions.

3. Amount of reproductive period spent after or between unions.
   a. When unions are broken by divorce, separation, or desertion.
   b. When unions are broken by death of husband.

B. Those governing the exposure to intercourse within unions.

4. Voluntary abstinence.

5. Involuntary abstinence (from impotence, illness, unavoidable but temporary separations).

6. Coital frequency (excluding periods of abstinence).

II. Factors Affecting Exposure to Conception ("Conception Variables")

7. Fecundity or infecundity, as affected by involuntary causes.

8. Use or non-use of contraception.
   a. By mechanical and chemical means.
   b. By other means.

9. Fecundity or infecundity, as affected by voluntary causes (sterilization, subincision, medical treatment, etc.).

III. Factors Affecting Gestation and Successful Parturition ("Gestation Variables")

10. Perinatal mortality from involuntary causes.
Economists have made some tentative steps toward integrating these aspects of fertility behavior. Becker considered the effect of birth control on family fertility behavior briefly. Throughout the first part of his paper he assumed "perfect control" over the quantity and spacing of births. In the second part of his paper, Becker introduced the idea of a differential rate of contraceptive knowledge and usage positively correlated with income which could "...convert a positive relation between income and desired fertility into a negative relation between income and actual fertility." (Becker, 1960, p. 220) With less than "perfect control", the actual number of children a family had might be greater than the desired number.

Easterlin considerably expanded upon the importance of birth control by applying "...the theory of consumer choice to decisions regarding fertility control as well as desired family size, thus providing a more unified treatment." (Easterlin, 1969, p. 136) Fertility control becomes necessary to enjoy the good, "coition", and still avoid the unwanted conception which, with some probability, would otherwise occur as a joint product.

Fertility control measures enter as possible forms of insurance, of varying effectiveness and cost, against the unwanted outcome. But the employment of any given insurance measure itself involves certain costs, pecuniary and psychological. Thus, in considering the use of a fertility control measure, the household weighs the loss of utility.
attributable to the possibility of an unwanted birth against that arising from the cost of fertility control, including subjective costs.

For the population as a whole, this decision-making process results in a certain level and distribution of fertility control practices, and a corresponding incidence of unwanted pregnancies. The factors responsible for more extensive use of these practices may be grouped under two heads--those lowering the cost of contraception and those raising the cost of an unwanted pregnancy. Under the former head, progress in contraceptive techniques is an obvious factor. The principal advantage of modern over pre-modern methods would seem to lie, not in their effectiveness, but in their lower subjective costs. The objection to abstinence is clearly that it entails giving up coition altogether, while practices such as abortion and infanticide also involve high subjective costs. The latest techniques—the IUD and the oral pill—by separating the act of contraception from that of coition have doubtless served to lower subjective costs further than previous modern methods. A second factor would be diffusion of knowledge of given techniques. This would lower the cost of contraception by reducing the search costs of information. A third would be a favorable shift in attitudes toward contraception, as might occur, for example, as a result of a weaker stand of the Catholic church on artificial birth control practices. Finally, the standard economic considerations of price and income would fall under this head. Lower pecuniary prices of given techniques or higher household incomes both would make for more extensive use of contraception.

Among the factors raising the cost of an unwanted pregnancy would be first the degree to which satiation regarding family size is approached. This is an obvious reason why the effectiveness of a technique rises as desired size is reached. A second reason would be a decrease in the relative desire for children, perhaps reflecting, for example, greater aspirations for material goods. Still another would be a lengthening of time horizons, which might lead to greater weight being attached to the possibility of a future unwanted outcome. (Easterlin, 1969, pp. 136-137)
W. Krishnan Namboodiri (1972) distilled most of the theoretical work done up to that time on economic theories of fertility and analyzed and answered many of the criticisms of the theory made by Judith Blake (1967 and 1968) and others. (Namboodiri, 1972, pp. 185-192) Namboodiri went on to suggest several modifications of the economic theory of fertility (Namboodiri, 1972, pp. 190-203) of which perhaps the most important dealt with using "...the sequential addition of each child and the timing thereof." (Namboodiri, 1972, p. 191) as the appropriate unit of analysis rather than total completed family size. Household decision-makers do not make a once and for all choice about how many children to have but instead are constantly making "decisions" about whether to have an additional (marginal) child, and, if so, when to have it. Given that the couple is enjoying coition, if "nothing positive is done to prevent it, in the ordinary course of events the wife will conceive..." (Namboodiri, 1972, p. 199) with some probability depending on fecundity, frequency of intercourse, etc. While a "person who makes a decision not to buy a new car this year will not ordinarily become the owner of a new car, unless he changes his earlier decision and buys one ... a fertility decision is different. A decision to postpone the next pregnancy for another two years needs to be re-emphasized almost daily, and positive steps taken to see that nothing happens which would defeat
the plan; in other words, the matter is never closed."
(Nambodiri, 1972, p. 199)

Put in a different way, if every act of coition will, with certainty, result in a pregnancy and if coition is desired solely as a means of procreation (instead of as a good in its own right) then a couple has perfect control over the number and spacing of pregnancies they chose to have. Alternatively, if every contraception act of coition will, with certainty, result in no pregnancy and if use of such means of contraception is completely costless (and does not decrease utility) then, again, a couple has perfect control over the number and spacing of pregnancies even if coition is desired for its own sake. In the first case, because coition is not itself a good but only a means then there is no divergence between desired and actual fertility. In the second case, coition itself is considered a good but because a perfectly effective, completely costless means of contraception is available then again there is no divergence between desired and actual fertility. Either situation is a sufficient condition for the desired number of children to be the same as the actual number of children which is usually an implicit or explicit assumption in the empirical work on economic models of fertility.²

²It should be noted that if every uncontracepted act of coition did not result in a pregnancy but only did so with some probability which might vary from couple to couple, then it is entirely possible that some couples would be faced with a problem of subfecundity so that the actual
Both the assumption of coition not being a good and the assumption of a perfectly effective and costless contraceptive technology are unrealistic. However, the accuracy of a model's predictions, not the realism of its assumptions, is the prime criterion in the acceptance or rejection of a theory. Unfortunately, however, the current theories of fertility do not explicitly predict a market for voluntary abortions.

Clearly, if we are to explain the occurrence of voluntary abortions, then the assumptions have to be changed. Contraception is defined as any means taken to reduce the probability of a pregnancy resulting from a given pattern of demand for sexual intercourse. Thus any alteration in the quantity and timing of acts of coition to reduce the probability of pregnancy can be interpreted as a method of contraception; while abortions, which do not take place until after a pregnancy occurs are not included in this definition of contraception. If coition is not desired as a good itself or if contraception is perfectly effective and costless then there would be no abortions unless, after a pregnancy occurred, there was a sudden unanticipated change in the circumstances of a family (perhaps a divorce or loss of job) so that an additional child was no longer

number of children would be smaller (or birth intervals longer) than desired. This problem could be at least partially overcome by the process of adoption. The analysis of this problem is quite straightforward and becomes similar to the purchase of any other durable good.
desired. Ruling out this unanticipated change in circumstances by assumption, the two necessary conditions to explain the demand for abortions by economically rational couples are that coition is desired as a good in itself and that there is no completely effective, perfectly costless contraceptive.

Assuming that coition is desired for purposes other than for procreation, what happens if the assumption about completely effective, perfectly costless contraceptives is relaxed? Even if contraception is perfectly costless, if it is not completely effective then it would be possible for a woman to have an unwanted pregnancy which could lead to a demand for an abortion. Moreover, contraception is not perfectly costless. Most of the technologies available use market purchased resources and/or parent's time (e.g. oral contraceptives, condoms, intrauterine devices, or sterilization). Acquiring information about the various methods of contraception also uses resources. In addition, some techniques reduce the utility a couple receives from intercourse (e.g. condoms, spermicidal foams, rhythm, or withdrawal). Given that contraception uses resources and/or reduces the utility from coitus, even the economically rational couple trying to maximize expected utility may choose to use a technique which is not completely effective (or even choose to use no contraception whatsoever). Thus as long as contraception is not costless (or reduces
utility), unwanted pregnancies can occur and the demand for abortions arise.
DEMAND FOR ABORTIONS

It has just been argued that if contraception is costly then even economically rational couples would, with some probability, face the prospect of an unwanted conception. If a couple has an unwanted (unplanned) pregnancy, they are then confronted with the choice of having and raising the baby, of having the baby and giving it up for adoption, or of having an abortion. It is, of course, possible that the fetus would die anyway due to involuntary causes but it is assumed that a couple faced with an unplanned pregnancy believes that this outcome has a probability of zero. It is also assumed that the couples are rational utility maximizers who will choose the option which results in the least total disutility given their tastes and the time and resource costs of each option.

We can thus think of choices the economically rational couple makes about the desired number and spacing of children, the amount and timing of coition, contraception, and how to deal with an unwanted conception. These decisions are probably not independent. For example, the option a woman intends to take in the event of an unplanned pregnancy may well affect her choice of contraception. The bulk of the work to date by economists has been concentrated on the total number of children. Some work has examined the choice of contraception with abortion and/or infanticide sometimes included conceptually as contraceptive techniques.
This current study, however, focuses on the choice a pregnant woman makes between having an abortion or carrying the fetus to term.

Given a pregnancy, what are the factors which affect the woman's choice concerning an abortion? If the pregnancy was wanted (planned for) beforehand, an abortion will not be wanted at all unless circumstances have changed since conception. If it was not planned for, then the less utility an additional child is expected to provide, the more likely the woman will choose to have an abortion. The lower the price of an abortion or the higher the costs of an additional child, the more likely an abortion will be chosen.

Income is a problem variable. If children are normal goods then a higher income will imply an increased demand for child services (however this might manifest itself in a smaller number of higher quality children rather than in a greater quantity of children of a given quality. Putting aside the quality-quantity trade-off for the sake of argument, one might expect higher income families to have more children. If this is so, then at every parity one expects higher income women to be less likely to choose an abortion in the event of unplanned pregnancy.3 On the other

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3 It has been suggested that higher income women are better fertility planners than low income women. If this is so, then there should be a smaller proportion of unplanned pregnancies among higher income women. But this alone does
hand, there may be reason to believe that the relationship between income and the choice of an abortion is positive. One would not want to argue that higher income people wanted more abortions for their own sake. Abortions are a means to an end—control of the spacing and quantity of children—not desired goods which provide utility from their own intrinsic worth. But higher income people might perceive themselves as better able to pay for abortions and so they may choose abortions more frequently than lower income women. Thus even if children are normal goods and conceptions are randomly distributed among women regardless of income level, there is no a priori way to determine which effect will predominate. Therefore no a priori prediction of the net effect of income on the abortion choice can be made.

The relationship between contraceptive usage and abortion choice is also problematic. Abortions can be considered a back-up procedure in the event of contraceptive failure. Alternatively, women may religiously use contraception because they are opposed to abortions yet still do not want additional children. A third possibility is that some women may not use any contraception but will rely on an abortion as their primary birth control strategy in the event of an unwanted pregnancy. Because of these

not necessarily imply that, in the event of contraceptive failure, higher income women would differentially elect to have an abortion. The decision would still be bound up in the amalgam of utility and costs surrounding the various alternatives.
conflicting relationships, no a priori prediction about abortion choice and the use of contraceptives can be made.

The only unequivocal predictions, therefore, are that the abortion choice will be positively associated with the cost of an additional child and negatively related to the price of abortions.
Abortion; penalties. Whoever maliciously, without lawful justification, administers, or causes or procures to be administered any poison or noxious thing to a woman when with child, in order to produce her miscarriage, or maliciously uses any instrument or other means with like intent, shall, if the woman is then quick with child, be fined not more than $1,000 and imprisoned at hard labor not more than five years; and if she is then not quick with child, shall be fined not more than $500 and imprisoned at hard labor not more than two years.

Section 768-6, Hawaii Revised Statutes, pre-1970

Abortion to save life justified. Where means of causing abortion are used for the purpose of saving the life of the woman, the surgeon or other person using such means is lawfully justified.

Section 768-7, Hawaii Revised Statutes, pre-1970

Act 1, Fifth State Legislature, Regular Session 1970 repealed Sections 768-6 and 768-7 and added the following section in its place:

Intentional termination of pregnancy; penalties; refusal to perform.  
(a) No abortion shall be performed in this State unless:
(1) Such abortion is performed by a licensed physician or surgeon, or by a licensed osteopathic physician and surgeon; and
(2) Such abortion is performed in a hospital licensed by the department of health or operated by the federal government or an agency thereof; and
(3) The woman upon whom such abortion is to be performed is domiciled in this State or has been physically present in this State for at least ninety days immediately preceding such abortion. The affidavit of such a woman shall be prima facie evidence of compliance with this requirement.

(b) Abortion shall mean an operation to intentionally terminate the pregnancy of a non-viable fetus. The termination of a pregnancy of a viable fetus is not included in this section.

(c) Any person who knowingly violates this section shall be fined not more than $1,000 or imprisoned not more than five years, or both.

(d) Nothing in this section shall require any hospital or any person to participate in such abortion nor shall any hospital or any person be liable for such refusal.

Section 453-16, Hawaii Revised Statutes, post-1970

CONCEPTION COHORTS

On March 11, 1970 it became the law in the State of Hawaii that any woman who was a resident of the State or had resided in the State for the three calendar months preceding could legally have an abortion as long as it was performed by a licensed physician or surgeon in a hospital licensed by the State Department of Health or operated by the Federal Government or its agencies. This made Hawaii the first state to make abortion available to any pregnant woman on request.

Just prior to this historic occasion as it became clear that the law might well change, the Hawaii Pregnancy, Birth Control and Abortion Study of the University of Hawaii was
established to collect and analyze data on abortion and maternity patients from hospital records and patient self-administered questionnaires. Data on abortion patients were collected from late 1969 through the middle of 1974. Data on maternity patients were collected for two-month periods approximately twice a year during this same period of time. This enabled the Study to construct "conception cohorts" for detailed analysis of pregnant women. Each conception cohort consisted of all the women who conceived during the same two-month period whether she went on to have a live birth or whether she chose to have an induced abortion. Women who had either spontaneous abortions or stillbirths were eliminated from the conception cohort.

It is these conception cohorts of pregnant women which form the data base for this study. The first two conception cohorts (October-November 1969 and December 1969-January 1970) were prior to the legalization of abortion and so are not used in this study. The 7th and 8th cohorts used a somewhat different questionnaire and so are not used for analysis of the abortion decision; however, data from cohort 8 (August-September 1973) are used to estimate the value of a woman's time. The data base for this study is thus

"Stillbirths constitute fewer than one percent of term pregnancies. ... fewer than five percent of diagnosed pregnancies result in fatal loss. Since most spontaneous abortions occur early in gestation, it is unlikely that many pregnancies terminated by induced abortion would have ended spontaneously." (Steinhoff et al., 1975, p. 38).
composed of pregnant women in conception cohorts 3 through 6 (conception dates: July-August 1970, April-May 1971, January-February 1972, and August-September 1972 respectively). These four cohorts were treated as four sets of cross-sectional observations on pregnant women who conceived at the same time.
WEIGHTING OF OBSERVATIONS

At the time the data were collected, it was recognized by the Study's investigators that they were getting less than 100% data coverage for maternity patients because maternity data were only collected at hospitals which performed abortions. Thus small rural hospitals (which did not perform abortions) did not have their maternity patients represented in the questionnaires. To correct for this, weights of greater than 1.0 were attached to the maternity observations on which data were available so that, by county, adding the weights (rather than the recorded number of observations) would yield the actual number of maternity cases for the period in that county.

For abortion patients, the problem was somewhat different. The abortion population had total coverage but the dates of conception were given as a range and hence uncertain. To correct for this, a probability weight (less than or equal to 1.0) was assigned to each abortion observation corresponding to the probability that the patient had actually conceived during the target period.

These two weights had the effect of adjusting the sample so the relative size of the maternity patients to that of abortion patients (counting weights, rather than observations) was what the relative sizes would have been if abortions had been correctly dated and there was 100%
coverage of all pregnant women who conceived during the same
two-month period.

Furthermore, in both groups of patients, while
demographic data from hospital records were available for
virtually all abortions and maternities, sometimes
questionnaire data were not obtained either because they had
not been distributed or because the patient had refused to
fill one out. This resulted in a response bias which was
differential by age, marital status, ethnicity, and
urban-rural residence. To correct for this bias, weights
were attached to the observations for which questionnaire
data were available so as to eliminate the bias based on the
four factors. At the same time weights of 0.0 were attached
to the observations for which questionnaire data were
unavailable.

By multiplying the two weights for the observations
where data were available, a single weight was able to be
assigned to each observation which assured that the weighted
observations were adjusted so that the abortion/maternity
ratio was correct and also that the proportions of patients
by age, marital status, ethnicity, and residence matched the
actual statewide proportions had all patients supplied
questionnaires. This weighting variable was attached to
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5See Steinhoff et al., 1975, p. 139 and Diamond et al.,
1973, p. 55 for greater detail on the way the weights were
constructed.

- 37 -
each observation by the investigators of the Study. The weights were often used by the investigators when analyzing the data in a table format so that the sample size and number of responses in each category were on the basis of summing the weights for all qualifying observations rather than crediting each response as a single observation with an implicit weight of 1.0.

The problem of whether and how to use these weights in the analysis of abortion choice posed itself. Probit analysis (like ordinary least squares regression) does not lend itself to treating each observation as anything other than a single case and cannot have any observation represent, say 0.42 cases or 2.78 cases. It was decided that, for the analysis of the abortion choice, the weights could not be ignored. Since maternities were underrepresented and abortions overrepresented in unweighted observations, any analysis using the unweighted observations would result in biased coefficients since there would be "missing observations" which were highly correlated with the dependent variable. The problem of missing data has not been definitively resolved in the literature but at least one proposed solution by Richard Korobud suggests that "Respondents who provide complete information and who

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resemble respondents giving partial information may be weighted more heavily in the sample." (Kosobud, 1963, p. 563) The way in which this might be done was not discussed. It was decided to handle this problem by generating observations in proportion to their weights? (See Appendix A).

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7After the final form of the abortion demand equation was determined (Table 10), it was reestimated on the same variables using the unweighted observations (sample size was 2211). The JAPN variable became statistically insignificant and the INCOME variable had a ratio of coefficient to standard error of -1.79 making it also statistically insignificant. While the magnitudes of the coefficients changed somewhat, their signs (except for JAPN) remained the same. The coefficient of PRICE went from -0.00169 to -0.00119, that of INCOME from -0.01609 to -0.01094, and that of TIME*D3 from 0.05542 to 0.06036. All variables except for JAPN and INCOME were statistically significant. It thus appears that failing to adjust for the observation weights would have a relatively small impact on the results with the exception of the INCOME variable.
DATA SET REFINEMENT

Since some of the observations available seemed inappropriate for use in the analysis of abortion choice of married women, some observations were deleted as described below. This was actually done prior to the generation of observations reflecting the weighting described in Appendix A. To begin with, the data were screened to ensure that every observation retained had responses for the critical variables to be used in later analysis. All observations with a weight factor of 0.00 (implying incomplete questionnaires) were eliminated. Next, observations were eliminated if there was no response to the questions on yearly family income (or if income was $30,000 or more), on the major source of their income, on who would pay most of the hospital and doctor bills, on age, on years of education, or on ethnicity. This again raised the problem of dealing with missing data. In this instance, however, observations with missing data were simply eliminated without further weighting of the remaining observations. The reason for this was that it was felt that non-response to a small number of questions was probably uncorrelated with the dependent variable. Yoel Haitovsky used a Monte Carlo technique to compare two alternative methods of dealing with missing data: discarding observations with missing data versus using information on other variables to estimate missing variables by computing "the covariances
between all pairs of variables, and to apply these covariances in constructing the system of normal equations.

In almost all the cases which were investigated the former method (ordinary least squares applied only to the complete observations) is judged superior. However, when the proportion of incomplete observations is high or when the pattern of the missing entries is highly non-random, it seems plausible that one of the many methods of assigning values to the missing entries should be applied."

(Haitovsky, 1968, p. 67) Pindyck and Rubenfeld supported this position when they wrote, if "we are dealing with a cross-section problem and the missing observations appear to be missing at random (e.g., not available because of data reporting problems), then eliminating the observations is a reasonable procedure. Because the observations dropped are random, the least-squares slope estimator ... will be an unbiased and consistent estimator of [the true coefficient] and the only effect of dropping the observations is a loss of efficiency." (Pindyck and Rubenfeld, 1976, p. 194)

Secondly, only observations were retained where the woman was married both at the time of conception and at the time of abortion or maternal delivery. This was done because it was felt that the choice of an abortion might be influenced in somewhat different ways by the same variables depending on whether the woman was married or not. Also it was felt that it would be difficult to interpret yearly
family income for non-married women. Should it be considered her income alone, or does it include the income of a man she is living with, or does it count her parents income if she lives at home, etc.? Lastly, but perhaps most importantly, since economic theories of fertility have been generally applied to married couples, it seemed appropriate to apply an economic theory of abortion to the same kind of population.

The third refinement was to delete observations on pregnant women who had "planned" to become pregnant on the grounds that since the focus of the study was on abortion choice, the relevant population were those women who might be in the market for an abortion. A woman who had "planned" to become pregnant would not be included in that group. Thus only married women who became pregnant while not actually planning it were left as the subjects for this study. And it was these women to whom the observation generating technique of the previous section was then applied so that the sample set would be appropriately weighted.

It must be noted that the data were collected when the woman was in the hospital rather than at the time the decision was made. For a woman having an abortion the time between the decision and the abortion is probably

*See Steinhoff et al., 1976, pp. 138-139 for a description of how the planning status was determined.*
negligible. For a woman having the baby, however, perhaps six months had passed from the time the decision was made to the time she was responding to the questionnaire in the hospital. While this does not distort such variables as those on ethnicity, it does result in about a half year upward bias in the age of the woman having the baby (relative to the age of a woman having an abortion). This timing consideration means that income and perhaps years of education may also be upward biased for women having maternal deliveries. This is not consistent however; only some of the women having babies have a higher income and more education than they had six months before. The extra half year may have an impact on whether or not the woman lives on the island where she was born. Moreover, for all women, there may be some inaccurate reporting of contraceptive usage because of the time lag between conception and the questionnaire response. A related concern might be a response bias on this question in conscious or subconscious rationalization of the fertility outcome.

Lastly, and perhaps most importantly, there may be a serious bias on the question: "Are you employed now?" because a woman who was employed at the time she made her decision to have a baby may well have left her job by the time she was in the hospital for a maternal delivery. Such a woman would respond to the employment question in the
negative even though she was employed at the time of her
decision. No adjustments in the data were made to account
for these biases.
CHAPTER IV
CONSTRUCTED ECONOMIC VARIABLES

PRICES OF ABORTIONS AND MATERNITIES

Two of the factors hypothesized to enter a woman's decision to have an abortion are the price of an abortion and the price of giving birth. A pregnant woman has to pay one or the other of these prices.

The price of an abortion or maternity which a pregnant woman must pay herself is a function of several factors: the charges of her physician, the hospital charges, traveling costs, and the amount of the total charges covered by insurance, the government, or others.

The women were asked the following question:

Which of the following will pay most of your hospital and doctor bills? (Please check only one box.)

( ) insurance or health plan
( ) welfare, Medicaid or other assistance
( ) military
( ) personal savings or income
( ) parents or other relatives
( ) the man involved (not your husband)
( ) loan (bank or other institution)
( ) don't know at this time
( ) other (please describe) __________

Both the military and welfare/Medicaid paid virtually 100% of the physician and hospital costs for either an abortion or a maternal delivery. Thus for women in those
two categories, the price as perceived as a financial obligation of the woman is assumed to be zero whether she chooses an abortion or chooses to have a normal delivery.

The military pays for the chosen procedure for women in the military and also for military dependents who have abortions either in civilian hospitals under the Civilian Health and Medical Program for the Uniformed Services (CHAMPUS) or in Tripler Army Medical Center. CHAMPUS was particularly important from March 1970 when the new abortion law went into effect until June 1970 when a revised federal policy allowed Tripler to begin performing abortions.

The State of Hawaii Department of Social Services (DSS) chose to treat abortion like any other medical service, with no special restrictions or policies. This meant that any woman who was receiving welfare assistance could obtain payment of abortion costs under the usual provisions for medical payments. In addition, any woman who was not receiving welfare support but who qualified as "medically indigent" could also have part or all of her abortion costs paid by state welfare services. The medically indigent category covered persons who were able to support themselves marginally under normal circumstances, but who could not afford any additional expenses for medical care. The eligibility requirements and policies were already established; elective abortion was simply considered as a legitimate medical service covered under the program.

In the first year of Hawaii's new law, the Department of Social Services paid for 9 percent of the state's abortions. More than half of these were for women in the medically indigent category. By the end of 1971, the proportion of abortions paid for by the DSS had increased, and more than three quarters were women not receiving other welfare assistance. (Steinhoff and Diamond, 1977, pp. 182-183)
There may be some distortion by assigning a zero price to all women where welfare was reported to be paying. In some cases welfare may only have paid a portion of the costs but there was no way to distinguish the women getting total compensation from those getting only partial compensation (and the proportion of partial compensation was also unknown).

There are two major insurance/health plan carriers in Hawaii: Kaiser Foundation Health Plan (Kaiser) and the Hawaii Medical Services Association (HMSA). Kaiser offers a prepaid health maintenance medical plan in which members go to Kaiser Medical Center for an abortion or delivery and are charged a relatively low flat fee. HMSA, on the other hand, offers a Blue Shield type of group insurance whereby it pays a certain percentage of allowable medical costs a member incurs for services received from the physician and hospital of her choice.

Since the payment question did not distinguish between HMSA and Kaiser (or any other plan for that matter) as separate types of health insurance, a procedure was used to determine which women fell under which category. It was assumed that if a woman had checked "insurance or health plan" and if the abortion or delivery occurred at the Kaiser Medical Center then she was under the Kaiser plan. If it was not at Kaiser Medical Center then she was assumed to be
under HMSA. This mis-classifies women under HMSA who chose to have the surgery at the Kaiser Medical Center and this was known to happen in a few cases but there was no way of distinguishing which women were involved. It also mis-classifies Kaiser plan women having the surgery at other hospitals but this is probably an empty set. Lastly it classifies women as HMSA members even if they had some other (non-Kaiser, non-HMSA) type of health insurance. An example of this is a woman who is a University of Hawaii student who had paid for a special student health insurance. This student insurance covered virtually 100% of abortion or delivery costs but since these women could not be distinguished, they were assumed to be covered by HMSA which only paid a portion of the costs. These errors in classification are not expected to seriously affect the results of later analysis.

From March 1973, Kaiser set a flat fee for elective abortions for plan members. This was done because the procedure was classified as elective surgery and was thus not covered in the basic insurance package. Kaiser initially requested permission to cover abortions but was turned down by the federal regulatory agency on the grounds that this entailed increasing service without increasing the premium. The fee was set at a rate comparable to the hospital charges at other major Honolulu hospitals. In effect, the plan member was covered for the doctor's fee but not for the hospital charges. This would not have seemed unusual except that a flat fee of only $60 covered complete prenatal maternity care and delivery, including any complications of pregnancy, labor, or delivery, and care of the newborn. The fee for therapeutic abortion or treatment related to a
spontaneous abortion was $40. In effect, the plan did not cover elective abortion in the same manner as other related or comparable medical situations. (Steinhoff and Diamond, 1977, pp. 183-184)

The flat charge for elective abortions at Kaiser from March 1970 to July 1972 (thus for cohorts 3, 4, and 5) was $135 for members and $270 for non-members including both physician and hospital charges. To qualify as a member at that time, a woman had to have been enrolled ten months prior to delivery or when delivery would have occurred in the event it had gone to term. In effect this meant that the woman had to be enrolled one month prior to conception. After July 1, 1972, for at least some of the (cohort 6) people covered by Kaiser, the cost of an abortion was $75. Beginning with January 1973, Kaiser lowered the price of an elective abortion to $40 (2/3 the price of a delivery) which was the same as had been charged for a therapeutic abortion all along. The $60 total price for a maternal delivery remained in effect throughout the entire period.

HMSA was organized somewhat differently. Immediately after passage of the new law, women who qualified for maternity benefits were also covered for elective abortions. To qualify for maternity benefits, however, a woman had to be married and the policy had to be in effect for the 9 consecutive months prior to delivery. Unmarried women were covered for neither maternity nor abortion benefits. Beginning in July 1971, the marriage requirement was
dropped, however the policy still had to have been in force at the time of conception ("If continuously covered for 9 consecutive months immediately prior to delivery or if required waiting period would have been met but for a premature termination of pregnancy" (Hawaii Medical Services Association, 1971)). This change was phased in as new Group plans were instituted throughout 1971.

The benefits also were changed. Prior to 1971 (which included cohort 3) the maximum allowances were $100 for the physician and $100 for the hospital for a normal or abnormal delivery (gestation of 6 months or longer). For a miscarriage or abortion requiring dilation and curettage (gestation under 6 months) the maximum allowances were $50 for the physician and $100 for the hospital. After the 1971 change (cohorts 4, 5, and 6), whether a woman was having a normal delivery, an abnormal delivery, or a pregnancy termination, the benefits were 75% of the doctor's charges (subject to upper limits on customary and usual charges) and 75% of the hospital's minimum ward rate and other in-patient extras.

Thus if an HMO covered woman in cohort 3 had a baby the calculated charges are reduced by $200, and if she had an abortion the charges are reduced by $150. Women in later cohorts have the calculated charges for either procedure reduced by 75% (she still pays 25%).
This still left the problem of calculating the basic physician and hospital charges. For physician charges, the \textit{Hawaii Relative Value Studies} (RVS) put out by the Hawaii Medical Association (1970) was employed. This publication provides a relative unit value for almost all medical procedures. It is based on fees actually charged by practicing physicians in the various specialties including surgery. The preface insists that "the various units referred to in each section do not represent fees per se, but only indicate relativity amongst individual procedures within various major sections of the book. This is not a fee schedule and physician compliance for the suggested values is strictly optional" (Hawaii Medical Association, 1970, p. 3) (italics in the original). However the Introduction states that:

The primary purpose of the RVS is to precisely describe and code the services provided by physicians. The general acceptance of the RVS by insurance carriers and government agencies assures the physician who uses its coding and terminology that the services and procedures he performs are identifiable. With appropriate consideration to individual and local variations in practice, the RVS may also be used:

1. as a guide to physicians in establishing fees;
2. as a guide for insurance carriers and government agencies in determining their commitment;
3. and as a guide in evaluating individual claims. (Hawaii Medical Association, 1970, p. 6)

There is anecdotal evidence that, in fact, for any particular physician the relative charges for different
procedures is in proportion to the relative unit values for the different procedures. Thus differences in charges among physicians for a particular procedure (assuming no complications and other pertinent medical considerations) are most likely to arise in the conversion value (dollars per unit) used to convert units into dollar charges. Physicians are known, however, to consider the economic circumstances of their patients before presenting the bill. To the extent that a "progressive" pricing scheme is employed, the estimates used here are overestimated for the poor.

Two procedures are of most interest. Category "59400 Total obstetrical care including antepartum care, vaginal delivery, and post partum care (with or without low forceps and/or episiotomy)" (Hawaii Medical Association, 1970, p. 82) was valued at 35.0 surgery units. Category 59850, Therapeutic abortion "by dilation and curettage (including suction curettage)" (Hawaii Medical Association, 1970, p. 83) was valued at 20.0 surgery units. These values are exclusive of anesthesia charges. While the RVS was compiled prior to the legal change, the 20 units value was subsequently applied to elective abortion as well as therapeutic ones since the medical techniques were identical. Most physicians charged $150 for an abortion in the period after passage of the law. This implies a conversion ratio of $7.50 per surgical unit. Other sources
in the medical community confirmed conversion rates of $7.00 to $7.50 per surgical unit for the 1970-72 time period. Using a conversion rate of $7.50 means that a maternal delivery will entail physician fees of $262.50.

The issue of inflation must be addressed briefly. The earliest data used in this study were on cohort 3 women who conceived in the July-August 1970 period. In September 1970, the Consumer Price Index (CPI) for medical care in Honolulu stood at 119.7 (when adjusted to a base period of 1967 equals 100). Cohort 6 conceptions took place in August-September 1972 and so most abortion decisions would have been made by December 1972. At that time, the CPI for medical care in Honolulu was 129.9. Thus over the relevant 2.25 year period the CPI for medical care increased by only 8.5% overall (less than 4% per year). To a great extent this was because of the price and wage controls which lasted from August 1971 to April 1974 under the national Economic Stabilization Program.

Moreover, between September 1970 and December 1972 the CPI for "all items" in Honolulu increased by 8.3% (from 114.9 to 124.4). If medical costs were increased by 8.5% over the period, then they should also be deflated by the overall CPI of 8.3% at the same time. This would leave the real costs of abortions and deliveries virtually unchanged. Thus for this study, it was assumed that all four cohorts
faced constant prices for abortions and maternities. There was therefore no need to make any direct adjustments for inflation.

One might argue that even if prices were assumed to be unchanged, the reported family incomes should be deflated by the overall CPI. If incomes had been reported as a continuous variable rather than by income groups, this would be a more compelling argument. However, since only income categories were available and since the 3.5% annual rate of inflation (8.3% over a 2.25 year period) was quite small, it was decided to not make any further adjustments to income.

It must be noted, however, that this was a time of inflationary expectations (part of the reason for the price and wage controls). To the extent the couple anticipates that the time and resource costs of children will increase significantly, the overall demand for children would be reduced. However, in the short run, the demand for children may increase as parents try to achieve their family size desires as soon as possible so costs are reduced. The net effect of these considerations on abortion demand cannot be established a priori.

In addition to physician's fees, there are hospital charges to contend with. In 1972 at Queen's Hospital, the all inclusive (room and care, drugs, operating room, recovery room, supplies, and the hospital anesthesiologist)
price for a first trimester abortion without complications was about $150. The comparable charge for a woman having a live birth was $300 plus an additional $80 for nursery charges for the baby. Queens Hospital and Kapiolani Hospital usually had an abortion patient discharged within one day because the procedure became relatively routine. The other hospitals in the State, because they performed fewer abortions, usually had an abortion patient stay for two days or more to guard against any complications which might arise. This was the major difference in expected charges between either Queens or Kapiolani and the smaller rural Oahu hospitals. Estimated Neighbor Island charges were based on the rates in effect in the State hospitals on each island including fees for hospital services and assuming a stay of two days for an abortion and four days for a maternity at ward rates. A maternity also had three days worth of nursery charges added on.

The hospital and physician charges were added together for each woman. Table 1 below shows the estimated hospital plus physician charges that were used in constructing the various prices.

If it was determined that she was covered by HMOA, then the appropriate adjustment as discussed earlier was applied.

One final cost still had to be added: transportation. One might think that this could be neglected. But the fact
TABLE 1

PHYSICIAN PLUS HOSPITAL CHARGES (INCLUDING NURSERY)

<table>
<thead>
<tr>
<th>HOSPITAL</th>
<th>ABORTION CHARGE</th>
<th>MATERNITY CHARGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queens</td>
<td>$310</td>
<td>$645</td>
</tr>
<tr>
<td>Kapiolani</td>
<td>310</td>
<td>590</td>
</tr>
<tr>
<td>Other Oahu</td>
<td>350</td>
<td>645</td>
</tr>
<tr>
<td>Other Oahu</td>
<td>350</td>
<td>645</td>
</tr>
<tr>
<td>Hawaii (Hilo)</td>
<td>320</td>
<td>590</td>
</tr>
<tr>
<td>Maui</td>
<td>330</td>
<td>500</td>
</tr>
<tr>
<td>Kauai</td>
<td>325</td>
<td>540</td>
</tr>
</tbody>
</table>

Tripler and Kaiser were omitted from this table.

was that women on the neighbor islands (any island but Oahu where Honolulu is located), especially Maui, found it somewhat difficult to get abortions at hospitals on their own island. Thus quite a few neighbor island women flew to Honolulu to have their abortions and the cost of inter-island transportation was not negligible. Table 2 shows the round trip adult air fares in effect from September 1970 to June 1973 by Hawaiian Airlines.

For an abortion patient, it was easy to know whether to add a travel charge or not based on the island where she lived and the island where the hospital she went to was located. What was more problematic was to determine, for women who had a live birth, whether they would have traveled or not if they had been having an abortion. It was assumed
that neighbor island women having babies would all have flown to Oahu if they had chosen an abortion. Welfare women, however, would have had the transportation paid for them so the cost to those women would have been zero. Women under HMSA would have had to bear the full cost of this transportation (not just a portion of it) because HMSA did not cover that sort of expenditure.

Following the procedure given above, an estimated price of abortion and an estimated price of giving birth was constructed for each observation. After the final form of the abortion demand equation was determined (Table 10), it was reestimated on the assumption that women sought out the cheapest way to have an abortion or birth rather than assuming that the particular hospital was the one for either procedure. Using this modified price variable, the signs of all the coefficients remained the same as did their statistical significance. The absolute value of the coefficient of the modified PRICE variable was 16% larger than shown in Table 10 and the coefficients of the other variables were within 4% of their original values.

---

<table>
<thead>
<tr>
<th>OAHU</th>
<th>KAUAI</th>
<th>MOLOKAI</th>
<th>LANAI</th>
<th>MAUI</th>
<th>HAWAII</th>
</tr>
</thead>
<tbody>
<tr>
<td>$38</td>
<td>$30</td>
<td>$32</td>
<td>$38</td>
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<td>$44</td>
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<td>$40</td>
<td>$40</td>
<td>$40</td>
<td>$40</td>
<td>$40</td>
</tr>
</tbody>
</table>
that the two variables were not independent and would be highly correlated with each other. To avoid the problems of multicollinearity which would otherwise have arisen, it was decided to combine the two variables into a single price variable: the price of an abortion minus the price of giving birth (medical costs only—costs of rearing the child are not included in this variable). One justification for this is that once a woman is pregnant, she is obliged to "purchase" one or the other option (an abortion or a birth); she cannot decline both. Given that circumstance, the difference in prices is the relevant price variable. This implies that a given dollar increase in the price of an abortion has the same impact as an identical dollar decrease in the price of giving birth.

There were generally four different groups of women each facing a different set of prices. If the woman (or her husband) was paying the hospital and physician bills and was not covered by health insurance then the price of an abortion to her was about $310 and the price of a maternity, say from Queens Hospital, was about $645 yielding a price difference of -$335. If she was insured by HMSA (for cohorts 4-6) then both prices would be reduced by 75% for a

---

10Domencich and McFadden (1975, pp. 161-163) followed a similar procedure in their study of the mode of travel used for going shopping. They used the difference in travel time between auto and mass transit and the difference in auto operating cost and transit fares as two independent variables of travel mode choice.
net price difference of about -$85. If she was connected to the military or on welfare, then the price of both an abortion and a maternity was $0 to her so the difference was $0. And if she was under the Kaiser program then she had an abortion price of $135 and a maternity price of $60 for a price difference of +$75 (or +$15 if she was in cohort 6). There was about 5.5% of the women in the first category (pay full price), 16.1% in the second category (HMSA), 64.7% in the third group (full subsidization), and 13.7% in the Kaiser program.
OPPORTUNITY COST OF A WOMAN'S TIME

One of the economic variables expected to influence a woman's choice between an abortion and a live birth is the opportunity cost of her time used in raising an additional child. If she was employed and if having a baby would cause her to stay at home then part of the cost of the baby is the earnings foregone by leaving the labor force entirely or by reducing the number of hours she works. But even if the woman is not working, there are opportunity costs involved. Time is a valuable resource whether used in work, leisure, home-making, or caring for already existing children. An additional (and especially a first) child causes the woman to reallocate some of her time from other activities to caring for the child. The amount of time spent on the child multiplied by the marginal valuation of a unit of that time represents part of the cost of having and raising the baby. Thus it becomes important to put a value on a unit of the woman's time as a proxy for the cost of a child. If the woman is able to freely adjust her hours of work, childraising, and leisure so that the net marginal value is the same in all uses and, further, if the marginal

11 If we assume that the number of hours spent on an additional child (of a given parity) is the same for all women then the time cost of the child is perfectly correlated with the marginal valuation of the woman's time. It may be, however, that women who have a relatively high per unit of time cost will expend fewer hours in caring for the child. This implies that the marginal valuation of time overstates the total opportunity cost of the child.
disutility of work is zero, then the marginal value of her time in all uses is equal to her wage rate.\footnote{12}{However, if the woman got positive utility from work then, to that extent, the wage rate is an underestimate of the value of her leisure time. Similarly, if there was disutility from work, the wage rate overestimates the value of leisure time.}

An initial attempt was made to estimate the value of a unit of the woman's time based on the women in cohort 6. When this proved unsatisfactory, data from cohort 8 were used since somewhat different questions were asked of those women and there was some additional data available. For both cohorts 6 and 8 there were data on the number of years of education of the woman, number of years of business or vocational training of the woman, age of the woman, ethnicity of the woman, ethnicity of the man, whether the woman was currently employed and her occupation, occupation of the man, and whether her income was primarily from a job.

\begin{itemize}
\item\footnote{12}{However, if the woman got positive utility from work then, to that extent, the wage rate is an underestimate of the value of her leisure time. Similarly, if there was disutility from work, the wage rate overestimates the value of leisure time.}
\item Additionally some studies on the value of time spent in traveling have suggested that a person's time may not have the same marginal value in all activities assuming that the marginal utility of work is not less than the marginal utility of commuting. For instance, based on their choice of transportation method, people only spend between 20\% and 50\% of their hourly wage to save an hour of commuting time between home and work (see, for example, Quarmby (1967), Lave (1970), and Beasley (1965)). If this is the case, and assuming the marginal utility of work is non-positive, then perhaps some relatively lower valued time (e.g. TV watching as opposed to time devoted to a moniterly compensated job) will be used for child raising. To value the woman's time by her wage rate overstates the opportunity cost of the child.
\item To some extent this overestimate, if it exists, might be offset by an institutional constraint which
\end{itemize}
(hers or the man involved), from her parents, from welfare, or from some other source. In addition, for cohort 6, there was a measure of annual family income (based on nine income groupings) and whether the man was currently employed. For cohort 8, although an open ended question on monthly family income was asked directly, this was adjusted to correspond to the annual income categories of cohort 6 and the midpoint of each category was taken as annual family income for each observation. Cohort 8 also had information on the number of years of education of the man, number of years of business or vocational training of the man, age of the man, and the number of people contributing to the family income (but not explicitly whether the man was employed).

The term family income may have an ambiguous interpretation for non-married women. What, for instance, is the family income for a single girl living with her parents; is it what she earns or what her parents earn? To avoid ambiguity, the analysis was limited to women who were married, for whom the primary source of family income was from "job" (rather than from welfare or parents), and (in

underestimates the opportunity cost. This constraint is the actual "lumpiness" of being in the labor force. A fulltime working woman may want to reduce her hours from 40 to 35 per week but her employer might insist on 40 hours or nothing. If this is the case, the woman may forego 40 hours of employment rather than just the 5 she would have chosen in the absence of "lumpiness". From here on we assume that these effects offset each other so that the estimate of the opportunity cost of a woman's time is perfectly correlated with the true value of her time used in bearing and rearing an additional child.
cohort 9) where the number of people contributing to income was one if the woman was not working and two if the woman was working.

The expectation was that if family income could be satisfactorily "explained" by a linear regression on the characteristics of the woman (and man) then the woman's contribution to family income could be estimated. More specifically, if the value of time (as judged by the marketplace) for the woman is determined as a function of her characteristics then a value of time can be assigned to every woman based on each woman's characteristics whether she works or not. The first step in this process is to estimate income as a function of the woman's characteristics as follows:

\[
\text{INCOME} = A + [B][H] + [C][W](\text{EMPLOY})
\]

where \( A \) is the intercept, \([B]\) and \([C]\) are vectors of estimated coefficients, \([H]\) is a vector of husband's characteristics, \([W]\) is a vector of wife's characteristics, and \(\text{EMPLOY}\) is a dummy variable taking a value of 1 if and only if the woman is employed at a job and a value of 0 if the wife is not working.\(^{13}\) Thus if a woman is not working, her characteristics are set to zero as she makes no contribution to family income.\(^{14}\) The term \([C][W]\) is the

\(^{13}\)It is assumed that non-labor income is negligible.

\(^{14}\)This may not be strictly accurate. Just because a wife does not have a job and contributes to income directly does not necessarily mean that she makes no indirect
estimated earnings of a woman with characteristics \( W \) if she is employed. But regardless of whether she is employed or not, it is an estimate of what she could have earned in the labor market and which is interpreted as an estimate of the opportunity cost of her time.\(^{15}\)

An initial attempt to estimate the value of the woman's time was made with the data of cohort 6. Unfortunately this procedure yielded implausibly high estimates. It is thought that this occurred because the wife's characteristics were picking up the contribution of the husband's characteristics (such as education and experience) which are not available for cohort 6. Because the data of cohort 6 did not yield plausible results, the second strategy was to use cohort 8 (August-September 1973 conceptions) for which data on the man's age and education were available.

contribution to measured income. By specializing in home production she may allow her husband to more fully specialize in market production and hence increase measured monetary income.

\(^{15}\)Since a working woman spends time at both home and work, if hours are assumed flexible then the woman is presumed to be equating the value of her time in her different pursuits at the margin. With a non-working woman, this becomes a more heroic assumption. It may be that, due to characteristics which are not measured, the non-working woman cannot get the market earnings implied by \([C][W]\) and that is why she abstains from participating in the labor market. If this is so, then \([C][W]\) is an overestimate of the opportunity cost for the non-working woman.
The vector of characteristics used for the husband, \([H]\), consisted of years of education (including vocational or business training), years since leaving school (a proxy for experience and maturity) calculated as age minus the years of education minus 6 (assuming education started at age 6), an ethnic dummy variable taking a value of 1 if and only if the husband was either Japanese or Chinese, and an occupational dummy variable taking a value of 1 if the husband's occupation was professional or managerial. The ethnicity dummy variable was introduced on the grounds that racial favoritism, discrimination, opportunities, work effort or some other characteristic correlated with this variable might statistically affect the market value of a person's time.

The vector of characteristics used for the wife, \([W]\), consisted of years of education (including vocational or business training), years since leaving school (computed as described above for husbands), and an ethnic dummy taking a value of 1 if the woman was either Japanese or Chinese. Table 3 describes the means, standard deviations, minima, and maxima for the variables. Table 4 shows the simple correlation coefficients for the variables. And Table 5 presents the estimated coefficients from the regression. Thus every year of education adds $208 to the value of a woman's time, a year of experience (year since leaving school) adds $120, and being Japanese or Chinese adds $3370.
## TABLE 3
**COHORT 8--STATISTICS FOR VARIABLES USED**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>MEAN</th>
<th>STD.DEV.</th>
<th>MIN</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INCOME</td>
<td>12.208</td>
<td>5.751</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>2. EDUC</td>
<td>13.862</td>
<td>2.162</td>
<td>6</td>
<td>22</td>
</tr>
<tr>
<td>3. EXPER</td>
<td>6.022</td>
<td>4.225</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>4. ETHN</td>
<td>0.2246</td>
<td>0.4176</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5. EMPLOY</td>
<td>0.2754</td>
<td>0.4470</td>
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<td>1</td>
</tr>
<tr>
<td>6. EDUCxEMPLOY</td>
<td>4.040</td>
<td>6.652</td>
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<td>19</td>
</tr>
<tr>
<td>7. EXPERxEMPLOY</td>
<td>1.926</td>
<td>3.915</td>
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<td>24</td>
</tr>
<tr>
<td>8. ETHNxEMPLOY</td>
<td>0.1216</td>
<td>0.3270</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>9. EDUC-Male</td>
<td>13.850</td>
<td>2.303</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>10. EXPER-Male</td>
<td>8.505</td>
<td>5.898</td>
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<tr>
<td>11. ETHN-Male</td>
<td>0.2122</td>
<td>0.4091</td>
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<tr>
<td>12. PROF-Male</td>
<td>0.2333</td>
<td>0.4232</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

1. INCOME.........Family Income in $1,000s
2. EDUC...........Education of Woman in years
3. EXPER.........."Experience" of Woman in years
4. ETHNIC.........Dummy=1 if Woman Japanese or Chinese
5. EMPLOY.........Dummy=1 if Woman Working
6. EDUCxEMPLOY...EMPLOY times EDUC
7. EXPERxEMPLOY...EMPLOY times EXPER
8. ETHNxEMPLOY...EMPLOY times ETHN
9. EDUC-Male......Education of Man in years
10. EXPER-Male...."Experience" of Man in years
11. ETHN-Male.....Dummy=1 if Man Japanese or Chinese
12. PROF-Male.....Dummy=1 if Man Professional or Manager

"Experience" = Age - EDUC - 6
### Table 4

**Cohort 8 Simple Correlation Coefficients**

<table>
<thead>
<tr>
<th>VAR</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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### Table 5

**Cohort 8--Regression: Income=Dep.Var.**

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</tr>
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<td>EXPER X EMPLOY</td>
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<tr>
<td>INTERCEPT</td>
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<td>1.1074</td>
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</table>

N=806 \[ R^2=0.4645 \]

F=98.905
There was one final question to be resolved if a value was to be assigned to the value of a particular woman's time. That question was how to split up the effect of the intercept of -5944 between the portion attributable to the man and the portion attributable to the woman. The procedure used was to look at the "average" couple, with "average" defined as one with mean characteristics. That is, the "average" woman had almost 14 years of education, had 6 years of experience, and was "22%" Japanese or Chinese. Table 6 shows the mean values for each variable for both male and female (assuming the woman works) multiplied by the appropriate regression coefficients previously determined in Table 5 above. Summing the products based on female characteristics yields 4364; summing the products based on male characteristics yields 11,671. Since 4364 is 27.2% of the 16,035 (= 4364 + 11,671) sum, the coefficient of -5944 is apportioned based on this percentage split. So -257 (= -5944 x .272) is considered attributable to the woman and the remainder of -587 is treated as the man's portion.

While this intercept was used in generating the value of a woman's time, the results in the later analysis are not crucially dependent on what intercept term is chosen. If in probit analysis, as in ordinary least squares regression, a constant is added to a particular variable for all observations than the results of the probit analysis are the
same as if the constant had not been added to the variable except for the intercept term of the probit analysis (or regression) equation. This means that the marginal impact of the variable (the estimated coefficient of the variable) is unaffected by the addition of a constant.

Thus in the analysis on the abortion decision, one of the independent variables are the opportunity cost of a woman's time. For each observation this variable is constructed by the following formula:

\[ \text{TIME} = -257 + 208 \times \text{EDUC} + 120 \times \text{EXPER} + 3370 \times \text{ETHN}. \]  (2)
CHAPTER V

ECONOMIC MODEL OF ABORTION CHOICE

There were frequent wars on these islands in ancient times arising from the mere desire of chiefs and people to obtain the plunder of the conquered, but inseparable from this was the desire of wantonly shedding blood. And on account of the frequent slaughter (luku pinepina) of the people in times of war, mothers were filled with fear lest their sons should be offered in sacrifice, if ever put to flight, and to avoid that, some mothers put their children to death with their own hands, and others forsook them that they might perish.

...  

Even the unborn child did not escape, but was put to death; for mothers thinking they should prematurely become old women without having gained property, pierced their unborn children, and thus many a child was destroyed before it was born. Others, from the time of conception to the birth of the child made it their business to extinguish its life. The child was frequently destroyed either because the father had no property, or because the mother feared the father would leave her and seek another wife, or because neither sustained such a relation to the chief as to be supported by him, and in that case the relatives of the parents destroyed the child. On this account, but few women had any desire for children, and many had the contrary desire of not having them, and therefore drank such medicines as would prevent conception, and some absolutely denied themselves the consequences of the marriage state. So also some of the men desired children and some not, hence arose the sin of sodomy, and many died childless having no connection with females.

ANALYTIC PROCEDURE: PROBIT ANALYSIS

In examining the demand for abortions using data on individual observations of pregnant women, a problem arises because the dependent variable is dichotomous. Either a pregnant woman chooses an abortion (dependent variable, Y, equals 1) or she does not (Y = 0). If OLS regression analysis is attempted on a dichotomous dependent variable then the error term will be "...heteroscedastic; i.e., the variance of the error term is not constant for all observations. ... The presence of heteroscedasticity results in a loss of efficiency, but does not in itself result in either biased or inconsistent parameter estimates." (Pindyck and Rubenfeld, 1976, p. 240) But because the errors are not normally distributed, one "...cannot apply the classical statistical tests to the estimated parameters, since the tests depend on the normality of the errors." (Pindyck and Rubenfeld, 1976, p. 241)

The predicted value for the dependent variable can also be meaningless. If the predicted value is within the (0, 1) interval, it can be interpreted as the probability that a woman with those characteristics and circumstances will choose an abortion. But if the predicted value is outside the (0, 1) range then such a probabilistic interpretation is not possible.
The literature relevant to this situation suggests the use of a functional formulation which, unlike a linear model, is restricted to the \((0,1)\) interval. The two most common forms are the cumulative logistic probability function (logit model) and the cumulative normal probability function (probit model). The arguments over which formulation is superior is based on the ease and cost of computation and on the interpretation of results. On the first point, both typically must be estimated using maximum likelihood methods since they are non-linear and the efficiency and speed of convergence can vary. On the second point, the logit model yields the logarithm of the odds of making an affirmative choice while the probit model predicts the cumulative conditional probabilities of an affirmative choice. Domencich and McFadden wrote that the "binary probit ... and logit models are virtually indistinguishable except at arguments yielding probabilities extremely close to zero or one, where the probit model approaches the extreme values most rapidly ... The maximum deviation in probability between the logit and probit curves is 0.018, with the result that these curves are virtually equivalent for empirical purposes ... and except for computational reasons, there is little to choose among them." (Domencich and McFadden, 1975, p. 58) Since a computationally

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inexpensive probit program (relative to the logit program) was available, the decision was made to adopt the probit model for this study. The computations are thus made using the probit (maximum likelihood technique) analysis of SHAZAM. (White, 1978)

This raises yet another problem: the appropriate statistical test to use for establishing whether or not an individual independent variable is statistically significant. The Probit procedure of SHAZAM reports the ratio of each estimated coefficient to its standard error which, in a legitimate OLS regression, would be the t-statistic of the coefficient. The question arises as to whether or not it is proper to use this ratio for testing the significance of single regressors under Probit. Little is known of the sampling distribution of the coefficient estimates for small samples using Probit analysis. Sunderson, however, argued that since "Probit estimates are Maximum Likelihood estimates they will have the large sample properties of being Best Asymptotically Normal estimates ... Consequently, t-tests based on the estimated standard errors can be used to test single regressor hypothesis."

(Gunderson, 1974, pp. 82-83) White seemed to concur by asserting that for probit analysis a "...method of testing individual coefficients uses the fact that the maximum likelihood estimates of the coefficients in large samples are approximately normally distributed. Thus, hypotheses
can be tested by examining the ratio of the estimated coefficient to its standard error. For large samples this ratio is approximately distributed as a standard normal random variable." (White, 1975, p. 14) In view of these precedents and the large (3057) sample of observations, the ratio of each variable's estimated coefficient to its standard error will be used as if it was distributed normally.
INDEPENDENT VARIABLES

The following independent variables are hypothesized to influence the probability of a pregnant married woman choosing to have an abortion (ABORT). ABORT is the dummy dependent variable taking a value of 1 if the pregnant woman chose an abortion and 0 if she chose to have the baby.

First a price variable (PRICE, measured in dollars) calculated as the difference between the price of an abortion and the price of giving birth (see previous chapter) is expected to be inversely related to the probability of deciding to have an abortion.

Second, a budget constraint, annual family income (INCOME, in thousands of dollars) measured as the midpoint of the range for the income category of the woman is included. As previously stated, the sign of this variable cannot be determined a priori because of potentially offsetting effects.

A variable is also included which measures the value of the woman's time (TIME, scaled to thousands of dollars). This is calculated, as described earlier, as a function of the woman's years of education, years of experience (years since leaving school), and an ethnicity factor if the woman was Japanese or Chinese. It is assumed that a child was "produced" (both during gestation and in being raised) using woman's time as well as market purchased commodities. Thus
the value of a woman's time is expected to serve as a proxy for the cost of an additional child. If this is an appropriate proxy, then as the cost of an additional child increases, women will be expected to choose an abortion more frequently so the relationship between cost and probability of abortion will be positive.

It has been argued, however, that the cost of the first child could be higher than the cost of the subsequent children. (Turchi, 1975, pp. 88-95) In general, the cost of an additional child is expected to differ by parity (the number of children a woman already has). If this difference in cost arises primarily because different parity children require different amounts of mother's time, then the effect of the value of a woman's time on the abortion decision will not be constant across parities.

One way to handle this situation is to use dummy variables to allow for different coefficients on the TIME variable. This is accomplished by defining dummy variables for parity. Thus a dummy variable, D1, is set equal to 1 if a woman had one or more children at the time she got pregnant and equal to 0 otherwise (that is, if she has not previously had any children). A second dummy, D2, is equal to 1 if the woman has two or more children at the time of her pregnancy and 0 otherwise. A third dummy, D3, takes a value of 1 if the woman is at parity three or more and 0
otherwise. Next, three new variables (TIME*D1, TIME*D2, and TIME*D3) are created for each observation by multiplying the parity dummies by the TIME variable.

The interpretation for women who are at a parity of zero of the effect of the value of time on the abortion decision is represented by the coefficient of TIME alone. For women at a parity of one, the effect of the value of time is the sum of the coefficients of TIME and of TIME*D1. Similarly, for women at parity two, the coefficients of TIME, TIME*D1, and TIME*D2 are summed. If, as the literature indicated (Turchi, 1975, pp. 88-95) the cost of each additional child (in terms of the amount of woman's time used) is lower for higher parity women, then the coefficients of TIME*D1, TIME*D2, and TIME*D3 are expected to be negative if the effect of a dollar increase in the cost of an additional child on the abortion decision is the same at all parities. 17

17 Ideally we would want to estimate the probability of an abortion as a function of the cost of an additional child. The right hand side of the estimating equation would include the following terms: \[ b1(CHILD1)(1-D1) + b2(CHILD2)(D1)(1-D2) + b3(CHILD3)(D2)(1-D3) + b4(CHILD4)(D3) \] where \( b1, b2, b3, \) and \( b4 \) are estimated coefficients and \( CHILD1, CHILD2, CHILD3, \) and \( CHILD4 \) are the costs of the first, second, third, and fourth (or more) children respectively. Thus if a couple has no children \( (D1=D2=D3=0) \) then the terms reduce to \( b1(CHILD1) \). If the couple had one child, the terms would reduce to \( b2(CHILD2) \) and so forth. So at each parity, the relevant term is a coefficient times the cost of the additional child at that parity.

Unfortunately, the cost of an additional child at each parity cannot be measured directly with the data.
The estimated value of $TIME$ for working and non-working women is identical if they have the same years of education, years since leaving school, and ethnicity. However, it was acknowledged in footnote 15 that the opportunity cost of a non-working woman's time may overestimate $TIME$. To allow for this possibility, a dummy variable called EMPLOY is included. EMPLOY takes a value of 1 if the woman was currently working and 0 otherwise. Thus, EMPLOY, to the extent it picks up aspects of opportunity cost missed by $TIME$, is expected to have a positive relationship to the abortion choice.

Available. Suppose, however, that the cost of a child is some positive fractional proportion of the opportunity cost of a woman's time, $TIME$. Thus for CHILD1 we could substitute the term $a1(TIME)$ where $a1$ is the proportionate multiple. Similarly, CHILD2=$a2(TIME)$, CHILD3=$a3(TIME)$, and CHILD4=$a4(TIME)$. If the marginal cost of children to parents decreases with increasing parity then $1>a1>a2>a3>a4>0$. Substitution and reduction of the right side of the equation yields $[b1a1 + (b2a2-b1a1)D1 + (b3a3-b2a2)D2 + (b4a4-b3a3)D3](TIME)$. Letting $B1=b1a1$, $B2=(b2a2-b1a1)$, $B3=(b3a3-b2a2)$, and $B4=(b4a4-b3a3)$, the equation has the terms $B1(TIME) + B2(TIME*D1) + B3(TIME*D2) + B4(TIME*D3)$. Note that if the effect of a dollar increase in the cost of a child on the abortion decision is the same and positive at every parity then we would have $b1=b2=b3=b4>0$. This implies that $B1>0$ while $B2<0$, $B3<0$, and $B4<0$ by what the literature suggests about the relative size of the $a$'s. If $B2$, $B3$, or $B4$ are positive, then one interpretation is that the $b$'s are not equal, that is, the effect of a dollar increase in the cost of an additional child on the abortion decision is greater at higher parities. Thus, for example, $b4$ would have to be sufficiently greater than $b3$ so that, even though $a4<a3$, the net result $[b4a4-b3a3]$ is positive.
Another variable is SAMEISLE, a dummy variable with a value of 1 if the woman was currently living on the same island as the one on which she was born and 0 otherwise. This can be interpreted in several ways. It may be acting as another factor in the opportunity cost of an additional child. If a woman lives on the island where she was born it may be hypothesized that there are positive externalities and hence the costs of raising the child are lower. With this interpretation, a negative coefficient is expected; lowering the cost of a child decreases the probability of choosing an abortion. A second interpretation based on utility rather than cost may be made. This interpretation suggests that the woman has higher psychic costs (more disutility) from an abortion because the social pressures from family and friends are stronger than if she was a stranger in the community. This also leads to an expectation of a negative coefficient. A third and non-economic interpretation is also possible since women born in the continental United States will, by definition, have SAMEISLE equal to 0. Thus this variable may be serving as a proxy for an in-migrant which includes both foreign migrants and U.S. mainlanders (civilian and military). These people may behave differently from each other as well as differently from locally born persons who make an interisland migration. Any of these latter "non-economic" aspects can affect tastes for abortions but not in an a priori predictable manner.
There are other variables expected to affect the utility function. One such variable is EFFBC, a dummy variable for using effective birth control, which takes a value of 1 if the couple was using any of the following methods of birth control when the woman became pregnant: pill, intrauterine device (IUD, coil, loop, spiral, etc.), condom (rubber), diaphragm or cap (with or without jelly), withdrawal, foam or jelly, or vasectomy of father. These methods have use effectivenesses of more than 0.90 \(^1\) and so the couple is considered to have seriously attempted to avoid the pregnancy. The effect of this variable on the abortion decision is not theoretically unambiguous, however. To the extent that a woman views abortions as a back-up technique in the event of contraceptive failure, she will be more likely to elect an abortion. The fact that she was using an effective contraceptive is an indication that she wants to avoid having another child. So for this type of woman (Type I), EFFBC would be positively related to ABORT.

It may be, however, that a woman is strongly opposed to having an abortion. The woman may thus use an effective birth control technique not only to avoid another child but to avoid having an abortion as an alternative. In this case, effective contraception is a substitute for abortions.

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rather than a complementary back-up measure. For this sort of woman (Type II), EFFBC would not be positively related to choosing an abortion. Since this woman will not choose an abortion when faced with an unplanned pregnancy under any circumstances, the correlation between ABORT and EFFBC must be zero.

Lastly, it may be that a woman does not want to use contraception even though she does not want another child. Perhaps she feels the costs of planning and using it outweigh the expected benefits, or she may be a risk taker. Yet, if an unplanned pregnancy occurs, she will readily have an abortion. Abortion, for this type of woman (Type III), is thus the primary birth control strategy. For a woman of this persuasion, EFFBC would also have a zero correlation with ABORT. Since she does not use contraception at all, the two variables cannot be correlated.

If the sample was composed of Type I women only, the coefficient of EFFBC would be expected to have a positive sign. If it was either all Type II women or all Type III women, the expected coefficient would be zero. However, if the sample was only composed of Type II women and Type III women there would be a perverse outcome. The only women using contraception would be those who were opposed to abortions and the only women having abortions would be those who did not use contraception. Statistically this would
result in a negative correlation between EFFBC and ABORT even though for either type separately the correlation is zero. With all three types of women in the sample, the predicted sign of the coefficient of EFFBC is indeterminant.

Several sociological variables are included. For instance, a dummy variable for religion, CATH/MOR, taking a value of 1 if the woman is either Catholic or Mormon is introduced. Since these two religions are strongly opposed to abortion, this variable is expected to be negatively related to the choice of an abortion.

A dummy variable, JAPN, taking a value of 1 if the woman is of Japanese ancestry is introduced. Another variable, CAUC, is 1 if the woman is ethnically Caucasian. There is no a priori expectation of what the signs of the coefficients of these variables will be.

The EDUC variable (years of education including vocational and business training) that is included in the estimate of TIME is included in its own right for each observation. The sign of the coefficient of this variable is also not predicted.

Because previous studies of abortions by non-economists have shown the age of the woman to be important, with younger women and older women more likely to have abortions, the variables AGE (age of the woman in years) and AGE$^2$ (age
squared) are employed. With both variables included, the relationship of the age of the woman to the estimated index is quadratic (parabolic) rather than linear. If the results of previous studies hold, the coefficient of AGE$^2$ will be positive and the coefficient of AGE will be negative.

The parity dummy variables discussed earlier in this section (D1, D2, and D3) are introduced to account for shifts in the abortion decision by parity. If they had not already been introduced in the function (by allowing for changes in the slope of the TIME variable) they would be expected to have positive effects on the abortion choice (more likely to choose an abortion at higher parities, ceteris paribus, because of decreasing marginal utility of children). However with the parity dummies affecting the marginal contribution of another variable, no a

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19 But there is an argument that the relationship might be negative. It may be that parity is correlated with anti-abortion sentiment. That is, higher parity women may be of higher parity because they chose not to have abortions with previous pregnancies. If this is the case then higher parity implies less preference for abortions and a smaller likelihood of choosing an abortion with the current pregnancy. Two factors tend to minimize the potential impact of this effect. First, only dummies up through the third child are used. At parities of 4, 5, 6, or more the anti-abortion (or pro-child) effect would probably be greater. Since 2 or 3 children is relatively commonplace, this aspect of parity is probably less of a factor in D1, D2, and D3. Secondly, the data for this study came from the period right after abortions were made legally available on demand. Thus the opportunity for these women to have had a previous abortion was somewhat limited unless the woman could afford a lot of money (e.g. to travel to a country like Japan where it was legal) or was willing to use illegal channels.
prediction of their effect on abortion choice can be made since the two effects can modify each other through their interaction.

While it is assumed that inflation does not have a differential effect on the four cohorts used, the amount of information on abortion may have been changing from one cohort to another. Moreover, tastes may be somewhat different among the cohorts. To account for shifts in demand due to these factors, dummy variables for the various cohorts are introduced. COH3 takes a value of 1 if the woman conceived during July-August 1970. COH4 takes a value of 1 if the woman conceived during April-May 1971. And COH5 is 1 if the woman conceived during January-February 1972. If all three of these dummies have a value of 0 then it implies that the observation is from cohort 6 and had conceived during August-September 1972. If the demand for abortions was increasing over the time period due to factors not accounted for by the other variables in the demand equation, then the cohort dummy variables will have negative coefficients.

Table 7 shows the means, standard deviations, minima, and maxima for each of the variables used in the Probit analysis. Table 8 presents their simple correlation coefficients.
### Table 7

**Statistics for Variables Used**

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1. ABORT.....Dummy=1 if Abort; =0 if Maternity
2. PRICE.....Difference between Ab. and Mat. Prices
3. INCOME.....Family Income in $1,000s
4. TIME.....Estimated Opportunity Cost of Woman's Time
5. TIME*D1...TIME times D1 Dummy
6. TIME*D2...TIME times D2 Dummy
7. TIME*D3...TIME times D3 Dummy
8. EMPLOY.....Dummy=1 if Woman Working
9. SAMEISLE..Dummy=1 if Living on Island where Born
10. EFFBC.....Dummy=1 if Using Effective Birth Control
11. CATH/MOR..Dummy=1 if Catholic or Mormon
12. JAPN.....Dummy=1 if Woman is Japanese
13. CAUC.....Dummy=1 if Woman is Caucasian
14. EDUC.....Education of Woman in years
15. AGE.....Age of Woman in years
16. AGE2......Age of Woman Squared
17. D1.......Dummy=1 if at Parity 1 or more
18. D2.......Dummy=1 if at Parity 2 or more
19. D3.......Dummy=1 if at Parity 3 or more
20. COH3.....Dummy=1 if Woman is in Cohort 3
21. COH4.....Dummy=1 if Woman is in Cohort 4
22. COH5.....Dummy=1 if Woman is in Cohort 5
TABLE 8

SIMPLE CORRELATION COEFFICIENTS

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EMPIRICAL RESULTS

The 3057 observations on the abortion choice of married women who had not planned to become pregnant were used to estimate the probability of abortion, using the probit maximum likelihood procedure of SHAZAM. The results are shown in Table 9 below.

At the 5% level of significance, the ratio of the coefficient to its standard error must have an absolute value of 1.96 or greater in order for the estimated coefficient to be judged significantly different from zero. It thus appears that the dummy variables, D1 and D3, have no significant effect so the only differentiation by parity is between women with one or fewer children and women with two or more children. The TIME*D3 variable will modify this conclusion however. TIME and its interaction with the dummies for parities 1 and 2 (differential slopes of the TIME variable at successive parities) are not significant. This means that the opportunity cost of a woman's time as measured by TIME has no effect on the demand for abortions until a woman has 3 or more children. Although the coefficient of the D3 dummy was itself not significant, once a woman is in parity three or more, the TIME*D3 variable becomes operative so there is an increase in the demand for abortions as a woman goes from parity 2 to parity 3 or more. EDUC is not significant. Neither the dummy variable for Cohort 4 nor the dummy variable for Cohort 5 are significant. This implies that there is no shift in...
abortion demand between Cohorts 4, 5, and 6. All the other variables, except for the JAPN dummy, are statistically significant at the 5% level.  

While the JAPN variable is not significant at the 5% level, it is at the 10% level. Omitting the insignificant variables TIME, TIME*D1, TIME*D2, EDUC, D1, D3, COH4, and COH5, the probit abortion demand equation is reestimated with the remaining variables. JAPN is included provisionally. If, with the other variables omitted, it is not significant at the 5% level, it will be dropped also. Table 10 shows the final probit estimated abortion demand equation results. The JAPN variable is significant at the 5% level as are all the other variables.

-----------------------

20 Using a dummy variable for the poor (defined as women whose INCOME was less than $6000) times the PRICE variable, an attempt was made to see if poor women had a greater price elasticity of demand for abortions because it would have composed a larger share of their INCOME. At a 5% significance level, they did not. It was concluded that the poor and non-poor quantitatively react to PRICE to the same degree.
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<td>19. D3</td>
<td>-0.31824</td>
<td>0.22039</td>
<td>-1.444</td>
</tr>
<tr>
<td>20. COH3</td>
<td>-0.42257</td>
<td>0.09721</td>
<td>-4.347**</td>
</tr>
<tr>
<td>21. COH4</td>
<td>-0.00546</td>
<td>0.07762</td>
<td>-0.070</td>
</tr>
<tr>
<td>22. COH5</td>
<td>0.02406</td>
<td>0.07531</td>
<td>0.319</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>1.03478</td>
<td>0.61361</td>
<td>1.686**</td>
</tr>
</tbody>
</table>

** = statistically significant at the 5% level

$R^2$ between Observed and Predicted = 0.2176
### Table 10

**PROBIT ANALYSIS--FINAL: ABORT=DEP. VAR.**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>M.L. ESTIMATES</th>
<th>ST. ERROR</th>
<th>COEF/ST. ERR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. PRICE</td>
<td>-0.00169</td>
<td>0.00036</td>
<td>-6.634**</td>
</tr>
<tr>
<td>3. INCOME</td>
<td>-0.01609</td>
<td>0.00574</td>
<td>-2.803**</td>
</tr>
<tr>
<td>7. TIME*D3</td>
<td>0.05542</td>
<td>0.01694</td>
<td>3.272**</td>
</tr>
<tr>
<td>8. EMPLOY</td>
<td>1.06037</td>
<td>0.06789</td>
<td>15.618**</td>
</tr>
<tr>
<td>9. SAMEISLE</td>
<td>-0.18572</td>
<td>0.06627</td>
<td>-2.802**</td>
</tr>
<tr>
<td>10. EFF8C</td>
<td>0.27464</td>
<td>0.05743</td>
<td>4.782**</td>
</tr>
<tr>
<td>11. CATH/MOR</td>
<td>-0.21019</td>
<td>0.06177</td>
<td>-3.403**</td>
</tr>
<tr>
<td>12. JAPN</td>
<td>0.24945</td>
<td>0.08724</td>
<td>2.859**</td>
</tr>
<tr>
<td>13. CAUC</td>
<td>0.44371</td>
<td>0.07375</td>
<td>6.016**</td>
</tr>
<tr>
<td>15. AGE</td>
<td>-0.19569</td>
<td>0.04175</td>
<td>-4.887**</td>
</tr>
<tr>
<td>16. AGE²</td>
<td>0.00338</td>
<td>0.00069</td>
<td>4.881**</td>
</tr>
<tr>
<td>18. D2</td>
<td>0.69015</td>
<td>0.07407</td>
<td>9.317**</td>
</tr>
<tr>
<td>20. COH3</td>
<td>-0.43379</td>
<td>0.08427</td>
<td>-5.147**</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>1.17905</td>
<td>0.58930</td>
<td>2.001**</td>
</tr>
</tbody>
</table>

** = statistically significant at the 5% level

$R^2$ between Observed and Predicted = 0.2146
CHAPTER VI

INTERPRETATION OF RESULTS

One would have thought that it was even more necessary to limit population than property; and that the limit should be fixed by calculating the chances of mortality in the children, and of sterility in married persons. The neglect of this subject, which in existing states is so common, is a never-failing cause of poverty among the citizens; and poverty is the parent of revolution and crime.

Aristotle Politics, Book II, Chap. 6.

SIGNS OF THE COEFFICIENTS

The most important result of this study is that price matters statistically. While this comes as little surprise to an economist, it is believed by some non-economists that the price of an abortion is not a deterrent to women who want abortions. The evidence of this study is that while it may be true that any woman who "wanted" an abortion was able to have one; larger price differences that would be borne by the woman between the price of an abortion and the price of a maternity makes the choice of an abortion less likely. That is, a rise in the price of an abortion or a decrease in the price of a maternal delivery reduces the probability of choosing to have an abortion. For a woman with mean characteristics facing mean prices, an increase in the price
of an abortion (holding the price of a maternity constant) of about $26 would reduce the estimated probability of an abortion by 0.01 (from 0.15 to 0.14).

A second important result is that income is inversely related to the choice of an abortion. It therefore follows that the choice of a pregnant woman to have the baby is directly related to family income and the price of an abortion and inversely related to the price of a maternal delivery and, at parities of 3 or more, to the opportunity cost of a woman's time.\(^1\) These relationships are highly supportive of the theories of the economics of fertility choice. Most previous studies, however, have taken the dependent variable to be the total number of children in the family or some measure similar to this.\(^2\) In this study, however, it is the sequential addition of a child or not which is the choice under observation. Given a pregnancy, the choice to have an abortion is the same as the choice to

\(^1\)A new equation using CHILD (=1-ABORT) as the dependent variable with the independent variables of Table 10 (except that the PRICE variable was defined as the price of a maternal delivery minus the price of an abortion instead of the other way around) was estimated. The results of this show that, in addition, the probability of a child (when pregnancy is unplanned) is inversely related to whether she is employed, to whether she was using an effective birth control method, to being Japanese or Caucasian, to age squared, and to having two or more children. It is directly related to living on the same island on which the woman was born, to being Catholic or Mormon, to her age, and to being in Cohort 3.

\(^2\)However, there is at least one parity specific study in the literature. (Snyder, 1978, pp. 12-16)
not have a child. The choice of having the child is equivalent to choosing not to have an abortion. The analysis of this study is thus in the context of choosing whether to have an additional child or not (given an unplanned pregnancy) rather than in the context of completed family size.

Having income positively related to choosing to have an additional baby (even though the pregnancy was unplanned) with opportunity costs and other variables accounted for is consistent with couples behaving as if children are normal goods. That is, given an unplanned pregnancy, as family income rises the probability of having an additional child increases. This also seems to suggest that the ability to pay for abortions (as related to income) is not an overwhelming factor in the abortion decision. Since the long term costs of raising an additional child is many times greater than the cost of an abortion, the latter observation is not surprising.

Getting back to the demand for abortions, a third important result is that the cost of an additional child as proxied by the opportunity cost of a woman's time does not matter until a woman has 3 children. Thereafter a higher value of time is associated with a greater likelihood of choosing an abortion. This is supportive of the conventional theory concerning the economics of fertility.
As the cost of an additional child rises, a pregnant woman is less likely to opt for the additional child (she is more likely to choose an abortion). It must be remembered, however, that the absolute magnitude of this coefficient may only be valid for 1970-72 because of the inflationary expectations of this period.

Another aspect of the opportunity cost of a child is whether the woman was employed (EMPLOY=1) or not, particularly if having a child would mean leaving the labor force. It must be remembered that the questions were asked while the women were in the hospital. Women who had been employed when they decided not to have abortions may have left their jobs by the time their babies were being delivered so they would have reported that they were not then employed (EMPLOY=0). The coefficient of this variable is positive in the abortion demand equation with an extremely high ratio of coefficient to its standard error. To the extent that this just reflects women leaving employment if they decide to have their babies, it is a statistical artifact in estimating the abortion demand equation. But if it is taken at face value, the positive coefficient would indicate that working women are more likely to choose an abortion. This does, however, increase doubts about the initial measurement of the opportunity cost of time (TIME) especially for non-working women. These results may suggest that the "estimated market wage" for
non-working women based on their education, experience, and ethnicity is an overestimate of the actual market wage they could obtain. Alternatively, EMPLOY may be identifying two distinct groups of women with different tastes: one group (EMPLOY=0) oriented toward home and children and the other group (EMPLOY=1) oriented toward market work.

The SAMEISLE variable has a coefficient with a negative sign indicating lower costs of child rearing and/or higher psychic costs of abortion for people not moving and/or relatively greater preferences for abortions among the people who have moved from their place of birth.

The EFFBC variable has a positive coefficient which is consistent with (Type I) women viewing abortion as a back-up technique in the event of contraceptive failure. The use of effective contraception is an indication that an additional child is not wanted so, in the event of pregnancy, an abortion is more likely to be chosen. This is not to say that there are no Type II women (using contraception as a substitute for abortion) or Type III women (using abortion as their primary fertility control method) in the sample but only that the effects of Type I women predominate.

As expected, Catholics and Mormons (CATH/MOR=1) are less likely to choose an abortion. Compared with non-Japanese, non-Caucasian women (that is, Hawaiian, Filipina, Samoan, Korean, Chinese, etc. and ethnically mixed
ancestry women), the Japanese, *Cateris paribus*, are more likely to have an abortion and the Caucasians are the most likely of all to have an abortion in the event of an unplanned pregnancy.

The coefficient of AGE was negative and the coefficient of AGE$^2$ was positive as expected. Taking the first derivative of the index with respect to AGE and setting it equal to zero yields:

$$2(0.00338) \times \text{AGE} - 0.19569 = 0.$$  

(3)

Solving this equation for AGE gives $\text{AGE}=28.95$ years. Thus at about 29 years of age, the abortion demand is at a minimum. At either lower or higher ages the probability of choosing an abortion is greater.

As a woman moves from parity one to parity two or more, the probability of electing an abortion increases. It was also expected that as she moves to parity three or more that the probability would increase further. However the coefficient of D3 was not significant. But going to parity three or more will give the TIME*D3 variable a positive non-zero value. Since the coefficient of the TIME*D3 term is positive, then going from a parity of two or more to a parity of three or more increases the demand for abortions.

Lastly, the women in Cohorts 4, 5, and 6, *Cateris paribus*, have an increased demand for abortions relative to the women of Cohort 3.
While each of the independent variables are individually significant statistically in estimating abortion demand, overall significance of the economic variables has not yet been addressed. For a maximum likelihood estimating procedure, the appropriate test of the significance of a group of variables is the chi-squared test. The log of the likelihood function for the estimation with all variables included (-1293.600) minus the log of the likelihood function for the estimation with the economic variables PRICE, INCOME, and TIME*D3 omitted (-1323.868) times -2.0 yields 60.536. At the 5% level, the chi-squared statistic with 3 (three variables omitted) degrees of freedom is 7.815. Since 60.536 exceeds 7.815, it can be concluded that the three main economic variables (PRICE, INCOME, and TIME*D3) are, as a group, statistically significant at the 5% level in the abortion demand equation.
If a "standard" woman is defined, a demand for abortions can be calculated and graphed based on the final results of the Probit analysis. Let us define the standard woman as pregnant, with two children already, having a family income of $10,000, not employed, not living where she was born, not using an effective birth control method, neither Catholic nor Mormon, 29 years old, neither Japanese nor Caucasian, and not in Cohort 3. Furthermore, let us assume that this woman faces a fixed price for a maternal delivery of $160 (this was about the mean price paid). For any given price of an abortion, the probability of an abortion can be computed and graphed. If the probability of an abortion is on the horizontal axis and the price of an abortion is on the vertical axis, a demand for abortions for the woman is obtained (see Figure 1) where three demand curves are drawn. Curve A is for the "standard" woman. Curve B is for a woman in the same circumstances except that she is at parity 1 instead of 2. Curve C is for a woman at parity 3 (with TIME taking the mean value for parity three or more women of 4,326 thousand dollars). Thus the effect

---

For 1000 pregnant women, each in identical circumstances, the probability of an abortion for each individual of say, 0.195, would yield 195 as the expected number of abortions for the group. This is on the assumption that a uniformly distributed random number between 0 and 1 is selected for each woman and if it is less than or equal to her probability as determined by the independent variables plus a normally distributed error term then she will choose the abortion.
of parity changes on abortion demand can be clearly seen. Similar curves for other sets of circumstances could also be drawn.

To avoid confusion, Table 11 is constructed to show the quantitative impact on the probability of an abortion by the "standard" woman for specific changes in characteristics. A few selected prices for abortions are shown.

The results can be quantitatively displayed in a different way. If the coefficients are treated as point estimates of the true relationships, changes in any of the non-price coefficients can be interpreted as equivalent to changes in the PRICE variable of various magnitudes. Thus being a Catholic or Mormon has the same effect on the probability of an abortion as an increase in the price difference between an abortion and maternity to a person not of those religions of $124.37 (=-0.21019/-0.00169). Table 12 shows the price change equivalent of changes in the other independent variables. A woman using an effective birth control method raises the probability of an abortion by the same amount as lowering the price of an abortion (or raising the price of a maternity) by $162.51. This has more than 19 times as much impact as raising the opportunity cost of a woman's time by $1000 if she had three or more children when she became pregnant.
Figure 1: DEMAND FOR ABORTIONS

A: Standard (Parity=2)

B: Parity=1 or zero

C: Parity=3 or more (TIME=$4,326)
### TABLE 11

**SELECTED DEMANDS GIVEN VARIOUS CHARACTERISTICS**

**PROBABILITIES OF ABORTIONS**

<table>
<thead>
<tr>
<th>Abortion Price:</th>
<th>$0</th>
<th>$100</th>
<th>$200</th>
<th>$300</th>
<th>$400</th>
<th>$500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>0.20</td>
<td>0.15</td>
<td>0.12</td>
<td>0.09</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>B</td>
<td>0.06</td>
<td>0.04</td>
<td>0.03</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>C</td>
<td>0.27</td>
<td>0.22</td>
<td>0.17</td>
<td>0.13</td>
<td>0.10</td>
<td>0.07</td>
</tr>
<tr>
<td>D</td>
<td>0.29</td>
<td>0.23</td>
<td>0.18</td>
<td>0.14</td>
<td>0.11</td>
<td>0.08</td>
</tr>
<tr>
<td>E</td>
<td>0.22</td>
<td>0.17</td>
<td>0.13</td>
<td>0.10</td>
<td>0.07</td>
<td>0.05</td>
</tr>
<tr>
<td>F</td>
<td>0.17</td>
<td>0.13</td>
<td>0.10</td>
<td>0.07</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>G</td>
<td>0.58</td>
<td>0.51</td>
<td>0.45</td>
<td>0.38</td>
<td>0.32</td>
<td>0.26</td>
</tr>
<tr>
<td>H</td>
<td>0.15</td>
<td>0.11</td>
<td>0.08</td>
<td>0.06</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>I</td>
<td>0.28</td>
<td>0.23</td>
<td>0.18</td>
<td>0.14</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td>J</td>
<td>0.14</td>
<td>0.11</td>
<td>0.08</td>
<td>0.06</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>K</td>
<td>0.27</td>
<td>0.22</td>
<td>0.17</td>
<td>0.13</td>
<td>0.10</td>
<td>0.07</td>
</tr>
<tr>
<td>L</td>
<td>0.34</td>
<td>0.28</td>
<td>0.23</td>
<td>0.18</td>
<td>0.14</td>
<td>0.10</td>
</tr>
<tr>
<td>M</td>
<td>0.30</td>
<td>0.25</td>
<td>0.20</td>
<td>0.15</td>
<td>0.12</td>
<td>0.09</td>
</tr>
<tr>
<td>N</td>
<td>0.30</td>
<td>0.25</td>
<td>0.20</td>
<td>0.15</td>
<td>0.12</td>
<td>0.09</td>
</tr>
<tr>
<td>O</td>
<td>0.10</td>
<td>0.07</td>
<td>0.05</td>
<td>0.04</td>
<td>0.02</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Model A is the "Standard" with Price of Maternity=$160, INCOME=$10 thousand, AGE=29, AGE²=841, Parity=2, and all other Dummies=0.

**Difference from "Standard" Model:**
- B: Parity=1
- C: Parity=3+ (with TIME=$4,326 thousand)
- D: Parity=3+ (with TIME=$5,326 thousand)
- E: INCOME=$5 thousand
- F: INCOME=$15 thousand
- G: EMPLOY=1
- H: SAMEISLE=1
- I: EBFEC=1
- J: CATH/MOR=1
- K: JAPN=1
- L: CAUC=1
- M: AGE=19 (AGE²=361)
- N: AGE=39 (AGE²=2521)
- O: COH3=1
Note that treating the AGE variable in this fashion has different effects depending on the ages considered. A one year age increase at age 39 has more effect than a one year age increase at age 29. Quantitatively the most important factors are the employment status of the woman and a woman's progression from parity 1 to parity 2.

| TABLE 12 |
| PRICE EQUIVALENT CHANGES IN THE INDEPENDENT VARIABLES |
| VARIABLE | CHANGE FROM | TO | PRICE CHANGE EQUIVALENT |
| INCOME | +$1000 | $1000 | $ 9.52 |
| TIME (par<3) | +$1000 | $1000 | $ 0.00 |
| TIME (par=3+) | +$1000 | $1000 | -$ 32.79 |
| EMPLOY | No | Yes | -$627.44 |
| SAMEISEL | No | Yes | $109.89 |
| EFFBC | No | Yes | -$162.51 |
| CATH/MOR | No | Yes | $124.37 |
| JAPN | No | Yes | -$147.60 |
| CIUC | No | Yes | -$262.55 |
| AGE | 19 | 20 | $ 37.79 |
| AGE | 29 | 30 | -$ 2.21 |
| AGE | 39 | 40 | -$ 42.21 |
| AGE | 29 | 39 | -$202.07 |
| PARITY | 1 | 2 | -$408.37 |
| PARITY (TIME=$4326) | 2 | 3 | -$141.86 |
| COHORT | 3 | 4,5,6 | -$256.68 |
ABORTION SUBSIDIZATION POLICY

But religion, isle of residence, parity, ethnicity, age, and the value of a woman’s time are not variables which are readily open to policy change. The prices of abortions and maternities as perceived by a woman, however, can be directly influenced by public policy. In fact, public policy already affects these prices. In Table 13 the mean characteristics (excluding the price variables) of women (based on our sample data) are multiplied by their respective coefficients and the sum of these products is taken (1.15068). To get a probability of an abortion, the product of the coefficient of the PRICE variable times the difference in the price of an abortion and a maternity must be added to the previous sum. A cumulative standard normal probability distribution table is then consulted to find the probability of an abortion for this index value.

For AGE and AGE² the values 27 and 729 are used respectively. The mean value for AGE is 26.734. The mean value for AGE² is 746.65. But the square root of 746.65 is 27.035. Using the actual means for AGE and AGE² would result in the two terms being internally inconsistent. To adjust for this, an AGE of 27 years was selected which implies a value of AGE² of 729. It must be added, however, that the relationship of AGE to abortion choice is not linear and the "mean" value of 27 years is close to the 29 years at which abortion demand is at a minimum. This implies that the abortion probabilities based on mean characteristics shown are less than would be experienced by women at ages lower than 27 years or greater than 31 years of age.
### Table 13

**Calculation of Index**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>MEAN</th>
<th>X COEFFICIENT</th>
<th>CONTRIBUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCOME</td>
<td>10.461</td>
<td>-0.01609</td>
<td>-0.16832</td>
</tr>
<tr>
<td>TIME*D3</td>
<td>1.101</td>
<td>0.05542</td>
<td>0.06102</td>
</tr>
<tr>
<td>EMPLOY</td>
<td>0.2329</td>
<td>1.06037</td>
<td>0.24696</td>
</tr>
<tr>
<td>SAMEISLE</td>
<td>0.4468</td>
<td>-0.18572</td>
<td>-0.08298</td>
</tr>
<tr>
<td>EFFBC</td>
<td>0.3801</td>
<td>0.27464</td>
<td>0.10439</td>
</tr>
<tr>
<td>CATH/MOR</td>
<td>0.4760</td>
<td>-0.21019</td>
<td>-0.10005</td>
</tr>
<tr>
<td>JAPN</td>
<td>0.1567</td>
<td>0.24945</td>
<td>0.03909</td>
</tr>
<tr>
<td>CAUC</td>
<td>0.3032</td>
<td>0.44371</td>
<td>0.13453</td>
</tr>
<tr>
<td>AGE</td>
<td>27</td>
<td>-0.09569</td>
<td>-5.28363</td>
</tr>
<tr>
<td>AGE*</td>
<td>729</td>
<td>0.00338</td>
<td>2.46402</td>
</tr>
<tr>
<td>D2</td>
<td>0.4724</td>
<td>0.69015</td>
<td>0.32603</td>
</tr>
<tr>
<td>COH3</td>
<td>0.1632</td>
<td>-0.43379</td>
<td>-0.07079</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>1.0000</td>
<td>1.17905</td>
<td>-1.15068</td>
</tr>
</tbody>
</table>

If a woman is not covered by health insurance and the unsubsidized market price of an abortion, say $310, and a maternity, say $645, is used then her estimated index takes a value of \(-0.58453 = 1.15068 + (310 - 645) (-0.00169)\) which yields an estimated probability of 0.2795. If both abortions and maternities are fully subsidized so both are free from the woman's point of view then the probability of an abortion is 0.1250. Note that full subsidization of both procedures acts to reduce the probability of an abortion because the dollar amount of subsidy of a maternity is greater than that of an abortion so the price difference is raised from $335 to $0 and raising the price differential
reduces the probability of an abortion. Thus full subsidization of both results in a price effect favorable to having the baby. A flat grant income transfer of $645 to a woman whichever procedure she chose, however, is predicted by the model to lower the probability of an abortion slightly (the probability would go down only to 0.2760).

It has been proposed that government subsidies for abortions, but not for maternities, be terminated. While this entails extrapolating beyond the range of data used to estimate the model, the model predicts that, for women in this study in the 1970-72 period, this would have the effect of reducing the probability of an abortion for a woman still further to 0.0470 assuming that no other source of subsidization could be found (which is unlikely--alternative sources could probably be found).

Of course if a woman has health insurance the results will be somewhat different because the prices the woman faces will be different. Table 14 depicts the results under no subsidy, maternity and abortion subsidy, and maternity subsidy only for an "average" (mean characteristics) woman. It is assumed that the subsidy covers the full monetary cost of each procedure which the patient would otherwise have to pay. It shows the impact if she has no health insurance or if she has either HMOA or Kaiser. It is assumed that HMOA pays 75% of each procedures costs and that Kaiser charges
flat rates of $60 for a maternity and $40 for an abortion (the latter figure was the charge for a therapeutic, as opposed to an elective, abortion). Since health insurance reduces the price differential, the impact of government subsidies on the abortion choice is lessened.

<table>
<thead>
<tr>
<th>TABLE 14</th>
<th>EFFECTS OF SUBSIDY ON THE PROBABILITY OF ABORTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBSIDY PROGRAM</td>
<td>NO INSURANCE</td>
</tr>
<tr>
<td>NONE</td>
<td>0.2795</td>
</tr>
<tr>
<td>MATERNITY AND ABORTION</td>
<td>0.1250</td>
</tr>
<tr>
<td>MATERNITY ONLY</td>
<td>0.0470</td>
</tr>
</tbody>
</table>

It might be asked if the government could reduce its expenditures by eliminating the subsidy of abortions (but continuing the subsidy of maternities) for the poor. If there were 1000 poor women without health insurance and only maternities were subsidized the government cost would be $614,685 (= $645 x 953 births). If both abortions and births are subsidized the total government cost is just slightly less: $603,125 (= $645 x 875 births + $310 x 125 abortions).
Costs go down by $11,560 because inexpensive abortions are substituted for more costly births.

For women with health insurance the results are only somewhat different. If the 1000 women were covered by HMSA, the government cost (paying the patient’s share only) of a maternities only program would be $145,125 and if both maternities and abortions were covered it would cost the government a little more: $150,781. This is because fewer births are converted to abortions since HMSA partially subsidizes the abortions. With the maternity only subsidy, there would be 900 (=1000-100) births and with both procedures covered there would again be 875 births. Under Kaiser the results would be similar; maternity only would have 889 births for $53,340 instead of 875 births for $57,500 if abortions are also subsidized. This analysis does not deal with the costs or benefits to society of the additional births which would be forthcoming as a result of discontinuing an abortion subsidy.
Appendix A

The procedure used in this dissertation to account for observation weights (after performing the data cleaning steps described in Chapter 3) was to "generate" observations in proportion to the observation weight. For every whole integer of the observation weight, a complete observation was recorded with each variable taking on the value of the corresponding variable from the original weighted observation. The decimal portion of the weight was the probability that one additional complete observation would be generated. The IMSL random number generator was used to produce a uniformly distributed random number between 0.0 and 1.0. If the random number was less than or equal to the decimal part of the observation weight then an additional observation was generated. Thus if an observation had, for instance, a weight of 2.64 the computer would produce 2 identical observations and there would be a 64\% chance of producing a third observation. By using this procedure, a sample of abortions and maternities which were expected to be in approximately the proper proportion to the actual statewide proportion and in approximate conformance to age, ethnicity, and residence statistics was obtained.


Palmore, James A.; Michael J. Furlong; Patricia G. Steinhoff; and Roy G. Smith. "Measuring the Success of Legalizing Induced Abortion," Paper prepared for presentation before the 1976 annual meetings of the Population Association of America, Montreal, Canada, April 1976.


