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ABSTRACT

This paper attempts to forecast the change in adolescent childbearing among New York City residents following a ban on legalized abortion. With monthly data on the number of births to white and black adolescents from January, 1963 to December, 1987 we used an interrupted time-series analysis to estimate the change in adolescent childbearing that followed the liberalization of the New York State abortion law in 1970. We found the level of births to black adolescents living in New York City fell 18.7 percent between 1970 and 1971, or approximately 142 fewer births per month ($p<.001$). The level of white births fell 14.1 percent or approximately 111 fewer births per month ($p<.001$). The absolute value of the percentage changes in births between 1970 and 1971 were applied to the forecasted number of monthly births in 1988 and 1989. If legal abortion had been inaccessible to New York City adolescents beginning January 1, 1988, there would have been 2143 black and 1067 white unintended births to teenagers in the first two years of a ban. The results suggest that a prohibition on legalized abortion would have a substantial increase in adolescent childbearing across the U.S. although the magnitude of the change will vary according to local conditions.

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There is great speculation in the popular press that the U.S. Supreme Court will overturn the 1973 decision in Roe versus Wade, the case which legalized abortion across the United States. A possible outcome of such a reversal is that the authority to regulate abortion will be given to individual states. Under this scenario, even states where the sentiment towards abortion is favorable may experience a period in which legalized abortion is unavailable while new legislation is written and debated. A ban on legalized abortion, or even an interruption, could have a profound effect on the incidence of unwanted childbearing.

The objective of our analysis is to examine the probable changes in teenage childbearing among New York City residents following a ban on legalized abortion. To this end, we first fit a model that estimates the change in the number of births to adolescents following the 1970 New York State law which liberalized abortion. We argue that the percentage decline in teenage childbearing between 1970 and 1971 is a good approximation, but in reverse, to what would occur today if legalized abortion were no longer available.

A number of studies have noted the decline in births after the New York State Law which liberalized abortion became effective (Pakter et al. 1973, Tietze 1973, Kramer 1975). However, the results in each of the studies were based on annual changes over a very short time span. Such unrefined estimates provide only a crude understanding of what might occur if the legalization of abortion were reversed. Pooled time-series, cross-sectional studies have examined the effect of liberalized abortion laws on annual, age-specific fertility rates within and across states (Sklar and Berkov 1974, Bauman et al. 1977, Quick 1978). The findings suggest that the legalization of abortion had an important impact on fertility. Again, the variation over time was limited to at most seven years.

Our study differs substantially in that it is a time-series analysis with monthly data that spans 25 years. The large number of observations allows for a more sophisticated means of fitting the data. For example, we use the Box-Jenkins time-series methodology to predict the monthly number of births to New York City adolescents that would have been observed had abortion not been liberalized in 1970 (Box and Jenkins 1976). Comparing these estimates to the actual number of births between 1970 and 1971 yields a first approximation of the number of births that were averted by the change in the law. The estimates are refined by means of intervention analysis: a technique for determining the magnitude, form, and statistical significance of the change in a time-series following a major external event (Mc Cleary and Hay 1980, Vandaele 1983). Finally, we use the model obtained by the intervention analysis to forecast the time-path of teenage births following a ban on legalized abortion.

We have limited our analysis to adolescents for several reasons. First, the medical, social and economic consequences of teenage pregnancy are staggering (National Research Council 1987a,b). Second, the proportion of teenagers who become pregnant has changed relatively little over the past 15 years. Approximately one out of ten adolescents aged 15-19 becomes pregnant every year and in 1988 about 86 percent of the pregnancies were unintended (Jones et al. 1988). Third, adolescents are disproportionate users of abortion and thus, would be more affected by an overturn of Roe versus Wade. Nationally, 30 percent of all abortions performed in the United States are to teenagers and 40 percent of all adolescent pregnancies are terminated by induced abortion (National Research Council 1987a).

The analysis was restricted to New York City because we needed an area in which the availability of legalized abortion would be as radically altered by a ban as it had been by the liberalization of abortion laws. The 1970 New York State abortion statute had the fewest restrictions of any state law in the country. Before July, 1970 there had been few legal abortions performed in New York City (Erhart et al. 1972).More importantly, prior to the change in 1970, pregnant adolescents had essentially no access to legal abortion. Although Hawaii, Alaska and Washington state had laws similar to

New York's by the end of 1970, each of the states had residency requirements. Consequently, the magnitude of the change in adolescent childbearing among New York City residents after the 1970 law became effective was not diminished by migration to other states. This was not true for residents of other states after the passage of the New York State law. Between July 1970, and June 1971, 75.4 percent of the 33,964 abortions performed on adolescents in New York City were to out-of-state residents (Pakter et al. 1973). The upshot is that New York City offers a unique setting from which to understand the changes in adolescent childbearing that followed the liberalization of abortion, and what is likely to occur if legal abortion is banned.

METHODS

DATA

Monthly figures on the number of black and white live births to New York City residents less than 20 years of age are from vital statistics maintained by the New York City Department of Health. Each year of individual birth records has been aggregated by month for blacks and whites separately. The number of birth records with unknown age in any one year was less than .03 percent. These records were deleted from the aggregation. The final series consisted of 300 monthly observations for whites and blacks from January, 1963 to December, 1987. Plots of the race-specific series are shown in Figures 1 and 2.

The analysis was limited to whites and blacks because ethnicity was not identified on New York City birth certificates until 1978. However, a substantial proportion of the adolescents who are white are of Hispanic origin or descent. In 1984, the first year in which data on births to Hispanic women were published, 75 percent of the white adolescents who gave birth were of Hispanic origin (NYC Department of Health 1985). How this proportion has varied over time is unknown. Data from the 1970 Census indicates that 13.4 percent of all women 15 to 19 years of age were of Puerto Rican descent (Bureau of Census 1973). The number of Hispanic adolescents that were not Puerto Rican is unknown. By 1980, the percent of Puerto Rican adolescents 15 to 19 years of age had risen to 17.0 percent while the total proportion of Hispanic adolescents of the same age stood at 25.9 percent (Bureau of Census 1984). The potential impact on the results of the apparent shifting ethnic composition of white adolescents who gave birth is discussed below.

The number of births as opposed to birth rates were analyzed because monthly population figures for New York City over the period under study were unavailable. Census data could have been used to estimate monthly population figures between the census years, but such crude estimates would only have introduced measurement error. Furthermore, month-to-month changes in the population are minor compared to the 10 to 20 percent drop in the number of adolescent births that were observed between 1970 and 1971.

STATISTICAL ANALYSIS

The data were analyzed by means of an Autoregressive Integrated Moving Average (ARIMA) model. The methodology is often referred to as the Box-Jenkins approach to time-series modeling (Box and Jenkins 1976). The objective is to use the observed data to describe the underlying time-series process in as concise a manner as possible. The first step is to decompose the stationary portion of the series into its autoregressive and moving average parts. Once a tentative representation has been established, the parameters of the model are estimated and then diagnosed to insure that the unexplained portion of the model, the residuals, are a random or white noise process. If the checks prove satisfactory, then forecasts can be generated.

A time series may undergo a dramatic change due to an external event that alters the underlying behavioral process generating the series. Such interventions can be incorporated into the Box-Jenkins methodology in order to evaluate the form and the magnitude of the change. In particular, a binary variable is used to capture the impact of the intervention. The variable equals zero prior to the change and one thereafter. The binary variable is appended to the specification and a t-test is used to determine whether the estimated coefficient on the binary variable is statistically significant. The methodology has become known as intervention analysis and has been widely applied in the social sciences (McCleary and Hay 1980, Vandaele 1983).

To successfully apply the intervention analysis, it is necessary to know the starting point of the event as well as the general shape of the response of the series to the event. The hypothesis maintained in this study is that the 1970 New York State Law which liberalized abortion had an important impact on the number of adolescent pregnancies that resulted in live births. The law became effective on July, 1 1970. However, because the law did not apply to pregnancies greater than 24 weeks, the effect of the law on the number of live births would not be observed for at least 16 to 20 weeks later. Thus, November, 1970 became the starting point of the intervention. Furthermore, the full impact of the law on adolescents births would not be possible until April of 1971 when the pregnancies of the first cohort of adolescents who conceived on or after July 1, 1970 reached term. Consequently, the intervention variable was specified in such a manner that the law's impact on the number of adolescent births increased gradually from November, 1970 through April, 1971.

The rate at which the law's impact grew between November and April was based on the distribution abortions to New York City residents the first year the law was in effect. For example, 6.1 percent of all abortions to New York City residents were to women whose pregnancies were beyond the twentieth week (Tietze 1973). Assuming the distribution of abortion by gestational age was the same for every month in the first year, the proportion of the law's full impact that would be felt in November was .061. Thirty percent of all abortions performed in the first year were to women whose pregnancies were between 13 and 20 weeks gestation. We assumed that 15 percent were performed between 13 and 16 weeks gestation, and the other 15 percent were performed between 17 and 20 weeks gestation. Thus, in December, the proportion of the law's full impact would be .216. This accounts for the 6.1 percent of the women who aborted in August, 1970 whose pregnancies were greater than 20 weeks gestation and for the 15 percent of the abortions in July, 1970 to women whose pregnancies were between 17 and 20 weeks gestation. Following this algorithm and noting that 64 percent of all abortion were performed in the first trimester, the figures for the remaining months were as follows: .361 in January, .574 in February, .785 in March, and 1.0 in April and all months thereafter.

To estimate the changes in adolescent childbearing following a ban on legalized abortion effective January 1, 1988, we first forecasted the number of births in 1988 and 1989 under the assumption that abortion remained legal. The complete series, including the intervention component was used to obtain the forecasts. Since the future error terms are unknown, they were set to their expected values of zero (Vandaele 1983, Granger and Newbold 1986). We then multiplied the forecasted births by the absolute value of the parameters from the intervention model. The assumption was that the absolute value of the percentage change in adolescent births after abortion was legalized provided a good estimate of the expected increase in adolescent childbearing if abortion were to be outlawed.

Finally, although we assumed that the relative change in births resulting from a ban on abortion in 1988 would be the same (except for a sign change) as was observed in 1970 and 1971, the rate of change from the pre- to the post-intervention level of births had to be altered. The modification was necessary because the distribution of abortions by gestational age had changed substantially from what was observed in 1970 and 1971. In particular, national data from 1981 indicates that 91 percent of all abortions were obtained in the first trimester, approximately 8 percent were obtained between 13 and 20 weeks, and fewer than one percent were at more than 20 weeks (Henshaw et al. 1985). Using the same algorithm as above, a ban on abortion that became effective January 1, 1988, would realize one percent of its full potential impact in May of 1988, 5 percent in June, 9 percent in July, 40 percent in August, 70 percent in September, and 100 percent by October.

RESULTS

Figures 1 and 2 present the monthly number of births to black and white New York City adolescents from January, 1963 through December, 1987. For blacks, the reversal of a seven-year upward trend which occurs between 1970 and 1971 is dramatic. In the case of whites, a relatively stationary series up to 1970 falls substantially between 1970 and 1971 and then continues to trend downwards until approximately 1986. Both figures suggest a major alteration in adolescent childbearing that is coincident with New

York State's liberalized abortion law which became effective July, 1 1970.

To understand the impact the legislation had on adolescent childbearing, we estimated the ARIMA structure for the pre-intervention series (January, 1963 - June, 1970). The data are expressed as natural logarithms in order to control for non-stationarity in the variance. A first-order difference transformation was applied to the logarithms of births in order to remove any trend; a twelfth-order difference was used to eliminate seasonality. Based on the autocorrelation and partial autocorrelation functions of the transformed series, black and white births can be characterized as a first-order moving average with a first-order seasonal moving average.[2] The coefficients of the models are displayed in Table 1.

If the models adequately depict the ARIMA processes governing the series, then the errors of the models should be white noise. The Q-statistics in Table 1 indicate that the residuals from the estimated models are white noise processes. Another approach for determining if the errors are white noise is to evaluate the autocorrelations of the first-differenced residuals. If the errors are a white noise process, then their first difference should follow an MA(1) process with the moving average parameter equal to 1, and the first autocorrelation equal to -.5. For the estimated

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[2]The complete set of estimated autocorrelation and partial autocorrelation functions is available from the authors upon request.

models in Table 1, the first differenced residuals indicated an MA(1) process. For blacks the MA(1) coefficient was .91 with a t-ratio of 18.78, and the first autocorrelation was -.53. For whites, the MA(1) coefficient was .95 with a t-ratio of 25.81, and the first autocorrelation was -.50. Thus, the analysis of the errors supports the appropriateness of the specifications.

Based on the ARIMA specifications in Table 1, we forecasted the number of race-specific adolescent births 24 months beyond June, 1970. Comparison of the forecasted births with the actual number of births over this 24 month period yields a first approximation of the number of unintended births to New York City adolescents that were averted by the legalization of abortion. The actual and forecasted births for the two races are presented in Figures 3 and 4. Subtracting the actual births from the forecasted births and summing over the 24 months indicates that 4091 black births and 3128 white births were averted by the availability of abortion.

To more formally test whether the 1970 law liberalizing abortion may have caused the precipitous drop in adolescent births, we used all the data to estimate the ARIMA structure of each series. As outlined in the previous section, an additional variable was added to the specification to control for the impact of the law. The results are shown in Table 2. Except for the intervention component, the ARIMA structure is unchanged for blacks. In the case of whites, a second-order seasonal moving average component improved the model's fit. The coefficient on the intervention variable, α, is statistically significant for blacks and whites. Thus, the data reveal that the decline in the level of births after October, 1970 was a change that could not be explained by the normal variation in the series. The Q-statistics indicate the adequacy of the models. Similarly, for both models the autocorrelation and the partial autocorrelation functions of the first differenced residuals demonstrated that they were governed by a MA(1) process. For blacks, the first autocorrelation of the differenced residuals was -.50, and the MA(1) coefficient was .95 with a t-ratio of 51.28. For whites, the first autocorrelation was -.53 and the MA(1) coefficient was .97 with a t-ratio of 70.45.

The magnitude of the change from the pre- to post intervention level of the series can be obtained by exponentiating the coefficient of the intervention variable α and subtracting it from one. Expressed as a percentage, the level of black adolescent births fell 18.7 percent after the liberalization of abortion in July 1970. White births fell 14.0 percent. By using the estimated percentage changes and taking into account the gradual transition between November 1970 and April 1971, one can calculate the total number of adolescent births that were averted in the 24 month period after July 1970. If we assume the average number of births over twelve months prior to July, 1970 is an estimate of the pre-intervention level of births, then 2588 black adolescent births and 1998 white adolescent births were averted in the 24 months after July, 1970. These figures are smaller than the ones obtained from the difference of the forecasted and the actual births over the two year period after July 1970 since they do not take into account the seasonality and trend movements inherent in the data prior to 1970.

To estimate how a ban on abortion effective January 1, 1988 would affect adolescent childbearing in New York City, we forecasted the monthly number of births to black and white teenagers based on the ARIMA specifications in Table 2. Beginning in May, 1988 we multiplied the predicted number of monthly births by .187 in the case of blacks and .140 in the case of whites. The products for May, 1988 through September 1988, were further adjusted to account for the distribution of abortion by gestational age. Summing the adjusted monthly forecasts from May, 1988 through December, 1989, we estimate that if legal abortion were banned January 1, 1988 there would have been 2143 additional black births and 1067 white births to adolescents in 1988 and 1989 above what would have been expected had the laws regarding abortion remained unchanged.

DISCUSSION

Using monthly data on the number of white and black births to New York City adolescents, we found that the liberalization of the New York State abortion law in 1970 had a substantial and statistically significant impact on adolescent childbearing. In particular, we estimate that at least 2500 unintended births to black teenagers and at least 1900 unintended births to white teenagers were averted in the first two years after the legislation became effective. We then estimated the probable impact on adolescent childbearing among New York City residents if legal abortion were unavailable nation-wide beginning January 1, 1988. Our model predicts that there would be over 2000 black and 1000 white unintended births to New York City teenagers in the first two years following the ban.

The forecasts are based on modeling the change in teenage childbearing that followed the liberalization of abortion laws in New York State in 1970. The plausibility of our forecasts depend on a number of assumptions that must be defended explicitly. First, we assume that if Roe versus Wade were overturned and abortion were banned in New York State, then legalized abortion would not be available to New York State residents in any other state. Although such a restrictive outcome is unlikely, the forecasts remain instructive for several reasons. For one, they provide upper-bound estimates based on the most restrictive scenario possible, a nation-wide ban on legalized abortion. This scenario cannot be dismissed lightly given that the President of the United States, the U. S. Attorney General, and the Head of the Department of Health and Human Services have all publicly stated their opposition to Roe versus Wade. A more likely scenario is that U.S. Supreme Court will return the regulation of abortion to individual states. If so, then New York would probably be one of the first states to respond in a "pro-choice" manner. New York is one of only 13 states plus the District of Columbia that funds abortions to Medicaid eligible women and only 1 of 8 states that does so voluntarily (Gold and Guardado 1988). Nevertheless, New York's 1970 law passed the State Senate by five votes and the State Assembly by only one. The debate in both houses was tumultuous (Lader 1973). Without dissecting the present political situation in the state, if Roe versus Wade is overturned, there could be a substantial delay and serious confusion regarding the availability of legal abortion while new legislation is written and debated. Border states such as Connecticut and New Jersey have been less supportive of abortion than has New York, and may be less likely to respond as quickly and as liberally as New York. Moreover, many teenagers, especially blacks and Hispanics, lack the resources to travel beyond the tri-state area to obtain an abortion. Thus, legal abortion in states like Massachusetts, Michigan, and California may represent inaccessible alternatives to pregnant adolescents in New York City. At the very least, therefore, the overturn of Roe versus Wade could seriously limit, if only temporarily, the options available to pregnant adolescents in New York City.

A second assumption upon which our estimates are based is that the proportion of teenagers in New York City at risk of an unintended pregnancy today is similar to the proportion at risk in 1970. National data indicates that the pregnancy rate among women 15 to 19 years of age has risen from 94 pregnancies per 1000 adolescents in 1972 to 109 pregnancies per thousand in 1984 (National Research Council 1987a). In addition, the percentage of teenagers residing in metropolitan areas who describe their pregnancies as unwanted rose between 1971 and 1979 (Zelnik and Kantner 1980). Consequently, the proportion of teens at risk of an unintended pregnancy has probably risen since 1970 despite the increased use of contraception among adolescents. In this respect, our projections may underestimate the impact of a ban on legalized abortion.

One explanation for the rising pregnancy rate is that the availability of abortion has engendered less effective contraceptive behavior; the more extreme version is that abortion serves as an alternative method of fertility control. Thus, if abortion is banned, the pregnancy rate may fall. There is no evidence to support either explanation. A recent survey of abortion patients reports that less than one percent of the women who used no contraception admitted doing so because they relied on abortion (Henshaw and Silverman 1988). And although little is known about the relationship between abortion availability and the effective use of contraceptives, a teenager who aborted a pregnancy was less likely to become pregnant again over the next 24 months than was a comparable adolescent who carried her first pregnancy to term (Koenig and Zelnik 1982).

As mentioned above, there has been an apparent rise in the proportion of births to whites of Hispanic origin in New York City. Based on the little data that exists, Hispanic adolescents are more sexually active than their white, non-Hispanic counterparts. At the same time, Hispanic adolescents are more likely to be married and less likely to abort (Hayes 1987, Joyce 1988). The upshot, therefore, is that the suspected increase in the proportion of births to white adolescents of Hispanic descent is unlikely to have altered our predictions in any meaningful manner from what they would have been had the proportion of white births of Hispanic descent remained unchanged since 1970.

With respect to the statistical analysis we imposed a number of restrictions that should also be made explicit. For example, instead of fixing the rate at which the law's impact grew between November 1970 and April 1971, an alternative specification would have been to model the intervention component as a first-order transfer function (McCleary and Hay 1980). This allows the data to determine the rate of change between the pre- and post-intervention series. The distribution of pregnancies by gestational age explains in large part why initially, the impact of the law was gradual. But the availability of abortion services in the early months under the new law may also have delayed the full impact of the law from being realized. There was considerable confusion in New York City with respect to the legality of performing abortions in doctor's offices and free-standing clinics (Lader 1973). For instance, the proportion of all abortions performed in free-standing clinics or physicians' offices rose from 45 percent in the first twelve months of the law to 62 percent in the ensuing year (Tietze 1973). Moreover, abortions performed in hospitals were at least twice as expensive as the ones performed in free-standing clinics or physicians' offices. Teenagers, especially minorities, were probably more affected by the price and non-price barriers since they were less likely to have access to private gynecological care. In sum, the step function we imposed assumes the law became fully effective in April, 1971, yet other factors may have further delayed the new law from realizing its full impact.

To examine this proposition, we re-estimated the effect of the 1970 abortion law by using a first-order transfer function model. The results for blacks were essentially unchanged from the estimates reported above. However, the first-order transfer function for whites indicated that the change in the level of the series between the pre- and post-intervention data declined without end. However, there is little evidence to support the hypothesis that the reform of New York's abortion laws initiated a continuous decline in the number of white adolescent births. The more likely explanation is that the white adolescent population in New York City declined. Census data indicates that the white female population 15 to 19 years of age (including Hispanics) in New York City fell from 219,834 in 1970 to 138,023 in 1980, an annual rate of decline of 4.8 percent. As a point of comparison, the black adolescent population of the same age grew from 77,174 to 95,262, an annual growth rate of 2.1 percent (Bureau of Census 1973, 1984). These figures are clearly insufficient to explain the 14 and 18 percent drop in the monthly level of white and black births respectively following the new abortion law. However, the decreasing size of the white teenage cohort is a reasonable explanation for the smooth decline in the number of white births after 1971 (see Figure 1).

In sum, the step function based on the distribution of abortions by gestational age is an appropriate alternative to the first-order transfer function. An additional advantage of the step function is that the conditions in 1970 with respect to the gestational age distribution of abortions and the availability of abortion services are notably different today. The step function allows us to adjust the rate at which a ban on abortion would impact on childbearing based on present distribution of abortions by gestational age. The parameters from the intervention model based on the first-order transfer function would have underestimated this rate of change.

There is voluminous literature on the social and economic consequences of adolescent childbearing. As the most recent and comprehensive review makes clear (National Research Council 1987a,b), adolescents who become parents will complete less schooling, have lower wages, experience greater marital instability, and be more dependent on welfare programs than their adolescent peers who delay childbearing. Moreover, the children of teenage mothers will experience greater health, cognitive, and socioemotional difficulties.

Nor would a ban on legalized abortion be costless to taxpayers. In 1986, 64.6 percent of all adolescent births in New York City were funded by Medicaid. Assuming Medicaid eligibility is a good proxy for AFDC eligibility, then applying this proportion to the number of unintended births reported above indicates that 689 white and 1384 black teenage mothers and their children will receive AFDC in the two years after the ban. Based on the methodology described in Burt (1986), the present discounted cost in terms of Medicaid, AFDC, and food stamps of supporting a family headed by a teenager over a twenty-year period is 5,560 in 1985 dollars above what it would have cost to support the same teenager and her family had she delayed childbearing until after she was twenty years of age. Thus, the total marginal costs of supporting the 689 white and 1384 black births described above would be 11.5 million dollars.

The relative changes in adolescent childbearing among whites and blacks following a prohibition on legal abortion reported in this paper cannot be generalized to other parts of the country because the forecasts are based on a set of circumstances specific to New York City in 1970. However, the number of unintended pregnancies among U.S. adolescents strongly suggests that areas in which legal abortion is prohibited will experience substantial increases in the number of births to teenagers. The magnitude of the change will vary by area because of differences in the use of abortion prior to a ban, the proximity to areas where abortion remains legal, and the availability of illegal abortions.

For those opposed to legal abortion, the increase in unintended childbearing is irrelevant to the debate. Abstinence from premarital sex, it is argued, is a simple solution to unintended childbearing among adolescents. Even supporters of abortion would agree that preventing an unintended pregnancy is the most preferable strategy for averting an unintended birth. Yet, the political situation in the U.S. is such that a concerted commitment to lowering the rate of teenage pregnancy is not part of the national agenda. In this void, legalized abortion remains one of the safest and most effective means of preventing adolescent childbearing and its attendant consequences.

FIGURE 1

MONTHLY NUMBER OF BIRTHS TO BLACK ADOLESCENTS LIVING IN NEW YORK CITY
JANUARY 1963 - DECEMBER 1987

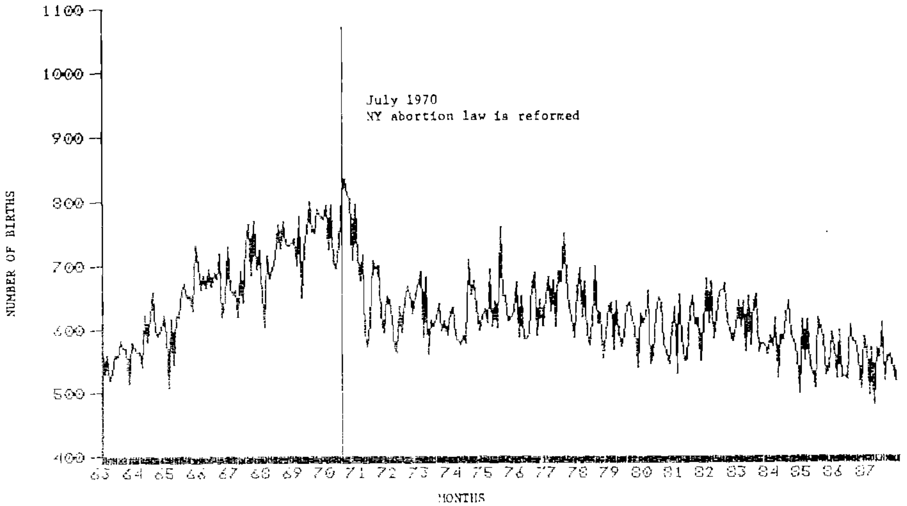

FIGURE 2

MONTHLY NUMBER OF BIRTHS TO WHITE ADOLESCENTS LIVING IN NEW YORK CITY
JANUARY 1963 - DECEMBER 1987

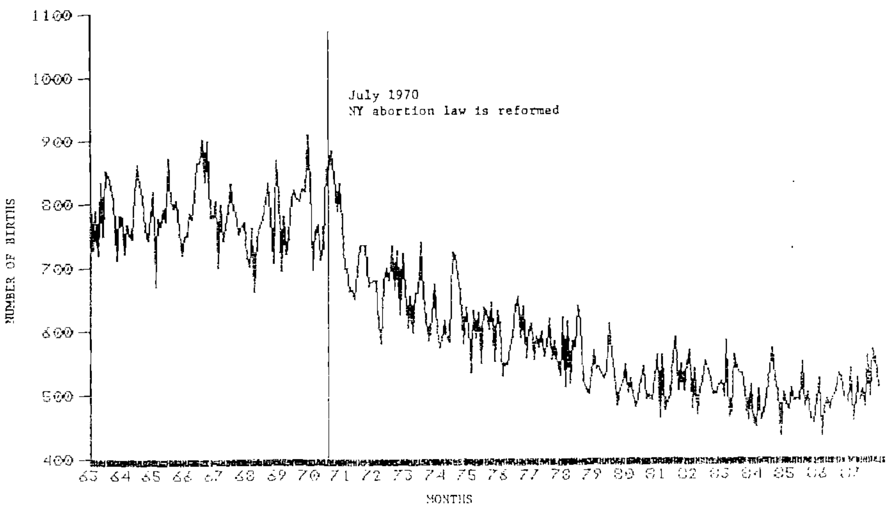

FIGURE 3

MONTHLY NUMBER OF ACTUAL AND FORECASTED BIRTHS TO BLACK ADOLESCENTS LIVING IN NEW YORK CITY
JULY 1970 - JULY 1972

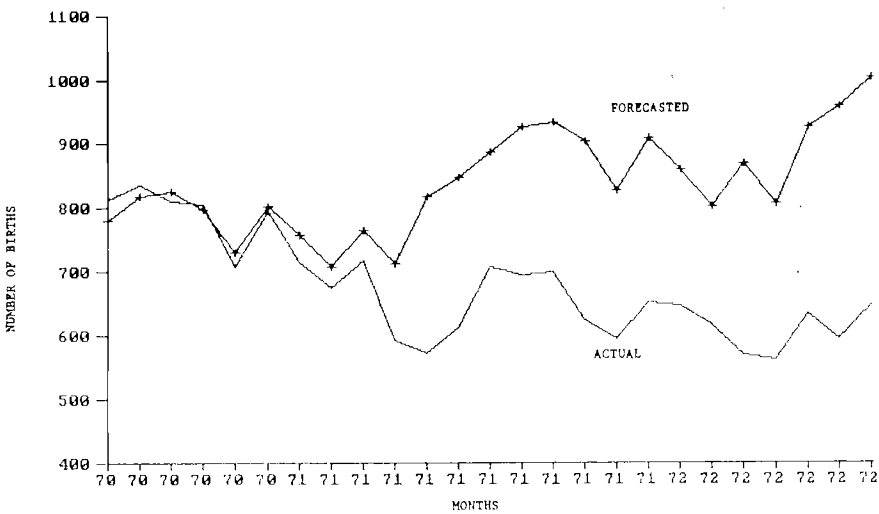

FIGURE 4

MONTHLY NUMBER OF ACTUAL AND FORECASTED BIRTHS TO WHITE ADOLESCENTS LIVING IN NEW YORK CITY
JULY 1970 - JULY 1972

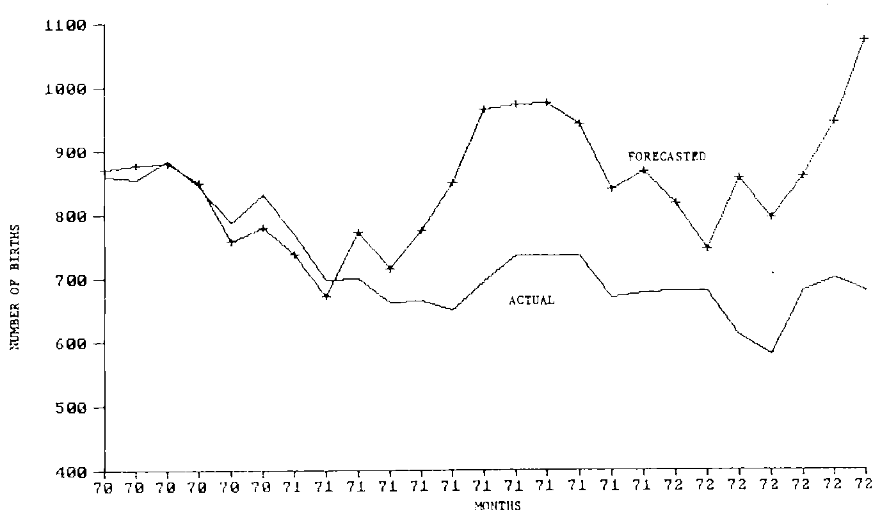

TABLE 1

Estimated ARIMA Equations for NYC Births to Black and White Adolescents 1964,2-1970,6

BLACKS	θ_1	$\emptyset_1$	$Q^a(24)$	R^2
$B_t=-\theta_1 e_{t-1}-\emptyset_1 e_{t-12}+e_t$	.735 (9.16)	.801 (9.24)	15.01 .92	.63
WHITES	θ_1	$\emptyset_1$	$Q(24)$	R^2
$W_t=-\theta_1 e_{t-1}-\emptyset_1 e_{t-12}+e_t$	.772 (9.38)	.644 (5.70)	19.41 .73	.56

B_t and W_t are the natural logarithms of the Black and White births respectively. θ_1 and $\emptyset_1$ are the coefficients and e_{t-1} is the error term. The numbers in the parenthesis are the t-ratios.

[a] The Ljung-Box Q statistic determines the randomness in autocorrelations of residual errors, and has a Chi-square distribution (Ljung and Box 1978). The numbers below the Q-statistics are the marginal significance levels; i.e. the probabilities of the null hypothesis that the autocorrelations of the errors are not different from zero.

TABLE 2

Estimated ARIMA Equations for NYC Births to Black and White Adolescents with the Intervention Component 1964,2-1987,12

BLACKS $B_t=-\theta_1 e_{t-1}-\emptyset_1 e_{t-12}+e_t+\alpha I_t$

θ_1	$\emptyset_1$	α	$Q^a(48)$	R^2
.776 (20.68)	.838 (24.87)	-.207 (-.5.32)	34.20 .93	.64

WHITES $W_t=-\theta_1 e_{t-1}-\emptyset_1 e_{t-12}-\emptyset_2 e_{t-24}+e_t+\alpha I_t$

θ_1	$\emptyset_1$	$\emptyset_2$	α	$Q(48)$	R^2
.824 (23.94)	.740 (12.04)	.122 (1.95)	-.150 (-4.10)	42.16 .71	.61

B_t and W_t are the natural logarithms of the Black and White births respectively. θ_1 and $\emptyset_1$ are the coefficients and e_{t-1} is the error term. I_t is the dummy variable for the intervention; α is its coefficient. The numbers in the parenthesis are the t-ratios.

[a] The Ljung-Box Q statistic determines the randomness in autocorrrelations of residual errors, and has a Chi-square distribution (Ljung and Box 1978). The numbers below the Q-statistics are the marginal significance levels; i.e. the probabilities of the null hypothesis that the autocorrelations of the errors are not different from zero.

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