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by

RENEE GOLDBERG

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Abstract

THE EFFECT OF PUBLIC POLICY ON HIGH-RISK BIRTHS

By

Renee Goldberg

Adviser: Professor Michael Grossman

The infant mortality rate has shown tremendous declines throughout the 1960's and 1970's. These two decades had Federal and State governments activating policies geared to helping a mother, her fetus, and/or her newborn infant. This dissertation explores the extent to which certain government policies had an effect in lowering certain identified high-risk births: low and very low-birth weight births for black and white infants, and births to young and older women (black and white women studied separately). The government policies used in this study are: 1) Medicaid coverage of obstetrics and gynecology 2) abortion legalization 3) Maternal and Infant Care projects 4) Subsidized family planning clinics for low income women.

The theory of household behavior as a production function is the framework of this model. The economic model that is developed here relates a certain high-risk birth group to medical care and fertility costs, while taking into account income and the state-of-the-art in neonatology. An increase in the amount of medical care supplied, or a decrease in the price, reduces the probability of a high-risk birth.

The eight different high-risk groups were regressed on social policy and program measures, income, schooling, and the state-of-the-art in neoenatal medicine for both black and white births. The study covered the years 1969-1971. The county is the unit of observation.

The regression results clearly indicate the powerful impact the government policies have on lowering high-risk births. Medicaid coverage for obstetrics and gynecology and the presence of Maternal and Infant Care projects are the most important variables in lowering black and white teenage births, more important than changes in abortion laws. The presence of subsidized family planning clinics and abortion legalization are responsible for lowering the number of births to black and white older women. The risk group of low-birth weight was shown here to be most affected by abortion legalization for black and white births.

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CHAPTER 1 INTRODUCTION

The infant mortality rate in the United States has received widespread attention, concern and study amongst politicians, social scientists and economists. In spite of the concern, the U.S. still remains a relatively poor performer when compared to many other industrial countries. While the placing of the U.S. varies among reports, it never is in the top ten countries with the lowest infant mortality rates. For a society that prides itself on having the latest technology this status is an embarassment.

While this looks like a bleak picture, the infant mortality rate has made a rapid decline in this country over the 1960's and 1970's. In 1964 the infant mortality rate was 24.8 per 1000 live births. In 1973, it was 17.7, indicating a decline of just around 4 percent per year. From 1955-1964, the annual rate of decline was 0.6 percent. The reduction has proceeded even faster through the 1970's. With an annual infant mortality rate of 10.2 per thousand births in 1983, this implies a decline of 5.8 percent per year over the last ten years. Ninety percent of the decline in infant mortality which occurred in the 70's involved neonatal mortality (deaths occurring within the first 27 days of life).[1]

Starting around 1963, the federal government began taking steps to reduce infant mortality, particularly among the poor. Medicaid, Maternal and Infant Care

Projects, family planning services to low-income women, Women and Infant Care Projects, and the legalization of abortion were the many policies instituted at the time.

The purpose of this dissertation is to examine the effect of different public services and programs on high-risk births. High-risk births are those categorized by a high chance of death within the first year of life. Generally, the mortality rate is split into two different groups: neonatal mortality and post neonatal mortality (deaths occurring between 28 days and one year of age) because there are differences as to the explanations of these deaths. Some reasons neonatal mortality occur are 1) low birth weight due to such things as mother's malnutrition or premature birth, 2) births to older or very young women, 3) unwanted and out of wedlock children-due to the lack of medical and prenatal care,[2] 4) genetic abnormalities. Post neonatal mortality is generally due to infectious diseases or accidents. Thus, the neonatal causes of infant death are more apt to respond to public policies relating to the birthing process and are the focus of this paper.

This paper will examine public policy effects on eight different categories of high-risk births: 1) the percentage of births to white teenage mothers less than 19 years of age 2) the percentage of births to black teenage mothers less than 19 years of age 3) the percentage of births to white women over 40 (older women) 4) the percentage of births to black women over 40 (older women) 5) the percentage of white births less than 2500 grams 6) the percentage of white births less than 2000 grams 7) the percentage of black births less than 2500 grams 8) the percentage of black births less than 2000 grams. The regression analysis will also take into account schooling, poverty, and the state of neonatal medicine. The time frame of this study in 1969-1971. The importance of the different policies on these eight categories of high-risk births will be analyzed to discover which policies affect which group. For instance, it has been noted that family planning clinics tend to serve young women (less than 18 years), and if true, would probably be very important in lowering risk for this group. Information on the impacts of different policies is indeed useful for future budget planners in understanding the consequences of their actions.

It is important to provide some background and description of the policies to be studies in this dissertation as an aid in interpreting the econometric results presented later on. This paper will measure the effect of four policies 1) Medicaid coverage for obstetrics and gynecology 2) Maternal and Infant Care Projects 3) Federal subsidization of family planning clinics 4) Abortion law changes. With the exception of abortion law changes, these policies are designed to enhance survival for black and other low-income births. This is especially important if one considers the fact that black births are twice as likely to be low-birth weight when compared with white births.

Title V[3] of the Social Security Act is the only federal program concerned exclusively with the health of mothers and children. It provides federal support for states to operate a program of health care in five areas 1)maternity and infant care, 2) intensive infant care, 3) family planning, 4) care for children and youths, 5) dental care for children in low-income areas. In 1963, Congress adapted the first in a series of amendments to Title V establishing special grants for specific maternal and infant health activities in low-income areas. The amendment provided grants to state and local health departments for maternal and infant care projects aimed primarily at reducing mental retardation and infant and maternal mortality through prenatal, perinatal and postpartum care. By 1971, 53 projects were fully operative. In 1974 the administration of the grants was turned over to state maternal and child health units. States therefore have substantial flexibility in the allocation of funds and the ways of providing services. This factor tends to lead to large variability in M&I clinics across the U.S.

Medicaid was created in 1965 as Title XIX of the Social Security Act. It is a Federal-State cooperative program designed to meet the medical needs of persons who qualify. The law permits each state latitude in determining eligibility, covered services and provider standards.

States participating in Medicaid are required to cover persons who are currently receiving public assistance under the Aid to Families with Dependent Children (AFDC) Program. At the states' option, coverage may be extended to cover financially eligible pregnant women, families in which the father is unemployed but not covered under AFDC, and 1 or 2 parent families meeting the AFDC income standard.

Only 31 states cover first time pregnant women, because other AFDC programs do not cover unborn children. Thirty states cover families in which the father is unemployed. Twenty states provide benefits to all children of two parent families meeting their AFDC income standard, and in only 10 states are all first time pregnancies to all financially eligible women covered. Even among those ten states, eligibility would differ based on the AFDC income level set by each state.

Title X of the Public Health Service Act, authorizing family planning services and population research, was enacted in 1970, due to the large number of unintended pregnancies among the poor. It was an effort to expand the 1967 amendment to the Social Security Act providing federal subsidization of family planning clinics. Its purpose is to make comprehensive voluntary family planning services available to all persons in a given area of service requesting them, with the stipulation that no one can be denied access to these services.

The subsidies go to clinics organized by hospitals, state and local health departments, and Planned Parenthood, among others, for the purpose of providing counseling, contraception services, pregnancy testing, and general health care and information. By 1980, these programs served 4.4 million low income women, including 2.8 million adults and 1.6 million teenagers, as compared with only 400,000 served in 1966, before major Federal intervention. The programs aims are to reduce high risk births through lowering the cost of fertility control and providing access, therefore lowering the incidence of unwanted births.

The last federal policy explored in this paper is abortion reform. It has always been, and remains today, a very controversial policy. It is the one government policy that is not aimed at a particular group and as such any change here affects all women. Prior to 1967, abortion was legal only if there was a substantial risk to the life of the mother if pregnancy continued. Beginning in 1967, several states began amending the qualifications for abortion. Abortions became legal if there was a substantial risk that continuance of the pregnancy would seriously impair the physical or mental health of the woman, or that the child would be born with a serious physical or mental defect, or if a pregnancy was caused by rape or incest. In 1967, three states enacted such abortion laws, in 1969 four more and in 1970 three more. In 1970, moreover, four states (Alaska, Hawaii, New York, and Washington) enacted extremely liberal abortion laws. There was no restriction on abortion within the first three months of pregnancy. New York's law was the most liberal in the country. It contained no residency restriction and allowed abortions within 24 weeks.

In 1973, the Supreme Court ruled that the most restrictive state abortion laws were unconstitutional. The number of abortions increased, the use of out of state and late abortions declined and illegal abortions faded away. With the passage of the Hyde amendment in 1977[4], the opposition hoped to restrict the use of abortion. For the most part, however, the funding just changed hands. The abortion rate has increased 2% per year from 1976-1978, even though the amount of federally funded abortions dropped drastically (from 250,000 per year in 1976 to less that 3000 in 1978). Many states have now assumed the responsibility of funding abortion services.

Abortion policy affects the incidence of high risk births in more than one way. As with family planning clinics, the reform of abortion can work through lowering the cost of fertility control, resulting in fewer births and increased demand for medical care (see Theoretical Framework page 20). It may also have an effect on certain high risk birth categories, independent of the reduction in fertility cost. Improved detection techniques (such as amniocentesis and karyotyping) aid parent and doctor in identifying certain high risk fetuses. This fetus could then be aborted instead of risking the birth of a nonviable or developmentally disabled child. Also, the revised abortion policy allows a woman the opportunity to terminate a pregnancy if she has suffered an illness (such as chicken pox) which could result in a high-risk birth outcome.

Chapter II of this thesis contains a review of the literature on infant mortality and high-risk births[5]. The theoretical framework is presented in Chapter III. The data and measurement of variables are described in Chapter IV. Empirical results and conclusions are contained in Chapter V.

FOOTNOTES

1) Statistical data was taken from the Statistical Abstract of the U.S. 1984 104th edition.

2) See Lewit

3) The data on public policy was gathered from the report "Better Health for our Children, a National Strategy"- a U.S. Department of Health and Human Services /Public Health Service publication Vol. 11 1981. The information on abortion legalization came from the Center for Disease Control Annual Summary 1970 "Family Planning Evaluation".

4) The Hyde Amendment was in effect from June 1977 to February 1980. Federal funding of abortion under Medicaid was banned except when the mother's life was in danger.

5) A high-risk infant is one that has a great risk of death within the first year of life and/or that will live but be developmentally disabled.

CHAPTER II -- REVIEW OF LITERATURE

It has been noted quite often in the previous literature that the U.S. has relatively high infant mortality rates when compared with other developed countries. One of the main reasons cited is low birth weight. Most of this literature, and the ones reviewed here, relate infant mortality to one or more of the following: socioeconomic variables, the use of prenatal care, gestational age, and low birth weight. One general conclusion is that low birth weight is the main cause of infant mortality.

Kehrer and Wolin (1979) studied the impact of income maintenance on the incidence of low birth weight births. They used data on 404 infants born in the Gary Income Maintenance Experience. Participants were chosen from low-income neighborhoods in Gary, Indiana. The head of the household had to be black. There were 4 different income groups and one control group that received no excess payments.

Kehrer and Wolin classified the factors affecting low birth weight into three categories 1) demographic characteristics (e.g. maternal age, birth order) 2) physiological characteristics (low prepregnancy weight, infections) 3) behavioral practices (e.g. smoking, drug addiction, maternal malnutrition). They feel that any income program can have an effect in all groups either indirectly through increased utilization of prenatal care or through the direct effects of income on diet.

In general, they concluded that the higher the risk pregnancy had for a group, the larger the response of birth-weight for an income plan group. They could not attribute this increased response to overall increased utilization of prenatal care. While the income maintenance experience was successful in raising birthweights, Kehrer and Wolin believe that the increased birthweight was due to increased nutrition while pregnant due to larger family income; however this could not be proved through the statistical techniques used in their study.

Gortmaker (1979) examined the relationship of "income poverty" to infant mortality and low birth weights for the period 1964-1965. The data came from nationwide random samples of legitimate white births and infant deaths in the U.S. selected by the National Center for Health Statistics. The use of log-linear multidimensional contingency tables allowed him to study infant mortality in relation to causal factors such as birthweight and socioeconomic characteristics to determine relative risks, and direct and indirect effects on infant mortality. Neonatal and post-neonatal death rates were examined separately. Many of his findings are in agreement with other literature on this topic. Young and old mothers (less than 18 and older than 35) are at significantly high risk of having a low birth weight infant. Gortmaker also found that large family size is more significant in post-neonatal deaths than in neonatal deaths and is the most significant factor in the former. Low educational level of the mother is another variable which operates through increased risk of post-neonatal death. Poverty was directly related to neonatal and post-neonatal mortality, with the risk of death for an infant born into poverty increasing by almost 50 percent[6].

Health insurance has a significant effect in Gortmaker's study in reducing the probability of a low-birth weight birth, which is achieved through decreasing the cost of prenatal care and increasing the probability that a birth will take place in a hospital. Surprisingly, education and income were not significant factors in determining birth weight.

Rosenzweig and Schultz (1980) examined production functions and input demand functions for the parental production of child health. The production functions were for birthweight, gestational age, and birthweight adjusted for gestational age. The input demand functions were for delay in seeking prenatal care, smoking, maternal age at childbirth, and the order of current live births. The data came from a national sample of 10,000 legitimate births from the National Natality Followback Surveys for the years 1967-1969. Racial differences were represented by a dummy variable for a black mother.

Rosenzweig and Schultz feel the reason past results have not been very successful in explaining child health was that production and demand functions were not studied together. A number of variables used in this study tend to have contrary effects on the production and demand functions, and are often passed over if not studied in a two-stage least square model. As an example, their results indicate that women in higher income families seek prenatal care earlier, but tend to smoke more on average. Smoking was shown in this study to reduce birthweight significantly, hence the income effect on child health may be contrary to theory. They use this two-stage least squares estimation of the production functions due to their hypothesis that women with poor endowed birth outcomes[7] have reason to alter their input mix, e.g. seek earlier medical care, better nutrition, (inputs are endogenous).

Rosenzweig and Schultz incorporated education into both their production functions and the demand models. They feel an education variable should be included because of the interactive effects with the other independent variables in their study. The results indicate that for black and white mothers, more educated women seek prenatal care early, smoke less while pregnant, and have on average fewer births. Black women with similar education and income levels due tend to postpone care for one half month more than white women of equal sociological class, have on average one more birth, but smoke less than white women while pregnant. The authors reported a U-shaped relationship between birthweight and school attainment, with mothers with less than 9 years of schooling or more than

12 years having children of lower weights than other mothers.

Higher income families generally delay child bearing, but income is positively associated with the number of births. Maternal age increases birthweight slightly, with births to very young mothers being particularly low in weight. This finding is contrary to most other findings in that it is generally noted that older women also are at risk of having a low-birth weight infant (the U-shaped curve).

Finally Rosenzweig and Schultz conclude that family planning programs affect low-birth weight through reducing the number of births, not the timing of them. In general after the socioeconomic characteristics and medical care were taken into consideration, their conclusion was that smoking while pregnant seemed to have the most deleterious effect on birthweight.

Eisner et al. (1979) studied the factors associated with low birthweight. Their data consisted of single live births recorded in the 50 states and Washington, D.C. for 1974. There were 505,243 observations with complete information on race, age of mother, prenatal care and other sociological factors. They used two methods of analysis, a linear regression technique and a chi-square based method for combining contingency tables.

A major finding of theirs was that gestational age was an inaccurately measured variable and therefore not useful in explaining infant mortality, and that low-birth weight should be used instead. This fact is important because many articles use gestational age (e. g. Rosenzweig and Schultz) as a variable closely related to infant mortality.

Once again, they find mothers over 35 with first births are severely at risk of having a low-birth weight baby, more so than multigravida (multiple birth mothers) over 35 years. The greatest risk factor in their study was the lack of prenatal care. While they couldn't get a consistent significant education effect for low-birth weight, in one study the results showed that low maternal education level is a risk factor for whites of low-birth weight and very low-birth weight ($\leq$1500 grams) and for blacks for low-birth weight births.

Lewit (1979) examined the demand for and use of prenatal care and its effect on pregnancy outcome as measured by birthweight. He used data obtained from New York State birth records for the period January-June 1970, just prior to the very significant change in abortion laws in New York. He was able to link a variety of socioeconomic characteristics as reported on the birth certificates to geographic availability of ob/gyn doctors, prenatal care clinics in hospitals and health centers and M&I clinics.

Ordinary least squares regression analysis was performed on this data set of over 50,000 observations. Maternal age had a non-linear significant effect on the use of prenatal care, with the demand for care peaking at around

38 years of age. Lewit points out that this somewhat surprising result occurs because not only older but also young mothers are at high risk. He feels the lack of demand by the young mothers for prenatal care may be a very important cause of their increased risk. Both parents' education had a positive effect on seeking prenatal care. Out-of-wedlock births, as well as births to Black and Puerto Rican mothers, received little medical care. The number of ob/gyn doctors in a given health area and the presence of prenatal care clinics had no consistent significant effects on increasing the utilization of prenatal care. The presence of an M&I project in a health district was associated with decreased demand for all medical services, as measured by the interval to the first visit.

In the regressions performed on the determinants of birth weight, the effect of mother's age is again non-linear, peaking at about 36 years of age. Black and Puerto Rican mothers and illegitimate births were also significantly and negatively related to birthweight. Parents education levels were insignificant, and while this result is common throughout the reported literature it is surprising. In this study, the education effect could have been encompassed in the variables representing the use of prenatal care. Positive past experiences in the birthing process are associated with higher birth weight in current babies. Lewit states that his most significant finding is the positive relationship between prenatal care and birth weight, and that this relationship can account for a substantial amount of the differences generally attributed to race, ethnic or legitimacy status.

Jacobowitz (1981) and Grossman and Jacobowitz (GJ 1981) examined race specific variations in neonatal mortality among counties in the U.S. for 1971, and this work is the forerunner to the paper being presented. They used ordinary least squares regression analysis to examine the effects of such variables as the number of active non-federal physicians per capita, the percentage of women 15-44 years of age with at least a high school education, and other sociological factors along with the set of policy variables described earlier: Medicaid coverage, abortion reform, M&I projects and the use of family planning clinics by low income women.

Their regressions were performed on race-specific cross-sectional data. All the public policy coefficients had the anticipated negative sign in the black regressions, and except for the Medicaid variables, in the white regressions as well. The hypothesis that the set of policy variables had an insignificant effect on neonatal mortality was rejected at the 1% level for both black and white women. Abortion reform and the use of subsidized family planning services by low-income women had the largest significant impacts on neonatal mortality of the four policies studied. The number of physicians per capita was insignificant. The schooling variable was significant only for whites. The lagged infant mortality rate was significant for both races. The lagged rate is a three year average of the infant mortality rate for the years 1966-1968. It is used to represent a control for the mortality rate without the presence of public programs as well as unmeasured determinants of infant mortality that are correlated with the included variables.

Grossman and Jacobowitz then applied their regression coefficients to trends in the independent variables for the period 1964-1977. The increase in the legal abortion rate was found to be the single most important factor in the reduction in neonatal mortality, dominating not only other program measures, but trends in schooling and poverty as well.

FOOTNOTES

6) Gortmaker defines poverty as the guidelines published by the Community Services Administration. The guidelines take into account family income, family size and consumer prices. The lower 15% of his study population was classified as being in poverty. See Gortmaker p. 284.

7) Poor endowed birth outcomes are genetic or environmental factors known to or believed by the woman to give a high probability of delivering a less than normal child.

8) Gestational age is defined in Eisner and generally as the time since the last day of the last menstrual period.

CHAPTER III -- THEORETICAL FRAMEWORK

The application of production functions to explain household behavior which began with Becker (1965) provides a good framework within which to describe a theory of birth outcomes. His notion was that households produce commodities from inputs such as purchased goods and family member's own time. The theory of household behavior was then explored by Becker and Lewis (1973) and Ben Porath (1973), among others, as to its ability to explain the demand for children. These authors assumed that the family's utility function includes the consumption of goods and the number of births. Michael (1972) and others explored the effect of education on the family's utility function. Lewit (1977), Grossman and Jacobowitz (1981) and others assumed that the utility function included consumption of goods and the number of surviving children (older than 27 days). In their models, the survival probability is an endogenous variable.

Assume a family's utility function is:

$$U = U(n,x) = U(\pi * b,x)$$

where n represents the number of surviving children and is the product of the survival probability (π) of a birth and the number of births (b). x is a composite of all other commodities. The unit price of x has been set equal to one dollar.

The survival probability then can be represented as a function of positive birth outcome variables (h) such as normal birth weight births, births to married women, births to women ages 19-34, etc.

$$\pi = \pi(h)$$

$$h = h(m)$$

This paper extends the theory to say that positive birth outcomes (h) can also be represented as a production function dependent upon a composite good m, where m is equal to medical care per birth, or a number of inputs such as medical care and nutrition, as long as medical care is a fixed proportion of all expenditures on m. This paper will explore the effect that the variables in m have on the different positive birth outcomes.

$$\frac{\partial h}{\partial m} > 0 \quad \& \quad \frac{\partial^2 h}{\partial m^2} < 0$$

The first derivative is positive and the second derivative will be shown to be negative when second order conditions are met. This means that there are diminishing returns to medical care, with, for example, the percentage of normal birth weight babies increasing as more m is supplied but at a decreasing rate.

The income constraint can be written as follows:

$$Y = x + b*m*p + F + b*g$$

where: p = price of medical care per birth

g = fixed cost of a given birth

F = the total cost of fertility control

The total cost a birth is b*m*p + F + b*g. There are three different costs to consider when determining the total cost of a pregnancy. The cost of fertility control can be thought of as the cost of a birth averted. If b* was equal to the number of births which would have occurred in the absence of any control, then F = f(b*-b).

Variable costs are those which are chosen by the family in order to achieve an optimal pregnancy outcome given resource constraints. A major component of variable costs is the amount of medical care demanded during the pregnancy. Also included in variables costs are the decisions about hospital care, diet and nutrition.

Fixed costs are costs that are independent of the survival probability. They are the result of experiences shared by all pregnant women- for instance, pregnancy is a drain on a woman's body. This may result in confinement surrounding a birth and possibly decreased productivity in the home and/or marketplace due to this drain. Maternal mortality during pregnancy, labor and delivery is also an example of a fixed cost, although today it is quite low.

Maximization of the parents' utility function given their income constraint results in the following Lagrangian:

$$L = U(\pi(h)*b,x) + \lambda(I-x-bmp-f(b^*-b)-bg)$$

The first order conditions are:

(1) $$\frac{\partial L}{\partial x} = U_x - \lambda = 0$$

(2) $$\frac{\partial L}{\partial b} = \pi(h)U_n - \lambda(pm-f+g) = 0$$

(3) $$\frac{\partial L}{\partial m} = b\pi_h h_m U_n - \lambda bp = 0$$

where $U_n = \frac{\partial U}{\partial n} + \frac{\partial U}{\partial \pi(h)*b}$

Dividing equation 2 by equation 3 results in the least cost production of surviving infants:

(4) $$\frac{pm - f + g}{p} = \frac{\pi(h)}{\pi_h h_m}$$

The lefthand expression simply is a ratio of the cost of a birth without the use of fertility control to the cost of a unit of medical care. In the efficiency expression it is set equal to the expected increase in the number of surviving infants due to an increase in one unit of medical care.

This model is a very basic one. The survival probability and the production of health are not affected by income or the number of surviving infants. More elaborate models, such as one to which an efficiency factor for education is added, may lead to other predictions are are explored later in the paper.

As Lewit (1977) proved, utility maximization yields the same results as cost minimization for a given number of surviving infants (n*). This proof can be shown simply using the following Lagrangian for cost minimization:

(5) $\frac{\partial L}{\partial x} = pmb - fb + fb^* + gb + \lambda(n^* - \pi(h)b^*)$

(6) $\frac{\partial L}{\partial b} = pm - f + g - \lambda\pi(h) = 0$ so $\lambda = \frac{pm-f+g}{\pi(h)}$

(7) $\frac{\partial L}{\partial m} = pb - \lambda b\frac{\partial \pi}{\partial h}*\frac{\partial h}{\partial m} = 0$ so $\lambda = \frac{p}{\frac{\partial \pi}{\partial h}*\frac{\partial h}{\partial m}}$

again $\frac{pm-f+g}{p} = \frac{\pi(h)}{\pi_h h_m}$

This result matches the result for utility maximization. The second order condition for a minimum is arrived at by forming the bordered Hessian as follows:

$$H = \begin{vmatrix} 0 & \phi_b & \phi_m \\ \phi_b & L_{bb} & L_{bm} \\ \phi_m & L_{bm} & L_{mm} \end{vmatrix} < 0$$

where:

$\phi = n^* - \pi(h)b^*$

$L_{bb} = 0$

$L_{bm} = p - \frac{\partial \pi}{\partial h} * \frac{\partial^2 h}{\partial m^2}$

$L_{mm} = -\lambda b\frac{\partial \pi}{\partial h} * \frac{\partial^2 h}{\partial m^2}$

so:

$$H = \begin{vmatrix} 0 & -\pi(h) & -b\cdot\frac{\partial \pi}{\partial h}\cdot\frac{\partial h}{\partial m} \\ -\pi(h) & 0 & p-\lambda\frac{\partial \pi}{\partial h}\cdot\frac{\partial h}{\partial m} \\ -b\cdot\frac{\partial \pi}{\partial h}\cdot\frac{\partial h}{\partial m} & p-\lambda\frac{\partial \pi}{\partial h}\cdot\frac{\partial h}{\partial m} & -\lambda b\cdot\frac{\partial \pi}{\partial h}\cdot\frac{\partial^2 h}{\partial m^2} \end{vmatrix}$$

$$\text{so } H = +\pi(h)\begin{vmatrix} -\pi(h) & p-\lambda\frac{\partial\pi}{\partial h}\cdot\frac{\partial h}{\partial m} \\ -b\frac{\partial\pi}{\partial h}\cdot\frac{\partial h}{\partial m} & -\lambda b\frac{\partial\pi}{\partial h}\cdot\frac{\partial^2 h}{\partial m^2} \end{vmatrix} - b\frac{\partial\pi}{\partial h}\cdot\frac{\partial h}{\partial m}\begin{vmatrix} -\pi(h) & 0 \\ -b\frac{\partial\pi}{\partial h}\cdot\frac{\partial h}{\partial m} & p-\lambda\frac{\partial\pi}{\partial h}\cdot\frac{\partial h}{\partial m} \end{vmatrix}$$

$$\text{or } H = \pi(h)^2\lambda b\frac{\partial\pi}{\partial h}\cdot\frac{\partial^2 h}{\partial m^2}<0$$

which implies that $\frac{\partial^2 h}{\partial m^2}<0$, since $\frac{\partial\pi}{\partial h}>0$, and so the proof that there are diminishing returns to medical care.

This simple model is useful in examing the effects of the social programs on the different health outcome factors studied here. Different policies can be grouped together since they produce similar chains of responses.

The following proofs first appeared in Jacobowitz (1981). They are changed slightly here to explain the effect on the percentage of high risk births (1-h).

Abortion reform and the subsidization of family planning services work through lowering the cost of fertility control. The relative cost of a birth will therefore increase. This would imply the quantity of births will decrease. Given the same income constraint, there will now be added income to spend on each birth-hence medical care per child will increase, the percentage of high risk births will decrease, and the survival probability will increase. This can be shown formally by rewriting the equation obtained by utility maximization (equation 4) as such:

$$\pi(h)\cdot\left|\frac{\partial\pi(h)}{\partial h}\cdot\frac{\partial h}{\partial m}\right|^{-1} = (pm-f+g)p^{-1}$$

where $\pi_h = \frac{\partial\pi(h)}{\partial h}$ and $h_m = \frac{\partial h}{\partial m}$

Differentiating with respect to f results in:

$$(\pi_h h_m)^{-1}\pi_h h_m M_f - \pi(h)\{\pi_h h_m\}^{-2}\pi_{mm}M_f = p^{-1}(pM_f-1)$$

where $\pi_{mm} = \frac{\partial(\pi_h h_m)}{\partial m}$

or $M_f = \frac{p^{-1}}{\pi_h(\pi_h h_m)^2\pi_{mm}} < 0$ since $\pi_{mm} < 0$

$h_f = \frac{\partial h}{\partial m}\cdot\frac{\partial m}{\partial f}$ is also <0 since $\frac{\partial h}{\partial m} > 0$ and $\frac{\partial m}{\partial f} < 0$

$$\pi_f = \frac{\partial\pi}{\partial h}\cdot\frac{\partial h}{\partial m}\cdot\frac{\partial m}{\partial f} < 0$$

so as the cost of fertility control is reduced, it will result in increases in 1) the demand for medical care, 2) the percentage of low risk births, and 3) the survival probability. The effect of these policy variables, according to this model, is that as the cost of fertility control is reduced, infant mortality will also be reduced.

Medicaid and Maternal and Infant Care projects lower the costs of medical care for the poor. Their impact can be examined by differentiating equation 4 with respect to p.

$$\pi(h)\{\pi_h h_m\}^{-1} = (pm-f+g)p^{-1}$$

where:
g=fixed cost of a given birth
f=total cost of fertility control

Differentiating with respect to p results in:

$$-p^{-2}(pm-f+g) + p^{-1}(m+p\frac{\partial m}{\partial p}) = \{\pi_h h_m\}^{-1}\pi_h h_m m_f - \pi(h)\{\pi_h h_m\}^{-2}\pi_{mm}\frac{\partial m}{\partial p}$$

or $$\frac{\partial m}{\partial p} = \frac{-p^{-2}(f-g)}{\pi(h)\{\pi_h h_m\}^{-2}\pi_{mm}} \quad <0 \text{ if } g>f \text{ since } \pi_{mm}<0$$

$$\frac{\partial h}{\partial p} = \frac{\partial h}{\partial m}\cdot\frac{\partial m}{\partial p} <0 \text{ if } \frac{\partial m}{\partial p} <0$$

$$\frac{\partial \pi}{\partial p} = \frac{\partial \pi}{\partial h}\cdot\frac{\partial h}{\partial m}\cdot\frac{\partial m}{\partial p} \quad <0 \text{ if } \frac{\partial m}{\partial p} <0$$

So medical care per birth and the percentage of low risk births increase as programs become accessible which lower the cost of medical care, if fixed costs are greater than the costs of averting a birth. Thus the infant mortality rate would once again be reduced.

Another variable which affects medical costs is the density of physicians per capita. A large number of doctors per capita would tend to lower the price of a birth, as competition sets in. This would imply, then, that in these areas infant mortality rates would be lower than in other areas. The presence of many physicians could also lower the fixed cost of a birth, by reducing waiting time for physician check-ups, for example. Lower fixed costs could make the first derivative positive as fixed costs became less than the cost of fertility control. Thus areas with a high density of physicians should experience a lower price for medical care. In the empirical sections, the number of physicians per capita is used to represent this effect.

Education is a variable that, as referred to earlier, tends to make the simple model more complex. Economists such as Michael (1972) and Grossman(1972) assume more educated persons are more efficient producers of commodities providing utility, where efficient can be used to mean either more output per unit of input, or a higher quality output. Lewit (1977) argued that education works through affecting the marginal products of the inputs. Hence, it would change the mix of inputs for a given output. Lewit states that the net effect of education on commodities producing utility is indeterminate.

Assume initially that education changed the marginal products of the inputs in the production function. Then represent $m^*=f(e)m$ as the effective units of medical care for a given number of years of schooling. Let P^* equal the effective price of a unit of medical care and assume that $p^*=\frac{p}{f(e)}$ so that education lowers the cost of m^* if $\frac{\partial f(e)}{\partial e} > 0$.

As Jacobowitz has shown, one can use the result obtained for the effect on the price of medical care and rewrite it slightly to yield:

$$\frac{\partial m^*}{\partial p^*} = \frac{-p^{*-2}(f-g)}{\pi(h)\{\pi_h h_{m^*}\}^{-2}\pi_{m^*m^*}}$$

$$\frac{\partial h}{\partial p^*} = \frac{\partial h}{\partial m^*}\cdot\frac{\partial m^*}{\partial p^*} = \frac{-\pi(h)\pi_h{}^2 h_{m^*}{}^3(f-g)}{p^{*2}\pi_{m^*m^*}} < 0$$

then multiply $\frac{\partial h}{\partial p^*}$ by $\frac{\partial p^*}{\partial e}$ or $-pf'ef(e)^{-2}<0$ to get

$$\frac{\partial h}{\partial e} = \frac{\partial h}{\partial p^*} \cdot \frac{\partial p^*}{\partial e} = \frac{\pi(h)\pi_h{}^2 h_m{}^3 (f-g)}{p^{*2}\pi_{m^*m^*}} \cdot \frac{pf'(e)}{f(e)^2}$$

$\frac{\partial h}{\partial e}$ >0 since h_{p^*} <0 and $\frac{\partial p^*}{\partial e}$ <0

So if education is viewed as affecting the productivity of all units equally, then m^*,h and π will all increase. Since $\frac{\partial m^*}{\partial e} = \frac{\partial m f(e)}{\partial e} + mf'(e)$, the effect on m- the actual units of medical care demanded- is uncertain, since

$$\frac{\partial m}{\partial e} = \frac{\frac{\partial m^*}{\partial e} - mf'(e)}{f(e)}$$

It depends on whether the productivity increase (mf'e) is sufficient to meet the new demand for m^* $\left(\frac{\partial m^*}{\partial e}\right)$.

It can also be argued that education may affect reproductive efficiency, although some economists (Lewit 1977) tend not to view an education effect that way. An increase in years of schooling, holding expenditures constant, could affect the number of low-risk birth infants (h_0). This change in reproductive efficiency could come about as education makes a woman a more efficient producer of her own health before conception, for example. It could also come about because education changes the demand for medical services. Thus there is a direct effect of education on the production of low-risk births and an indirect effect through its effect on medical services demanded. If reproductive efficiency and h_0 are raised by education, it follows that $\frac{\partial h}{\partial m}$ will have to fall at some point because the probability of low-risk births asymptotically approaches 1. The demand for medical services is lowered because the same amount of h requires less m. If $\frac{\partial h}{\partial m}$ (the marginal product of m on h) is reduced consistently, it has the same effect as an increase in p^*. Less m will be demanded, but endowment increases. If the marginal product declines more as more m is used, there is an even greater incentive to substitute away from quality to quantity.

All of these separate effects makes the education variable's effect on the demand for medical care ambiguous.

Uncertainty

There are many risks in having a child, some of which are and some of which are not under a woman's control. How a family deals with previous experience in the formation of expectations about the current birth should not be ignored.

The groundwork for this approach has been laid down by Ben Porath (1973) and Welch (1973) both singly and jointly. The basic approach is to study uncertainty as a learning process. A family[9] begins with some expectation of h_o. With experience, it may decide to alter its initial values or choose to keep them the same, no matter what the past results of h were.

Assume a family had an unhealthy birth outcome, such as a low-birth weight baby, and that it does not learn (or alter its expectations) about future births. The family will experience a utility or real income loss due to the unhealthy outcome. Family members will, in the next period, again optimize their utility given this new lower income constraint. The lost utility or income will be spread throughout all consumption by family members, nominal income may or may not change, the consumption of purchased goods decreases, so the number of births should increase. If medical expenditures are a normal good, and if no learning occurs, expenditures per birth should also fall.

Now consider a family that does change its expectations after a certain outcome. An unhealthy outcome would tend to cause a family to lower its expectation of reproductive efficiency. This effect was discussed earlier in terms of education. In general, medical expenditures on future births will rise, to compensate for the lowered reproductive efficiency. This rise is contrary to the income loss effect, in which medical expenditures would fall, and hence the final effect on medical expenditures and birth outcomes is ambiguous.

In the model tested in this paper, lagged mortality is included in the production-demand function as an exogenous variable. It would have been preferable to use the lagged specific birth outcome studied (lagged endogenous variable), but data were not available. This lagged rate might represent a learning effect which would directly affect the current birth outcome, aside from just being representative of missing variables.

General Utility Function and Empirical Specification

The theory encompassing the added effects of education and uncertainty indicate that previous health outcomes can affect the utility function. A more general utility function is clearly required.

$$U = u(X, \pi(h) \cdot b, \mu(h) \cdot b, h_m(M, RE, E))$$

In this expanded utility function, utility is also affected by the number of births that were unhealthy birth outcomes ($\mu(h) \cdot b$). Also affecting utility is the health status of the mother, which has several dimensions, one being her reproductive efficiency, another is her knowledge of nutrition.

In this utility function, income may have an effect on health outcome and the survival probability. As income rises parents realize that they can increase utility by reducing unhealthy birth outcomes, or by increasing the health of the mother. These changes could be achieved through increased expenditures for medical care.

To estimate this type of model, one should estimate the production functions for the health outcomes, and the input demand functions for the variables affecting the production functions. This procedure was not practical because of data limitations. The fitted health outcome equations are a mixture of demand and production functions. They contain, for example, such variables as policy variables and medical inputs (from the production function) and education and income (from the input demand functions).

A cross sectional regression analysis was performed for this model. For this type of analysis, a cross sectional regression has some very desirable properties. It holds the state of the art in neonatology constant. It also avoids the problems of multicollinearity that would certainly arise in a time series regression for the U.S. It allows us to study the differential effects of the policy variables on the different health outcomes at a moment in time. The result of this analysis is a set of impact coefficients, net of such determining variables as poverty, schooling, the availability of physicians and the changing knowledge of neonatology.

In examining the results of such an equation, one cannot look at the "pure" effects. Since this type of equation is neither a production nor a demand equation, the roles of some of the variables are changed. For instance, income or some other poverty measure in this model does not yield a pure effect. It is included in part to represent some other omitted variables, such as mother's nutritional intake while pregnant and smoking. These latter variables have a direct effect on the production of positive outcome births, but the data are not available for this study. Since a variable such as income could affect the quality of nutrition or the decision to smoke, one or more representative variables (income, education, or both) are included in the final equation.

FOOTNOTES

9) Whereas family is used here with the underlying assumption of an agreement between a man and a woman, the theory does also hold for a single mother.

CHAPTER IV -- DATA

DATA SOURCES

The data used in this study were compiled from two different data sources: 1) The Urban Institute's expanded version of the Area Resource File (ARF), 2) a tape created by Grossman and Jacobowitz (GJ) (see same 1979,1981)

The Area Resource File is a county-based data file containing various types of information from diverse sources for 3,078 counties of the United States. The demographic and socioeconomic characteristics are taken from the 1970 Census of Population. Deaths by age, race and sex for the years 1969-1976 were obtained from the National Center for Health Statistics (NCHS) Mortality Tapes. Birth data reported both on the ARF and the expanded Urban Institute File by race, weight, age and educational level of the mother came from the NCHS Natality Tape. Physician and hospital facilities data came from the American Medical Association, the American Hospital Association, and other sources.

The Grossman and Jacobowitz tape added public policy variables to the Urban Institute tape. The presence of an M&I clinic and the use of family planning clinics are county based, but Medicaid and abortion data were reported statewide.

In this study, I have used county data rather than aggregating to the Standard Metropolitan Statistical Area

(SMSA) or even the state as the unit of observation. SMSA's tend to be very large and extremely heterogenous. Family income, schooling levels, medical resources, and public policies can have a wide range of variability within an SMSA. The use of counties, which tend to be more homogenous, is intended to reduce these problems, but using counties does have its share of problems. Smaller counties' health care statistics may not have much value if transportation is available for people to travel to a larger neighboring county. I reduced the problems somewhat (along the lines of GJ) by including only counties with a population of at least 50,000 in 1970, and by using those counties with at least 5,000 blacks in the black regressions. Therefore, only 679 counties are included in the white regressions and 359 counties in the black regressions.

PLAN FOR EMPIRICAL ANALYSIS: DEPENDENT VARIABLES

Separate race-specific regression analyses were performed for the four high risk groups studied here: 1)the percentage of births to women under age 19 2) the percentage of births to women over age 40 3) the percentage of births to babies weighing less than 2500 grams 4) the percentage of births to babies weighing less than 2000 grams.[10] Since twice as many babies born to black women are low-birth weight babies, in a non race-specific regression analysis, one would have to control for this difference, and the control variable would probably be correlated with the poverty and schooling variable. By fitting separate equations for black and white births, I allow the coefficients of the independent variables to vary between races. Thus, this study contains an analysis of eight dependent variables. Division by race is especially useful for seeing the effect of the various public policies described below, most of which are targeted for low-income black and white areas.

Weighted linear regressions are estimated, where the set of weights is the square root of the number of white or black births for the years 1969-1971. Weighting the regressions has the effect of dampening somewhat the random movement or noise in the data.

The estimation centers around the period 1969-1971 because measures for most of the independent variables are reported on the tapes for that period. This is an ideal time frame for use in the study for two reasons: 1) most of the policy variables were in the midst of change at this time and 2) they vary among states. Abortion reform, for instance, was in a state of flux during this period. In 1957, the American Law Institute (ALI) proposed a more liberal set of guidelines for a legal abortion. It took ten years for any state to adopt them. The model law of the ALI states that abortions are legal if the continuance of the pregnancy would gravely impair the physical or mental health of the woman, if the child resulting from the pregnancy would be physically or mentally deformed, or if the pregnancy was the result of rape or incest. In 1967, 4 states enacted new guidelines for a legal abortion. While they used the ALI law to legalize abortion, the new guidelines for abortion were more lenient. By 1970, seven more states had adopted the new abortion laws, four of them passing very liberal laws in which there was no legal restriction on the reason for having an abortion. The New York law also dropped a residency requirement (Center for Disease Control 1971). After 1970, there was no significant changes in abortion laws until 1973, when the Supreme Court ruled that the most restrictive state abortion laws were unconstitutional. So the period 1969-1971 is a prime time frame in which to study the impacts of abortion reform on high-risk births.

MEASUREMENT OF INDEPENDENT VARIABLES

The number of active non-federal physicians per thousand population (TDOCTORS) is used to represent the price and availability of medical care. The number of hospital beds and the number of premature nursery beds (HOSPPC,PMNURSPC) are used to represent the state of the art in medicine[11]. The roles of family income (MINCOME) and education levels (MSCHOOL) were previously discussed.

The policy variables studied here are Medicaid coverage for prenatal and perinatal care services, Maternal and Infant Care projects (M&I), the use of organized family planning clinics by low-income women, and abortion reform. In the case of Medicaid prenatal and obstetrical care services, there is a wide variation in the treatment of first pregnancies by states. The coverage is based upon each state's Aid to Families with Dependent Children (AFDC) programs. Nineteen states give no coverage to first time pregnancies because their AFDC program does not cover unborn children. In 1970, Alaska and Arizona did not have any Medicaid programs. The treatment of Medicaid in this study is handled by three dummy variables (M1,M2,M3). M1 equals one for counties in states that provide coverage to all financially eligible women. M2 equals one for counties in states that cover first-time pregnancies only if no husband is present, M3 equals one for counties in states that cover first-time pregnancies if no husband is present or is present but unemployed and not receiving unemployment insurance. The omitted category was the counties in the nineteen states that cover no first time pregnancies.

Since coverage for the first unborn child varies, it would be useful to know the percentage of the dependent variables (low-birth weight, births to teenage and older women) that were first time births. However, no such data exist. One can make the assumption that the probability of a first time birth is greater in young than older women, and therefore test the importance of those variables between the two cases.

The presence of a M&I project in a county in 1971 is denoted by the dichotomous variable MIDUMMYV. The M&I program was relatively small in 1971 when there were only

53 projects throughout the country. Therefore, an additional variable was included to represent the total effect. The second variable (PMIBIRTH) is the number of births in an M&I project in 1971 as a percentage of the "estimated" number of births to low income women. Data on births to low income women were not reported anywhere. Grossman and Jacobowitz had to estimate this variable by regressing the race-specific birth rate in a given county on the fraction of families (not race-specific) with incomes below the poverty level. This is the variable used in the present study.

As with the other public policies described above, the presence of family planning services varies among counties and states. The variable used here is the percentage of women ages 15-44 with ffamily incomes equal to or less than 150 percent of the poverty level served by an organized family planning clinic in fiscal 1971 (UFAMPLAN). These clinics are organized through hospitals, state and local health departments, Planned Parenthood and other agencies. This variable was created from a survey completed by the National Center for Health Statistics and the technical assistance division of Planned Parenthood, now known as the Alan Guttmacher Institute. (Center for Family Planning Program Development 1974). This variables does not include family planning services to low-income women by private physicians. The other measure of health care (TDOCTORS) is a representation of this missing piece of data.

The measurement of the use of abortion is indeed less than optimal because of numerous data limitations. Ideally for this study one would want legal abortion rates by county from July 1968 through June 1971, from which an average abortion rate per county could be derived for the period studied in this paper.

$$\bar{a}_j = (a_i 68\text{-}2 + a_i 69\text{-}1 + a_i 69\text{-}2 + a_i 70\text{-}1 + a_i 70\text{-}2 + a_i 71\text{-}1)/6$$

where i denotes the i^{th} county. It is assumed here that abortions performed affect the endogenous variable (birth outcome variable) one half year later. Thus 1968-2 would be required for an abortion variable covering 1969-1971.

There were two problems: first, county abortion rates were not available, although state rates were. Secondly, reported data on the tapes used begin in July 1970. Therefore, I decided to define a variable that would attempt to measure the abortion rate for 1970. Since truly significant reforms occurred during the year 1970, I assume that the second half of 1970 showed a rapid growth in legal abortions performed. Hence the rate can be represented as follows:

$$AR_{70.2} = 1.5 * AR_{70.1}$$

where $AR_{70.1}$ (70.2) is the abortion rate for the first (second) half of 1970

therefore

$$AR_{1970} = .5 * \frac{AR_{70.2}}{1.5} + .5 * AR_{70.2} = 5/6 * AR_{70.2}$$

In the absence of a "correctly" defined abortion rate variable, a second abortion variable was defined as a substitute. It is the dichotomous variable RAD, which was defined as 1 for counties in states that had changed their laws by the middle of 1970, and 0 for all others. Both variables performed quite well.

The final variable used in the regressions is a three year average of the infant mortality rate for the years 1966-1968 (IMORT3YR). The purpose of a lagged variable is to control for unmeasured variables and/or variables correlated with other independent variables. The policies included in this study have been designed and implemented in areas with poor health statistics. This affects the interactvie relationship between the policies and the percentage of high-risk births. Without the inclusion of a lagged effect, the large value of the percentage of high-risk births would tend to bias the coefficients on the policy variables toward zero. Ideally, the lagged effect should be the lagged dependent variable in each equation. However, the lagged data by high-risk birth category are not contained in the ARF tape. Since all the high-risk groups directly affect infant mortality, the lagged infant mortality rate is the variable used. Results are shown with and without this variable.

TABLE 1

DEFINITION OF VARIABLES

VARIABLE	DEFINITION
PWW(B)19(40)	Percentage of white (black) births to women less than 19 (older than 40) yrs. average for years 1969-1971
PBW(B)L2500(2000)	Percentage of white (black) births less than 2500 (2000) grams. average for years 1969-1971
MINCOMEW(B)	Median family income white (black) for 1969
MSCHOOLW(B)	Median years of schooling white (black) for 1970
MIDUMMYV	Presence of an M&I project in a county in 1971
PMIBIRTH	Number of births in an M&I project as a percentage of the number of births to low income women
M1	0,1 dummy representing states that provide Medicaid coverage to all financially eligible women
M2	0,1 dummy representing states that provide Medicaid coverage if no husband is present
M3	0,1 dummy representing states that provide Medicaid coverage if no husband is present or is present and unemployed and not receiving compensation
PFAMPLAN	Percentage of women in poverty served by family planning clinics in 1971
ABORT70	"Estimated" 3 year average of the state specific abortion rate center on 1970

TABLE 1 (CONT'D)

VARIABLE	DEFINITION
RA	0,1 dummy representing states that reformed abortion laws by June 1970
TDOCTORS	Active non-federal physicians practicing in 1971
HOSPPC	Total number of hospitals per capita in 1968
PMNURSPC	Number of hospitals with premature nurseries in 1974
IMORT3YR	3 year average of the infant mortality rate for 1966-1968 not race or age specific

TABLE 2

WEIGHTED MEANS AND STANDARD DEVIATIONS OF VARIABLES USED IN ANALYZING WHITE BIRTHS

VARIABLE	MEAN	STANDARD DEVIATION
PWWL19	8.477	2.678
PWWG40	1.376	0.423
PBWL2500	7.200	0.920
PBWL2000	2.250	0.304
MINCOMEW	10596.171	1675.608
MSCHOOLW	12.063	0.652
MIDUMMYV	0.274	0.446
PMIBIRTH	0.254	0.506
M1	0.389	0.487
M2	0.085	0.279
M3	0.139	0.346
PFAMPLAN	31.314	22.501
ABORT70	57.981	66.681
RA	0.252	0.434
TDOCTORS	1.544	1.004
HOSPPC	.00002	.00003
PMNURSPC	0.010	0.006
IMORT3YR	34.326	5.496

The weight is the square root of the number of white births for the years 1969-1971

TABLE 3

WEIGHTED MEANS AND STANDARD DEVIATIONS OF VARIABLES USED IN ANALYZING BLACK BIRTHS

VARIABLE	MEAN	STANDARD DEVIATION
PWBL19	22.417	3.921
PWBG40	1.409	0.404
PBBL2500	13.962	1.366
PBBL2000	5.290	0.724
MINCOMEB	6587.607	1841.611
MSCHOOLB	10.234	1.228
MIDUMMYV	0.521	0.500
PMIBIRTH	0.521	0.714
M1	0.261	0.439
M2	0.153	0.360
M3	0.132	0.338
PFAMPLAN	42.653	20.150
ABORT70	49.537	59.854
RA	0.249	0.432
TDOCTORS	1.984	1.225
HOSPPC	.00002	.00002
PMNURSPC	.00915	.00549
IMORT3YR	38.953	6.044

The weight is the square root of the number of black births for the years 1969-1971

FOOTNOTES

10) Included in these low-birth weight numbers is twin births. Ideally, these should be taken out for this analysis, however the data did not exist. Also twin births account for only a small part of all births and low-birth weight births.

11) Here I am assuming that the more hospitals and premature nurseries a locality has, the better is the state of the art in medicine and neonatology.

CHAPTER V -- EMPIRICAL RESULTS AND CONCLUSIONS

Eight different dependent variables are studied here 1) the percentage of births to women (black and white data studied separately) less than 19 years old, 2) the percentage of births to women (black and white data studied separately) over 40 years old, 3) the percentage of births (black and white data studied separately) weighing less than 2500 grams, 4) the percentage of births (black and white data studied separately) weighing less than 2000 grams. The regression results are organized so as to show, for each regression, the influence of including or omitting a lagged effect, using one or the other measure of abortion, and to consider the effect of schooling and/or income on the dependent variables and the policy variables.

PART 1: RISK GROUPS BASED ON AGE

The first group to be discussed is the ordinary least square regressions performed on the risk groups of older (over 40 years) and teenage (less than 19 years) women having children. These results establish a clear difference in the two age groups as far as public policy is concerned. They indicate that Medicaid coverage of obstetrics and gynecology and M&I clinics are effective policies for lowering the percentage of teenage births. Abortion law changes is not as effective for this risk group. Older women, however, are more responsive to shifts in abortion policy and to the presence of a family planning clinic in the area.

The variable median income had the anticipated negative sign in both equations for teenage mothers. For older women, the effect was positive for both equations. Since this is not a "pure" income effect, it appears that income is substituting for missing variables as explained earlier.

The schooling effect sheds light on the ambiguity question raised earlier. In all four equations, the effect was negative and significant. In the young white equation, schooling and income cannot be entered together as the correlation is high, and therefore the sign and significance of the schooling variable is turned around. In the three other groups, the two variables can be entered together without changing the results of the other variables. These results concur with the intuition that more schooling would reduce the percentage of women having children if they were informed as to the risks involved for their age group.

The availability and price of medical care variables (TDOCTORS,HOSPPC,PMNURSPC) perform considerably well if one takes into account the fact that they are highly correlated. In three out of the four equations, two of the three variables had the anticipated negative sign. These are only quantitative measures and cannot represent actual quality differences among counties. For teenage mothers variables for the number of doctors and hospital beds were negative, which did not hold for older women. However, the majority

TABLE 4

EMPIRICAL RESULTS FOR THE PERCENT OF BIRTHS TO WHITE WOMEN $\leq$ 18 YRS OLD

INDEPENDENT VARIABLE	EQUATIONS (1)	(2)	(3)	(4)
MINCOMEW		-.0009 (-17.3)	-.001 (-29.8)	-.001 (-20.1)
MSCHOOLW	-.483 (-3.4)			
MIDUMMYV	-.796 (-2.3)	-.849 (-2.9)	-.530 (-1.8)	-.437 (-1.6)
PMIBIRTH	-.115 (-0.5)	0.032 (-0.2)	-.040 (-0.2)	-.083 (-0.4)
M1	-1.585 (-6.0)	-2.085 (-9.3)	-2.380 (-10.8)	-1.831 (-10.4)
M2	-.151 (-0.5)	-.545 (-2.0)	-.483 (-1.7)	-.969 (-3.6)
M3	-.071 (-0.3)	-.282 (-1.2)	-.505 (-2.2)	-.664 (-3.0)
PFAMPLAN	0.013 (2.6)	0.017 (3.8)	0.019 (4.2)	0.018 (4.2)
ABORT70	0.010 (5.7)	0.011 (7.4)	0.010 (6.8)	
RA				1.768 (10.4)
TDOCTORS	-.474 (-4.4)	-.257 (-2.8)	-.215 (-2.3)	-.175 (-2.0)
HOSPPC	18741.0 (4.9)	-1343.0 (-0.4)	-1786.0 (-0.5)	-2513.7 (-0.8)
PMNURSPC	32.500 (2.0)	5.720 (0.4)	6.323 (0.5)	3.035 (0.2)
CONSTANT	8.976 (4.4)	15.846 (16.8)	19.636 (32.2)	19.328 (33.0)
IMORT3YR	0.152 (8.1)	0.082 (5.2)		
R^2	.32	.53	.51	.55
F TEST	26.6	61.7	62.4	73.1

t ratios in parentheses 1.64 is the critical value at the 5% level for a one tailed test

TABLE 5

EMPIRICAL RESULTS FOR THE PERCENT OF BIRTHS TO BLACK WOMEN $\leq$ 18 YRS OLD

INDEPENDENT VARIABLE	EQUATION (1)	(2)	(3)	(4)	(5)	(6)
MINCOMEB	-.0004 (-2.3)	-.0003 (-2.3)	-.0005 (-3.2)	-.0005 (-3.3)		
MSCHOOLB	-1.213 (-5.0)	-1.204 (-5.2)	-.889 (-3.8)	-.952 (-3.9)	-1.262 (-5.6)	-1.434 (-6.4)
MIDUMMYV	-1.106 (-1.7)	-1.125 (-1.8)	-.791 (-1.3)	-.645 (-1.0)	-.702 (-1.1)	-1.176 (-1.8)
PMIBIRTH	0.484 (1.2)	0.487 (1.2)	0.190 (0.8)	0.167 (0.4)	0.100 (0.3)	0.467 (1.2)
M1	-2.716 (-5.1)	-2.709 (-5.1)	-1.166 (-1.8)	-1.180 (-1.8)	-1.224 (-1.8)	-2.692 (-5.0)
M2	-2.445 (-4.0)	-2.441 (-4.0)	-2.391 (-4.0)	-2.420 (-4.0)	-1.664 (-3.0)	-1.916 (-3.4)
M3	1.052 (1.8)	1.052 (1.8)	1.794 (2.0)	1.794 (3.1)	1.506 (2.6)	0.811 (1.4)
PFAMPLAN	0.018 (1.6)	0.018 (1.1)	0.022 (2.0)	0.023 (2.0)	0.022 (1.9)	0.017 (1.5)
ABORT70			-.018 (-3.7)	-.018 (-3.8)	-.017 (-3.5)	
RA	0.754 (1.8)	0.761 (1.8)				1.059 (2.6)
TDOCTORS	-.101 (-0.5)	-.105 (-0.5)	-.140 (-0.8)	-.111 (-0.6)	-.070 (-0.4)	-.062 (-0.3)
HOSPPC	-22635.0 (-2.0)	-22784.0 (-2.0)	-13945.0 (-1.3)	-12873.5 (-1.2)	-7005.0 (-0.6)	-19846.5 (-1.8)
PMNURSPC	44.266 (1.2)	44.141 (1.2)	10.004 (0.3)	10.661 (0.3)	19.330 (0.5)	51.705 (1.5)
CONSTANT	37.733 (12.6)	37.506 (17.2)	35.677 (16.2)	37.357 (12.7)	37.031 (12.7)	37.288 (12.4)
IMORT3YR	-.0038 (-0.1)			-.029 (-0.9)	-.027 (-0.7)	.00067 (0)
R^2	.381	.381	.399	.401	.382	.372
F TEST	16.3	17.8	19.2	17.7	17.8	17.1

t ratios in parentheses 1.64 is the critical value at the 5% level for a one tailed test

TABLE 6

EMPIRICAL RESULTS FOR THE PERCENT OF BIRTHS TO BLACK WOMEN OVER 40 YEARS OLD

INDEPENDENT VARIABLE	EQUATION (1)	(2)	(3)	(4)	(5)	(6)
MINCOMEB	.00002 (1.0)					.00002 (1.0)
MSCHOOLB	-.089 (-3.0)	-.078 (-2.9)	-.068 (-2.7)	-.086 (-3.3)	-.072 (-3.0)	-.080 (-2.9)
MIDUMMYV	.123 (1.6)	.125 (1.6)	.105 (1.4)	.138 (1.9)	.110 (1.5)	.103 (1.4)
PMIBIRTH	.019 (0.4)	.022 (0.5)	.025 (0.5)	.005 (0.1)	.009 (0.2)	.002 (0.5)
M1	.083 (1.0)	.084 (1.1)	.087 (1.1)	.023 (0.4)	.033 (0.5)	.085 (1.1)
M2	.117 (1.6)	.089 (1.3)	.093 (1.4)	.105 (1.6)	.110 (1.7)	.121 (1.7)
M3	-.089 (-1.3)	-.079 (-1.2)	-.079 (-1.1)	-.070 (-1.1)	-.068 (-1.0)	-.089 (-1.3)
PFAMPLAN	-.004 (-3.0)	-.004 (-3.0)	-.004 (-3.0)	-.004 (-2.7)	-.004 (-2.7)	-.004 (-3.0)
ABORT70	-.0008 (-1.4)	-.0008 (-1.5)	-.0008 (-1.3)			-.0008 (-1.3)
RA				-.197 (-4.1)	-.188 (-4.0)	
TDOCTORS	-.008 (-0.4)	-.010 (-0.5)	-.014 (-0.6)	-.017 (-0.8)	-.022 (-1.0)	-.012 (-0.6)
HOSPPC	2509.3 (1.9)	2295.1 (1.8)	2138.9 (1.7)	3180.4 (2.5)	2949.1 (2.3)	2360.9 (1.8)
PMNURSPC	-5.40 (-1.3)	-5.70 (-1.3)	-5.80 (-1.4)	-5.90 (-1.4)	-6.11 (-1.5)	-5.40 (-1.3)
CONSTANT	2.500 (7.1)	2.512 (7.1)	2.270 (8.6)	2.658 (7.7)	2.320 (9.2)	2.270 (8.6)
IMORT3YR	-.004 (-1.0)	-.004 (-1.0)		-.006 (-1.4)		
R^2	.19	.18	.18	.22	.21	.18
F TEST	6.11	6.54	7.04	8.10	8.62	6.54

t ratios in parentheses 1.64 is the critical value at the 5% level for a one tailed test

TABLE 7

EMPIRICAL RESULTS FOR THE PERCENT OF BIRTHS TO WHITE WOMEN OVER 40 YEARS OLD

INDEPENDENT VARIABLE	EQUATION (1)	(2)	(3)	(4)	(5)	(6)
MINCOMEW	.00008 (6.5)	.00008 (7.1)	.00009 (7.5)	.00008 (6.9)		.00001 (1.0)
MSCHOOLW	-.310 (-12.2)	-.296 (-11.8)	-.315 (-12.3)	-.328 (-12.6)	-.242 (-10.2)	
MIDUMMYV	0.040 (0.7)	0.014 (0.3)	0.009 (0.2)	0.035 (0.6)	0.043 (0.7)	0.114 (1.8)
PMIBIRTH	0.034 (0.9)	0.038 (1.0)	0.048 (1.2)	0.043 (1.1)	0.046 (1.1)	-.010 (-0.2)
M1	0.207 (5.9)	0.239 (7.2)	0.281 (6.8)	0.254 (6.0)	0.216 (5.0)	0.253 (5.4)
M2	-.100 (-2.0)	-.108 (-2.1)	-.172 (-3.3)	-.165 (-3.2)	-.199 (-3.7)	-.194 (-3.4)
M3	-.010 (-0.2)	0.012 (0.3)	-.021 (-0.5)	-.042 (-0.9)	-.057 (-1.3)	-.041 (-0.8)
PFAMPLAN	-.0033 (-4.2)	-.0035 (-4.4)	-.0038 (-4.6)	-.0036 (-4.3)	-.0033 (-5.2)	-.0037 (-4.6)
ABORT70			-.001 (-3.4)	-.001 (-3.6)	-.001 (-3.4)	-.001 (-4.0)
RA	-.240 (-7.4)	-.236 (-7.3)				
TDOCTORS	0.044 (2.6)	0.039 (2.3)	0.046 (2.7)	0.050 (2.9)	0.063 (3.6)	0.032 (1.7)
HOSPPC	-1536.4 (-2.6)	-1540.7 (-2.4)	-1564.6 (-2.4)	-1562.9 (-2.4)	-3230.6 (-5.2)	-2647.8 (-3.7)
PMNURSPC	6.98 (2.8)	6.79 (2.7)	6.81 &2.6)	6.95 (2.7)	4.61 (1.8)	4.71 (1.7)
CONSTANT	4.59 (14.6)	4.09 (15.9)	4.23 (16.0)	4.71 (14.6)	4.71 (14.1)	1.32 (6.7)
IMORT3YR	-.008 (-2.8)			-.008 (-2.6)	-.012 (-3.8)	-.0005 (-0.1)
R^2	.36	.35	.31	.32	.27	.16
F TEST	28.8	30.3	25.3	24.0	20.6	10.4

t ratios in parentheses 1.64 is the critical value at the 5% level for a one tailed test

of negative results is important.

The public policy variables also resulted in a fair number of anticipated negative signs, and also some clear distinctions as to the policies' effect on these groups. Maternal and Infant Care projects are represented by two variables. The number of births in an M&I project was almost never negative and could be deleted in future work. The variable which indicates the presence of an M&I project was negative and significant for teenage mothers, while positive for older mothers. It is an interesting finding that this public policy has such a major impact on teenage births, especially for white teenage births where abortion reform has no effect.

The presence of a family planning service had its effect on older women having children. For all race-specific equations of women over 40 the coefficient was negative, significant and extremely stable. In addition, the magnitude of the coefficient was the same for whites and blacks. This variable was positive and significant in all equations for teenage mothers. These services are reported to be used greatly by both older and teenage mothers. The positive result for teenage births is therefore disturbing. The correlation was high between this variable and the M&I clinic variable, which may explain the positive relationship for teenage mothers.

In examining the effect of Medicaid coverage of obstetrics one can also see that there was a disparity in significance between births to teenage vs. older women. For teenage mothers, both black and white, Medicaid coverage produces significant downward pressure on the percentage of births. For women over 40, it was almost always positive and insignificant. For white women over 40, coverage when no husband is present and coverage when a husband is present but unemployed and not receiving unemployment insurance had the correct negative sign, with the former being significant. For black women over 40, the coverage when the husband is present but unemployed and not receiving unemployment insurance is negative but it is not significant at the 5 percent level.

One point to be noted at this time is that another high correlation exists between M1, the most liberal coverage, and the abortion reform variables. This is not surprising since states that offer more liberal coverage for first time births would probably tend to have more liberal abortion laws. When abortion was removed from the equation, for older white women the sign on M1 became negative.

The last policy variable to consider is abortion reform. Again this policy points to a different reaction among the risk groups studied here. For all women over 40, both measures perform well, resulting in the anticipated negative sign. The abortion rate is not significant at the 5 percent level for black women over 40, but it is significant at the 10 percent level. For teenage mothers, the abortion variables are almost always positive, except for the abortion rate for young black women. Abortion reform, therefore, does not seem to have much of an effect on teenage births.

The last variable used in these regressions is the lagged infant mortality rate. This term seems to be representative of a race-specification problem, as it is significant in the white regressions but not in the black ones. The equations are shown with and without the lagged term. For the white regressions in which the lagged term was significant, the omission of this variable had no effect on any of the other variables studied, notably not on any policy variable. It was hypothesized that without the lag, the policy variables might be biased toward zero due to the fact that policies are often enacted in high-risk areas, or due to inexact measurement.

PART II: LOW BIRTH WEIGHT REGRESSIONS

The last four sets of regressions were the low-birth weight regressions. Low-birth weight is defined as a birth of less than 2500 grams (approximately 5 pounds). I studied births less than 2500 grams and births less than 2000 grams. The study of low-birth weight in the economic and medical literature has revealed that it is associated with, among other things, prematurity, the age of the mother, race--with black women giving birth to lower weight babies than whites, short interpregnancy interval, smoking, and no prenatal care. Both low-birth weights were studied here to see if the highest-risk group (<2000 gms) had a different reaction to policies than the <2500 gms group.

These results are shown on the following four pages. Again weighted ordinary least squares analysis was performed for the percentage of race-specific low-birth weight births and very low-birth weight births. In examining the empirical results, one must keep in mind that there is a large disparity between white and black low-birth weight data. The incidence of black low-birth weight babies is almost twice that for whites. That being the case, the policy variables should more strongly affect the black population studied here because they are the target group for the policies. This is exactly what did happen

In examining the income variable, the white equations were responsive to the income measure with the coefficient being negative and significant. The black equations were totally unresponsive to any measure of income, always being positive and insignificant, and therefore not reported here. The efficiency variable, mean years of schooling, worked well in three of the four groups. In these equations, the results agree with the intuitive "negative" response, and were significant. Only for the group of black births less than 2000 grams was this not true. For that group no income or efficiency variable was significant.

The significant measure of the cost and availability of

TABLE 8

EMPIRICAL RESULTS FOR THE PERCENT OF WHITE BIRTHS <2000 GMS

INDEPENDENT VARIABLE	EQUATION (1)	(2)	(3)	(4)
MINCOMEW		$-1.9e^{-7}$ (-2.4)	$-1.7e^{-7}$ (-2.2)	$-3.9e^{-8}$ (-5.0)
MSCHOOLW	-.0007 (-4.2)			
MIDUMMYV	-.0003 (-0.6)	-.00009 (-0.2)	.000007 (0)	.0008 (1.7)
PMIBIRTH	.0005 (1.6)	.0004 (1.2)	.0003 (1.0)	.0001 (0.4)
M1	-.0004 (-1.4)	-.0004 (-1.5)	-.00002 (-0.1)	-.0007 (-2.2)
M2	.00005 (0)	.000005 (0)	-.0002 (-0.5)	-.00007 (-0.2)
M3	.0008 (2.4)	.0008 (2.4)	.0008 (2.4)	.0003 (0.3)
PFAMPLAN	-.000002 (-0.4)	-.000002 (-0.4)	-.000002 (-0.3)	.000003 (0.4)
ABORT70			-.000007 (-3.1)	-.000008 (-3.7)
RA	-.0007 (-2.7)	-.0008 (-3.2)		
TDOCTORS	.0004 (3.4)	.0004 (3.1)	.0004 (3.2)	.0005 (3.8)
HOSPPC	-2.12 (-0.5)	-5.14 (-1.0)	-5.52 (-1.1)	-6.58 (-1.3)
PMNURSPC	.0037 (0.2)	-.002 (-0.1)	-.005 (-0.3)	0.004 (0.2)
CONSTANT	.025 (10.0)	.017 (12.7)	.017 (12.7)	.026 (28.0)
IMORT3YR	.0002 (8.1)	.0002 (8.6)	.0002 (8.5)	
R^2	.243	.230	.230	.140
F TEST	17.8	16.5	16.4	10.2

t ratios in parentheses 1.64 is the critical value at the 5% level for a one tailed test

TABLE 9

EMPIRICAL RESULTS FOR THE PERCENT OF WHITE BIRTHS <2500 GMS

INDEPENDENT VARIABLE	EQUATION (1)	(2)	(3)	(4)	(5)
MINCOMEW	-.000001 (-4.6)	$-6.4e^{-7}$ (-2.4)	-.000001 (-4.5)	-.000001 (-7.1)	-.000002 (-7.3)
MSCHOOLW		-.002 (-3.3)			
MIDUMMYV	-.0012 (-0.9)	-.0016 (-1.3)	-.0012 (-0.9)	.0009 (0.7)	.0007 (0.6)
PMIBIRTH	.0022 (2.4)	.002 (2.7)	.002 (2.3)	.002 (1.8)	.002 (1.9)
M1	.0007 (0.8)	.0011 (1.2)	.0011 (1.3)	-.0007 (-0.8)	-.0015 (-1.8)
M2	.001 (1.0)	.0009 (0.7)	.0007 (0.6)	.001 (0.9)	.0017 (1.3)
M3	.004 (4.0)	.004 (3.9)	.004 (3.8)	.003 (2.4)	.003 (2.6)
PFAMPLAN	.000009 (0.5)	.000008 (0.4)	.000008 (0.4)	.00002 (1.0)	.00002 (1.1)
ABORT70		-.000007 (-1.1)	-.000009 (-1.3)	-.00001 (-2.0)	
RA	-.002 (-2.3)				-.002 (-2.8)
TDOCTORS	.0015 (3.8)	.0017 (4.2)	.0016 (3.9)	.0018 (4.4)	.0018 (4.3)
HOSPPC	-40.40 (-2.7)	-34.43 (-2.3)	-41.10 (-2.8)	-43.90 (-2.8)	-42.90 (-2.8)
PMNURSPC	.025 (0.4)	.037 (0.6)	.023 (0.4)	.027 (0.4)	.032 (0.5)
CONSTANT	.063 (15.3)	.083 (11.3)	.063 (15.2)	.087 (31.7)	.087 (31.9)
IMORT3YR	.0005 (7.5)	.0005 (6.8)	.0005 (7.5)		
R^2	.23	.24	.23	.16	.17
F TEST	16.7	16.1	16.3	11.7	12.1

t ratios in parentheses 1.64 is the critical value at the 5% level for a one tailed test

TABLE 10

EMPIRICAL RESULTS FOR THE PERCENT OF BLACK BIRTHS <2500 GMS

INDEPENDENT VARIABLE	EQUATION (1)	(2)	(3)	(4)
MSCHOOLB	-.002 (-2.0)	-.001 (-1.3)	-.002 (-2.3)	-.003 (-3.2)
MIDUMMYV	.003 (1.1)	.004 (1.3)	.005 (2.1)	.005 (1.9)
PMIBIRTH	-.002 (-1.4)	-.003 (-1.5)	-.003 (-1.7)	-.003 (-1.6)
M1	-.003 (-1.5)	.001 (0.5)	.001 (0.4)	-.004 (-1.9)
M2	-.001 (-0.4)	-.0009 (-0.4)	-.001 (-0.5)	-.001 (-0.5)
M3	-.0003 (-0.1)	.0008 (0.4)	.0008 (0.3)	-.0004 (-0.2)
PFAMPLAN	-.00002 (-0.4)	-.00002 (-0.5)	-.00002 (-0.4)	-.00002 (-0.3)
ABORT70		-.00006 (-2.9)	-.00006 (-3.2)	
RA	-.004 (-2.1)			-.004 (-2.5)
TDOCTORS	.002 (3.0)	.002 (3.2)	.003 (3.7)	.003 (3.4)
HOSPPC	-138.4 (-3.0)	-138.7 (-3.1)	-125.0 (-2.8)	-123.2 (-2.7)
PMNURSPC	.126 (0.9)	.070 (0.5)	.078 (0.5)	.140 (1.0)
CONSTANT	.142 (11.7)	.138 (11.3)	.158 (17.3)	.164 (18.3)
IMORT3YR	.0004 (2.6)	.0004 (2.6)		
R^2	.15	.16	.14	.13
F TEST	5.11	5.47	5.30	4.86

t ratios in parentheses 1.64 is the critical value at the 5% level for a one tailed test

TABLE 11

EMPIRICAL RESULTS FOR THE PERCENT OF BLACK BIRTHS <2000 GMS

INDEPENDENT VARIABLE	EQUATION (1)	(2)	(3)	(4)
MSCHOOLB	.0002 (0.4)	.0006 (1.2)	-.00004 (-0.1)	-.0004 (-1.1)
MIDUMMYV	.001 (0.8)	.002 (1.2)	.003 (3.5)	.002 (1.8)
PMIBIRTH	-.001 (-1.3)	-.001 (-1.6)	-.002 (-1.9)	-.001 (-1.5)
M1	-.003 (-3.0)	-.0004 (-0.3)	-.0005 (-0.4)	-.004 (-3.5)
M2	-.002 (-1.5)	-.002 (-1.4)	-.002 (-1.6)	-.002 (-1.7)
M3	-.003 (-2.2)	-.002 (-1.5)	-.002 (-1.5)	-.003 (-2.3)
PFAMPLAN	-.00001 (-0.5)	-.00001 (-0.5)	-.00001 (-0.4)	-.00001 (-0.4)
ABORT70		-.00004 (-3.7)	-.00004 (-4.1)	
RA	-.0014 (-1.6)			-.0018 (-2.1)
TDOCTORS	.001 (2.6)	.001 (2.9)	.001 (3.5)	.001 (3.3)
HOSPPC	-91.1 (-3.9)	-85.5 (-3.7)	-75.5 (-3.2)	-79.5 (-3.3)
PMNURSPC	.061 (0.8)	.017 (0.2)	.024 (0.3)	.072 (0.9)
CONSTANT	.041 (6.5)	.039 (6.2)	.054 (11.4)	.058 (12.3)
IMORT3YR	.0003 (3.8)	.0003 (3.7)		
R^2	.19	.21	.18	.15
F TEST	6.6	7.7	7.0	5.7

t ratios in parentheses 1.64 is the critical value at the 5% level for a one tailed test

medical care throughout these equations was the number of hospital beds per capita. It is consistently negative and significant. However, the number of doctors per capita is always positive and significant in these equations, and therefore the two effects might counteract each other. This positive finding, however, may be indicating that within the counties with better medical care (more physicians per capita) more low-birth weight babies are being born alive.

The social and public policy variables performed well for the equations of the percentage of black low-birth weight births, exceptionally well for black births less than 2000 grams. Six of the seven policy variables for this group were negative and mostly significant. As a group they create a significant negative response to low-birth weight. Based on the age results for whites, I expected that the white equations would have been more responsive than they turned out to be.

The Maternal and Infant Care variable is shown here to be more important in reducing the percentage of low-birth weight for blacks. The number of births in an M&I project is negative for both classifications of low-birth weight, significant and remarkably stable. The presence of the lagged effect does not alter its importance. The other measure of an M&I clinic was positive. For the white low-birth weight equations, quite the contrary occurred. In general, neither measure was significant, except for the classification less than 2500 grams. When the lagged effect is included, the variable PMIC (the presence of an M&I clinic) is negative. When the lagged effect is excluded, the effect of the variable tends toward zero, as was hypothesized earlier. The M&I projects, then, do have an effect in lowering the percentage of low-birth weight babies, especially for black births.

The use of family planning clinics by families with the incidence of income less than 150 percent of the poverty level was not significant in any equation. It did, however, have the anticipated negative sign for every group except white births less than 2500 grams, the group with very little response to public policies.

A major finding of this thesis is that the three measures of the Medicaid payment plan seem to be significant in reducing the percentage of low-birth weight births in blacks, especially for babies weighing less than 2000 grams. As reported earlier, a strong correlation can be shown between the abortion variable and the Medicaid variable M1. For all the groups except the percentage of white births less than 2500 grams, M1 is significant when the abortion dummy is used, but becomes zero when the abortion rate is used. This effect does occur for the white group less than 2500 grams when the lagged effect is excluded from the equation. The Medicaid reimbursement policy is shown here to have a major effect in reducing the percentage of low-birth weight births, especially for black births which are at higher risk.

The last policy variable to be discussed is abortion reform. This is the one policy variable across all the different equations that is consistently negative and significant. For the abortion dummy variable, the coefficient is twice as large for the black equations as compared with the white ones, the same multiple as the occurrence of low-birth weight births. The coefficient for the abortion rate also shows a large difference between blacks and whites, with the effect on black low-birth weight being much higher.

The policy variables in general have the greatest effect on black low-birth weight births. This result is rewarding because the policy variables (excluding abortion) are targeted for that group since the incidence of low-birth weight births is so much higher. The policy variables also seem to affect the very low-birth weight births (less than 2000 grams) more than low-birth weight births. This finding is important since these babies are at higher risk. While obvious important determinants are missing, such as legitimacy status and whether or not the mother smoked during her pregnancy, these results are clearly meaningful and provide useful knowledge for future budget planning.

The last variable included in these equations was the lagged infant mortality rate. Low-birth weight is the most important cause of infant mortality. Hence, this variable acts more like a lagged dependent variable as compared with the age equations. The results are indicative of that. The lagged variable is always significant and is consistently positive and of similar magnitude in the two races. Its exclusion, however, does not alter the significance or sign of the other variables.

CONCLUSION

The results presented in this paper show the importance of the policy variables in reducing high-risk births, holding income and medical variables constant. They point out how different policies are reaching different risk portions of our population to achieve their aim of reducing the neonatal death rate. Abortion reform clearly affects most of the risk groups studied here (seven out of the eight) and as such has the major role in decreasing high-risk births. The other policies do have their purposes. The percentage of teenage births to both black and white women are reduced most by having M&I clinics in the neighborhood and by covering these women under Medicaid. The percentage of births to older women was clearly affected by family planning clinics.

This dissertation has proven that the social and public policies studied are a positive and vital force in the fight against neonatal death. Policy makers should be advised that based on the results in this paper, if these policies are discontinued, the death rate would begin to increase.

REFERENCES

Becker, Gary S. "A Theory of the Allocation of Time." Economic Journal, Vol. 75, No. 299, Sept. 1965

Becker, Gary S. and Lewis, H.G. "Child Endowments and the Quantity and Quality of Children" Journal of Political Economy, Vol. 59, NO. 9, Sept. 1969

Ben-Porath, Yoram and Welch, Finis. "Do Sex Preferences Really Matter?" Quarterly Journal of Economics, Vol. 90, No. 2, May 1976

Bureau of the Census. Statistical Abstract of the United States 1984. Washington, D. C. U.S. Government Printing Office 1985.

Center for Disease Control. Family Planning Evaluation: Abortion Surveillance Report, 1970-1972. U.S. Department of Health, Education and Welfare, Public Health Service, 1971, 1972, 1974.

Eisner, Victor et al. "Improvement in Infant and Perinatal Mortality in the United States, 1965-1973." American Journal of Public Health, Vol. 68, No. 4, April 1978.

Fuchs, Victor R. "Some Economic Aspects of Mortality in Developed Countries." in The Economics of Health and Medical Care, edited by Mark Perlman. London:Macmillan 1974

Gortmaker, Steven L. "Poverty, Race and Infant Mortality in the United States." Institute for Research on Poverty Discussion Paper No. 404-77, University of Wisconsin March 1977

Gortmaker, Steven L. "Poverty and Infant Mortality in the United States." American Sociological Review, Vol. 44 No. 2, April 1979

Grossman, Michael. The Demand for Health: A Theoretical and Empirical Investigation. New York: Columbia University Press for the National Bureau of Economic Research, 1972

Grossman, Michael and Jacobowitz, Steven. "Variations in Infant Mortality Rates Among Counties of the Unites States: The Roles of Public Policies and Programs." Demography, Vol 18, No. 4, Nov. 1981

Jacobowitz, Steven. "Determinants of Variations in Infant Mortality Rates Among Counties of the United States: The Roles of Social Policies and Programs." Ph.D. Dissertation, City University of New York Graduate School, 1981

Kehrer, Barbara H. and Wolen, Charles M. "Impact of Income Maintenance on Low Birth Weight: Evidence from the Gary Experiment." Journal of Human Resources, Vol. 14, No. 4, April 1979

Lewit, Eugene M. "The Demand for Prenatal Care and the Production of Healthy Infants." Nov 1979 draft article in The Annual Series of Research in Human Capital and Development, Vol IIII JAI Press, Inc. 1983

Muller, Charlotte, et al. "Reproductive Efficiency as a Social Indicator." International Journal of Health Services, Vol 6. No. 3, 1976

Rosenzweig, Mark R. and Schultz, T. Paul. "Birthweight, the Production of Child Health, and Input Demand." Proceedings from the National Bureau of Economic Research Conference on Economic Aspects of Health, Palo Alto July 30- Aug 1 1980.

United States Dept. of Health and Human Services. Public Health Services Better Health for Our Children: A National Strategy, Vol 11, 1981

Welch, Finis. "Sex of Children: Prior Uncertainty and Subsequent Fertility Behavior." The Rand Institute paper R-1510 Aug. 1974