

DRAFT: PLEASE DO NOT CITE WITHOUT PERMISSION

*Cohort Abortion Measures for the United States: An Application of an Old  
Technique Reveals New Findings*

Sarah K. Cowan  
UC Berkeley  
sarahc@demog.berkeley.edu

February 27, 2011

**Abstract:**

Demographers interested in abortion have thus far focused on cross-sectional and synthetic cohort measures, due to data availability. We now have cohorts that have completed their entire reproductive years after the Roe v. Wade decision legalizing abortion federally. For women who are in the midst of their childbearing years at the conclusion of data collection, I apply the Lee-Carter forecasting technique – its first application in abortion research – to complete their age-specific abortion rates. Using true cohort measures reveals markedly different abortion experiences by cohort and surprising stasis in abortion intensity measures and racial composition of abortion incidences. In addition to the substantive findings, cohort measures shift the focus of quantitative abortion research from incidence rates to women's lives over their reproductive years.

When demographers research abortion in the United States, they will typically create a period total abortion measure, or a synthetic cohort measure, using the most recent period age-specific rates (Henshaw and Kost 2008, Henshaw 1998, Tietze and Bongaarts 1982). There are important analytical reasons for this, namely that a period total abortion rate measure provides a more precise description of incidence rates without regard to population size than simply crude rates. Further, they are a convenient, insightful metric to compare across time. Of course, data constraints may necessitate the use of a period measure as was the case for much of American abortion history.

Period measures, however, cannot speak to cohort experiences when age-specific rates change over time. This is precisely the case for abortion in the United States. For example, in 1990, the abortion rate for women aged 18-19 was 57.9 abortions per 1,000 women; in 2005 the rate was 31.0. For women aged 20-24 in 1990, there were 56.7 abortions per 1,000 women; in 2005 the rate was 38.9 per 1,000 women. Perhaps more to the point, 18 year olds in 1990 are 24 year olds in 1996. The synthetic cohort approach applies the 1990 rate for 24 year olds – 56.7 – when in fact they experience the 1996 rate – 49.3. Though synthetic cohorts are a helpful tool for understanding period rates, such large and rapid changes in rates render unadjusted synthetic cohort measures inappropriate for providing insight into the abortion experience of women over their reproductive lives. The synthetic cohort is no cohort at all.

As the first in what will hopefully be a long literature of abortion demographic translation and cohort abortion analyses, this paper answers two questions: what empirical findings are revealed by cohort abortion analyses? What is the best means by which to translate between period and cohort abortion rates?

A cohort perspective reveals heretofore undiscovered substantive findings, namely it reveals marked differences in the total abortion rates of women by cohort. It also shows somewhat smaller differences in the mean age of aborting. I track the changing experiences of women by race and ethnicity and outline their substantial differences in total rates and mean age of aborting. I find two surprising sources of stasis. First, when abortion rates decline which begins around 1990, all racial and ethnic groups decline at approximately the same rate. Second, even throughout the decline, the same proportion of women have their first, second or third abortion in the period and by cohort. I also consider racial differences in abortion rates from the period and cohort perspectives.

Using insights from the literature on demographic translation, I illuminate the relationship between cohort and period experiences of abortion, a previously unexamined topic. Thus, this paper fulfills the prescription Norman Ryder put forth for demographers to study “the transformation of measurements from one shape into another to accommodate diverse analytic or policy purposes. In the process, there often occurs the important by-product of the revelation of new and interesting topics for substantive inquiry” (Ryder 1964).

### *Existing Literature*

Scholars have done important work on abortion from the period perspective (Henshaw and Kost, 2008; Henshaw 1998; Tietze and Bongaarts, 1982; Ventura et al 2001; Jones et al 2010 among others.) They have collected the data to develop age specific abortion rates, and illuminated incidence rates and differential experiences by race, education, parity and geography. They have examined changing rates over time by the population as a whole and decomposed the rates by sub-population. Despite the severe challenges of data collection, these scholars have painted a complex picture of abortion from the period perspective.

Figure 1 shows the age-specific abortion rates from 1974 to 2005 and the total abortion rate for the same period. The total abortion rate is directly analogous to the total fertility rate, that is, the average number of abortions a woman would have if she survived to the end of the childbearing years and experienced at each age a particular set of age-specific abortion rates. The total abortion rate is increasing until 1980 where it plateaus, with a short increase before 1990 followed by a long decline. The increase is largely attributed to expanding access after the national legalization of abortion with *Roe v Wade* in 1973.

[insert Figure 1 about here]

The decline in total abortion rates is largely due to the decline in abortions to teenagers and women aged 20-24. The decline in these young ages is attributed to two factors, first is the increased use of contraception and the movement to effective contraception resulted in a decrease in the unintended pregnancy rate for teenagers. The unintended pregnancy rate for women aged 15-19 was 82 per thousand women in 1994 and 67 per thousand in 2001 (Finer and Henshaw 2006). The contraceptive risk index, a summary indicator of contraceptive use and risk, for women aged 15-19 declined 34 percent from 1995 to 2002, indicating that women were decreasing their risk of pregnancy through contraception (Santelli et al 2007). The second factor is that fewer of those unintended pregnancies ended in abortion, instead women were carrying the pregnancy to term. In 1994, 47 percent of unintended pregnancies to women aged 15-19 ended in an abortion; in 2001 that number was 40 percent. In 1994, 55 percent of unintended pregnancies to women aged 20-24 ended in an abortion; that number dropped to 49 per thousand in 2001 (Finer and Henshaw 2006).

Racial differences in period rates of abortion are considerable; the cohort rates are discussed below. Much of the differences in abortion rates are due to differences in pregnancy

rates. Hispanic women have the highest pregnancy rates of women living in America, black women follow shortly behind. Black women have the highest unintended pregnancy rates and the highest rates of transitioning those unintended pregnancies into a termination. As a result, black women have the highest abortion rates but they also have high unintended birth rates. White women and Hispanic women have similar rates of transitioning an unintended pregnancy into an abortion but because white women have fewer pregnancies and fewer unintended pregnancies, they have a lower abortion rate (Finer and Henshaw 2006). In summary, black women have the highest abortion rates, followed by Hispanic women and then white women. These differentials in abortion rates are the result of differentials at each step in the process that leads to an abortion – pregnancy, unintended pregnancy and transitioning that unintended pregnancy to an abortion.

In addition to documenting the abortion experience of cohorts of women, this inquiry looks at the relationship between period abortion rates and cohort abortion rates. It thus extends the the demographic transition literature from fertility (Ryder 1980 among others), marriage (Keilman 2006) and mortality (Goldstein and Wachter 2006) into a new arena. Demographic translation details the interplay between period and cohort measures for both repeatable and singular events and formalizes it mathematically.

There is another literature on period and cohort rates that has not yet entered the realm of abortion. This literature looks to the causal mechanisms of demographic phenomena and explores whether those mechanisms operate in the period or on the cohort. The argument in fertility is characterized by Norman Ryder's (1980, 1986) argument for the centrality of the cohort, particularly for fertility whereby early-life experiences will affect lifelong childbearing targets and timing. Opposing the cohort approach is the argument put forth most coherently by Marie Ni Bhrolchain (1992) that the variance in fertility is observed in the period and there is

little evidence for age-period effects that imprint on the cohort. Furthermore, distinctive fertility patterns by age and period are observed whereas no fertility patterns by cohort have been noted.

The debate has not turned to abortion yet and should. I, however, do not address that here and instead focus on what we can learn regarding abortion in the United States when we take a cohort perspective. The cohort perspective is vital because of the fluctuating rates evident in the period.

#### *Data*

The data for this analysis span from the period 1973 to 2005 for total number of abortions by age and come from the National Center for Health Statistics, a division of the Centers for Disease Control. These data were adjusted by researchers from the Alan Guttmacher Institute based on their abortion provider surveys. The adjustments were made to account for abortions that occur in states that do not report to the federal government and under-reporting by providers to the state. These data begin at age 14. Data on the distribution of those abortions by race are from the annual abortion surveillance reports from the Centers for Disease Control and are available from 1979 to 2004 and these data begin at age 15. The only racial categories consistent across these data are white and black/other; hence no finer decomposition is possible for this time frame. The CDC did not collect data on Hispanic ethnicity until 1990; separate analyses consider ethnicity as well. Not all states report to the CDC and so applying the distributions by race and ethnicity to the national number of abortions assumes that the distribution of the abortions that are not reported is identical to that of the reported. This is a standard assumption in American abortion research (see Henshaw and Kost, 2008) and is validated by reference to surveys of abortion patients.

The observed data extends for over thirty years; some birth cohorts, however, are in the midst of their childbearing years when the observed data conclude. To complete these cohorts, I

forecast the age-specific abortion rates using the Lee-Carter forecasting method (Lee and Carter 1992). Though developed for mortality in the United States, it has been extended to fertility and the method works well for forecasting abortion in the United States. It employs time-series methods and an approach to dealing with the age schedule by decomposing it into an age-profile and a time-variant parameter. The time-variant parameter outlines deviations from the age-profile when the overall level of the event changes.

Specifically, the method describes the logarithm of an age-specific rate, for these purposes the age-specific abortion rate, as being composed of two elements. The first element is an age-specific component that is independent of time ( $a_x$ ). It indicates the average shape of the age-profile. The second element is the product of a parameter that varies with time and captures the general level of the event ( $k_t$ ) and a coefficient that is age-specific and indicates how the age-specific rate will vary given the change in the overall rate ( $b_x$ ). Lastly, there is an age and time specific error term.

$$\ln(T_{x,t}) = a_x + b_x k_t + e_{x,t}$$

The above model may be fit using least squares to yield  $\hat{a}_x$ ,  $\hat{b}_x$ ,  $\hat{k}_t$  which minimize the residual-squared. This fit may be readily obtained via singular value decomposition. This model is fit to historical data to obtain the first element of a singular value decomposition. To identify a unique solution, in this case, two constraints are placed – the sum of the  $b_x$  coefficients will equal one and the sum of the squared  $k_t$  parameters will equal zero. By fitting the model to historical data, we obtain estimates for the age-specific and time-varying parameter. The time-varying parameter,  $k_t$ , is then forecast using a random walk with drift. These forecasted values are

combined with the estimated age-specific parameters to forecast age-specific rates (Lee 2000, Lee & Carter 1992).

There are a number of advantages to using Lee-Carter for forecasting. First, it is a familiar technique for demographers, used in a variety of settings. Second, the model fits the observed data well. In this application of Lee-Carter, I fit Lee-Carter to data from 1980 to 2005. Age-specific abortion rates increased from 1973 to until 1980 at which point they stabilized and began to fall around 1990. The ascension is attributed to an effect of national legalization in 1973 but is unlikely to affect trends after 2005 and hence is excluded from the data on which the forecast is based. Figure 2 shows the fitted values for the entire period 1980-2005. It has an average error from the observed data of .015 abortions per 1,000 women and an absolute maximum error of 4.84 abortions per 1,000 women. For all age groups, over 99% of the variance in the observed data is explained by the fitted data. Second, the forecasted trends make intuitive sense. The rates are forecasted to 2035 at which point the youngest birth cohort on which we have data will have completed its childbearing years. The forecasted rates fit common-sense predictions as can be seen in Figure 1. Figure 3 shows that 95% confidence bands on the forecasted rates are narrow, though, as to be expected, widen over time. Given the complexity of the data presented, Figure 3 presents three lines for each age group in the same color. The 95 and 5 percent confidence intervals are indicated by dashed lines on either side of the solid line which represents the average. Note that for some age-groups, the bands are so close together as to be indistinguishable from each other and appear as one solid band. The confidence bands reflect the recently observed levels of fluctuations around the trends. The Lee-Carter method was also employed for forecasting the age-specific abortion rates by race and it performed well though somewhat less so for the minority group and non-Hispanic blacks due to its volatility. As with all

forecasts, readers are cautioned that there may be future changes in the trends rendering these forecasts noticeably inaccurate.

[insert Figure 2 about here]

[insert Figure 3 about here]

Though common for fertility analysis, these rates were not tempo-adjusted. The debate about tempo-adjusting has not yet entered abortion but at a face-value, it is inappropriate. Central to tempo-adjusting is the notion that events may be delayed if the timing is undesirable for the actor. Hence, in the realm of fertility, there can be pent-up demand for childbearing after a period in which childbearing is undesirable. There is no equivalent for abortion. Women seek abortion after an unintended pregnancy; the abortion follows an unplanned and unwanted event. The demand for the abortion disappears after the second trimester when she cannot legally terminate. In addition Figure 7 which is discussed in detail below gives a hint on the shape-violation that gives further evidence for not tempo-adjusting.

For one part of the analysis on the distribution of abortions among women, I use the National Survey of Family Growth (NSFG), cycles 5, 6 and 7. The NSFG is a probability survey conducted among non-institutionalized adult (15–44 years of age) residents of the United States. This analysis only examines women aged 40-45 in each cycle (N=1701 for 1995; N=1051 for 2002; N=886 for 2006-2008). Abortion under-reporting in the NSFG is considerable and well-documented (Jones and Kost 2007 among others). In cycle 6 (2002), respondents answered the questions in a face to face interview and then had an opportunity to re-answer some of the pregnancy questions using audio computer assisted self-interview (ACASI) technology which has been shown to reduce under-reporting. The ACASI answers have been excluded from my analysis to maintain interview method consistency across cycles. The NSFG is used here to

consider the lifetime distribution of abortions among women who have them (what proportion of women have one abortion, two etc.). The analyses therefore rely on the underreporting to be random among total lifetime abortions. This assumption is further discussed with the analyses using the NSFG below.

*Cohort Analyses for the Total Population and Decomposed by Race and Ethnicity*

The age-specific abortion rates used to calculate a cohort total abortion rate are the ones experienced by a birth cohort traveling through time. For a period total abortion rate, the rates applied are those for women across birth cohorts in a particular year. Period total abortion rates appear regularly in the abortion literature. This is the first time cohort total abortion rates are used.

Figure 4 shows cohort total abortion rates for the birth cohorts 1959 to 1990. The total rates increase until they peak with the 1969 cohort at 817 abortions per 1,000 women. The rates then fall by over 225 abortions or 28% of the 1969 rate. Hence the women of the 1969 birth cohort had a distinctly different abortion experience than their daughters.

[insert Figure 4 about here]

Birth cohorts also experienced differences in the mean age of aborting. These differences, however, are not nearly as marked. The range of the cohort mean age of aborting was between 22.5 years (1967 cohort) and 24.5 years (1990 birth cohort). The largest year to year change was 1.5 months. The cohort mean age of aborting is relatively stable, a point that is helpful in the analyses on demographic translation.

Figure 5 shows the cohort total abortion rates by birth cohort from 1964 to 1989 for the data decomposed into white and minority rates and from 1975 to 1990 for the data decomposed into non-Hispanic black, non-Hispanic white and Hispanic rates. On the left panel is the series

plotted on the linear scale; on the right panel is the series plotted on the log scale. For comparison, it also shows the total abortion rate for the population as a whole. First, consider the longest time series – that where the population is decomposed into white and minority groups. Minority women have higher cohort total abortion rates across the entire time series. Both groups of women have a downward trending cohort abortion rate but minority women experience an initial ascent followed by a steeper descent. This is largely driven by differences in the experience of women aged 15-24; while the rates for this age group of white women remained stable or fell from 1979 to 1992, the rates for minority women increased dramatically. As a result, the cohort total abortion rates for minority women show an increase followed by a decrease and then a plateau as opposed to white women whose rates show a gradual decline.

[insert Figure 5 about here]

Until 1990 Hispanic women were categorized as either white or minority and that categorization moderated the extremes of both the minority and white groups. Hispanic rates are in between the rates for non-Hispanic white and non-Hispanic black women. When there are only two racial categories, some Hispanic women are categorized as white and raise the rates of that group and some Hispanic women are categorized as minority and lower the rates of that group.

All three groups – non-Hispanic white, non-Hispanic black and Hispanic women -- have total abortion rates that are falling for the birth cohorts 1975 to 1990, according to observed and projected rates. What is particularly noteworthy is that the downward trend affects the different racial and ethnic groups almost identically. This is most clearly demonstrated in the panel on the right which is plotted on the log scale. The trends for minority, white, non-Hispanic black and Hispanic women all move in parallel. Non-Hispanic white women have a slightly aberrant trend

with a steeper decline. Over this period, cohorts of non-Hispanic white women will see a 42% drop in their cohort total abortion rate compared to a 23% decline for Hispanic women and a 16% decline for non-Hispanic black women.

Lastly, consider the comparison between the race-specific rates and the total rates; this comparison gives a sense of each race's contribution to the total population abortion experience. Minority women disproportionately contribute but white women contribute the most absolutely. Minority women have much higher rates of abortion than white women but white women, due to their larger total population, have higher absolute numbers of aborting. For example, in 1975, white women had 701,000 abortions at a rate of 17.2 per thousand; minority women had 333,000 abortions at a rate of 49.3 per thousand. In 1990, white women had 1,039,000 abortions at a rate of 21.5 per thousand; minority women had 570,000 abortions at a rate of 54.4 per thousand. Dividing the population by Hispanic ethnicity reveals that non-Hispanic women had 1,414,000 abortions at a rate of 28.7 per thousand while Hispanic women had 195,000 abortions at a rate of 34.8 per thousand. White women contribute more to the numerator of these rates but disproportionately more to the denominator. As a result, the total population rate will be above the rate for white women but below minority women.

During this time period, younger women were decreasing their abortion rates more dramatically than older women. The result was an aging of abortion, as can be seen in the rise in the mean age of abortion (Figure 6.) This aging, however, was modest. Figure 6 shows the cohort mean age of aborting by race and birth cohort. As before, the data in which the population is decomposed into white and minority women spans from the 1964 to 1989 birth cohorts. Data on Hispanic ethnicity begin with the 1975 birth cohort.

[insert Figure 6 about here]

The mean age of aborting is different by race and ethnicity and spans about a 2 year range over these cohorts. The mean age for Hispanic women was closer to that of non-Hispanic black women for the earlier cohorts. For later cohorts, the mean age for Hispanic women remained somewhat constant while it rose for both non-Hispanic black and non-Hispanic white women, leaving the Hispanic women's experience closer to that of non-Hispanic white women. The greatest disparity is between non-Hispanic black and non-Hispanic white women at just over 8 months for the 1990 cohort.

As a general trend for all races the mean age of aborting is increasing over this time period. This is due to the dramatic decrease in rates for teenagers and women aged 20-24 throughout the time period, especially relative to the older ages. There are, however, some aberrations. The cohort mean age of aborting initially dropped for minority women but then rose quickly beginning with cohorts in the early 1970's. The data by ethnicity and race indicates that the rising minority rate was primarily due to the abortion patterns of non-Hispanic black women. The mean age of aborting for Hispanic women is relatively flat.

A final area of analysis is in the intensity of abortion – what proportion of women have what proportion of the abortions? Are the total rates composed of a few women who have a lot of abortions or many women who have one abortion? We do not have complete data from the cohort perspective but sewing together the full time-series from the period perspective and the limited data from the cohort perspective tells one unified story – stasis.

Figure 7 shows the period distribution of prior abortions for women having abortions in a given year. The total abortion rate per 1000 women is also shown. Throughout the time series, for most women who get abortions in a given year, it is their first abortion. As abortion access

grows, more and more women are having abortions for the first time. As the decline in the total abortion rate begins (1990) the distributions of patient by prior abortions enters stability. From 1990 to 2004, just over 50% of abortion patients each year were having their first abortion. Just over a quarter of patients had one prior abortion; 12 percent had two prior abortions and eight percent had three or more. Figure 7 tells the period story.

[insert Figure 7 about here]

The cohort story on the intensity of abortion is also a story of stasis. Cohort analyses veer from period analyses when rates are changing, as we saw above. The period rates of abortion intensity are largely stable; therefore the cohort rates should be as well. To capture the cohort rates of intensity, I turn to the oldest women who have participated in three waves of the National Survey of Family Growth (NSFG). The under-reporting of abortion in the survey is well-documented (Jones and Kost 2007 among others). I am not interested in the total number of abortions for which the underreporting would pose a severe challenge. Rather, I am interested in the distribution of abortions by women's prior abortion experience. I assume that the under-reporting occurs in two possible ways. First, the under-reporting happens randomly across abortion experience – that women who have had one abortion under-report at the same rate as women who have had more. Second, under-reporting by number of abortions is consistent across time. For example, equal numbers of women who have had four abortions report they had three across the birth cohorts 1951-1967. It is possible that one of these assumptions is true or they both are. In the latter scenario, for example, equal numbers of women who had four abortions report they had three; the other women under-report randomly. The survey data shown in Table 1 support that the first, second or both assumptions are accurate.

Table 1 shows the lifetime number of abortions among women who had any for the birth cohorts 1951-1967. The data are from three rounds of the NSFG where I analyzed the responses from women aged 40-45 in each cross-section. I report them unweighted in 5-year age groups. These data also show stasis, that approximately the same proportion of women had one, two etc. abortions across these cohorts. Stasis is most likely to occur if my assumptions above were correct. Were the assumptions incorrect, stasis would occur only if under-reporting was differential in a manner so as to create stasis from changing rates, an improbable scenario.

The women represented in Table 1 came of age at the beginning of legalized abortion. During this time access was growing, the total abortion rate was rising and the period intensity measures had not yet reached stasis. Yet, quickly into their experience, the intensity measures reached close to their stasis values. In 1974, the first year after federal legalization, 85 percent of women who had abortions were having their first, a reasonable figure for this unique year. Within ten years, that number dropped a dramatic 18 percentage points to 60 percent of all abortion patients and remained relatively stable after that. Most of the decline occurred within six years after legalization. The period rates of intensity rapidly reached stasis so even the women who came of age in the early years of legalized abortion show this stasis across cohorts.

Table 1: Intensity of abortions among women who have had abortions for birth cohorts 1951-1967

	1951-1955	1958-1962	1962-1967
1 lifetime abortion	67.05	65.5	68.21
2	23.3	24.03	22.05
3	5.11	5.81	6.15
4+	4.54	4.66	3.59

Note: Due to the under-reporting, these data can be interpreted as indications of stasis, only, and should not be taken as true values of abortion intensity.

### *Racial Differences in Abortion Rates*

Researchers and policy-makers often ask the question, “what are the abortion rates for minority women compared to white women?” The answer to the question can come in two forms – for a specific period or for a specific cohort. To date, the answer has only been given for periods. When the reader compares to the correct cohort, then the period rates are a close proxy. That correct cohort is the one whereby the period falls in the middle of their abortion experience; this is discussed more fully in the section below. To illuminate this, I compare the differences revealed in a given year with the differences revealed in the cohorts that reach the mean age of aborting (23) in that year. This comparison can be seen in Table 2.

Table 2: Racial Disparities by Measurement

Ratio of Minority to White Total Abortion Rates			
Birth Cohort	Period of Mean Age		Percent Difference
	Aborting	Birth Cohort	
1964	2.47	2.40	-2.83
1965	2.51	2.42	-3.37
1966	2.69	2.46	-8.53
1967	2.37	2.50	5.33
1968	2.50	2.54	1.35
1969	2.61	2.61	0.03
1970	2.68	2.64	-1.34
1971	2.70	2.67	-0.92
1972	2.66	2.70	1.35
1973	2.81	2.74	-2.33
1974	2.82	2.74	-2.71
1975	2.84	2.79	-1.84
1976	2.97	2.81	-5.27
1977	2.80	2.83	0.93
1978	2.80	2.84	1.18
1979	2.77	2.85	2.79
1980	2.76	2.88	4.42
1981	2.83	2.91	2.97
1982	3.04	2.95	-3.15
1983	3.06	2.99	-2.35

Table 2 reveals that in some years, the period rate provides a more optimistic view on racial disparities in abortion and in some years a more pessimistic view. In either case, the difference between the period rate and the cohort that reaches the mean age of aborting in that period are modest. If the reader incorrectly translates the period rate to say, the cohort born in that year, or the cohort reaching reproductive maturity in that year, the reader will underestimate racial disparities. The next section on demographic translation will reveal in greater detail the process of moving from periods to cohorts.

### *Demographic Translation*

Demographic translation attempts to reconcile the cohort and the period viewpoint by answering the question, “Which cohort’s rates do these period rates most closely approximate?” This is helpful for two reasons: first, it assists in understanding the rates and their patterns over time and second, it can provide a shortcut to doing cohort analyses without having to wait until the cohort completes its stage – in this case, childbearing years. This is the first inquiry into demographic translation for abortion. This discussion of demographic translation will begin with the data on the population as a whole and then will continue to the data decomposed by race and ethnicity.

Figure 8 illustrates the basic premise of demographic translation. It shows the age specific abortion rates for (1) the 1974 birth cohort (2) the year 1974 (3) 1988: the year the 1974 cohort reached childbearing age and (4) 1997: the year in which the 1974 birth cohort reached their average age of aborting. We see relative stability at the youngest and older ages. The cohort rates most closely mimic the patterns for the 1997, the year in which the cohort reached its average age of aborting. This is a common finding in the demographic translation of fertility. Figure 8 also shows the challenge of comparing any period and cohort rate ; no period rates are

identical to the cohort experience in a time of changing rates. Figure 8 also gives a hint at a finding proven later – the period rates from the year the cohort reaches its average age of aborting are closest to the completed cohort rates.

[insert Figure 8 about here]

Three candidate periods are considered in the translation literature generally to compare to the cohort experience for the purposes of translation – the year of the cohort’s birth, the year of the cohort’s reproductive maturity, and the year the cohort reaches the mean age of aborting. The comparison using the year of the cohort’s birth excludes too much data and may be fruitfully analyzed in the future when a longer time series is available. This comparison is unlikely to be successful as a translation tool, as can be seen in Figure 8, given the changing period rates. The comparison of the cohort total abortion rate to the period total abortion rate for the year of the cohort’s reproductive maturity shows vast differences between the two. The period rate is lower than the cohort rate as abortion access becomes more widespread and the period rates are rising. This reflects that the cohort rate is composed of earlier and therefore at this juncture, lower, rates. The period rates plateau between 1980 and 1990 and approximately halfway through that decade, the period and cohort rates cross. As the period rates decline, the cohort rate remains above the period rates, reflecting that the cohort experience is composed of earlier, and now higher, period rates.

Figure 9 further demonstrates that a good translation tool are the period rates in the year in which the cohort reaches the mean of each included cohort’s mean age of aborting. That is to say, for each cohort included in the series, 1967 through 1990, I calculated its own mean age of aborting. I then averaged the 23 cohort mean ages of aborting, which coincidentally was 23. I compared the cohort abortion rates for each cohort with those of the year in which those women

turned 23. As an example, the cohort total abortion rate for women born in 1960 were compared to the period rates for 1983, the year in which those women turned 23. This mimics an approach used in prior fertility demographic translation research (Ryder 1964, Vallin and Caselli 2006).

[insert Figure 9 about here]

Despite the translation improvement, there are significant differences between the two lines. The comparison between the 1972 cohort rate and the 1995 (year in which the 1972 cohort turned 23, the mean age at aborting of cohorts since 1967) reveals the starkest difference of 80 abortions per 1,000 women. Throughout much of the time series, the cohort total abortion rate exceeds the period rate which is a result of the aging of the mean age of aborting. As mentioned above, younger women were having fewer abortions, especially starting in 1990, as a result the mean age of aborting was rising. The average discrepancy is 30 abortions per 1,000 women; this is a good but imperfect translation. This is an advancement over the way the literature speaks about total abortion rates currently – as period rates that will apply only to a hypothetical group of women.

Since the decline in abortion rates is seen disproportionately among some age groups, namely teenagers and women aged 20-25, there is no period proxy for the cohort mean age of aborting. The best candidate for a translation tool is the year in which the cohort reaches the average cohort mean age of aborting. Even in that comparison, the cohort mean age of aborting was between two and four years higher than the period mean age of aborting. The period mean age cannot be a proxy for the cohort mean age of aborting. This is discouraging for researchers hoping to make cohort estimates before the conclusion of the childbearing years. The narrow range and stability of the cohort mean age of aborting, however, means it can be easily forecasted without much error.

The first foray into demographic translation for abortion reveals that the period rates for the cohort mean age of aborting is an adequate translation tool, with reservations. Further, there is no period substitute for the cohort mean age of aborting. The cohort mean age of aborting, however, is such a slow moving measure that forecasting it should provide the appropriate benchmark by which to translate between cohort and period rates.

The insights from the demographic translation analyses conducted on the population as a whole remain primarily true for the population decomposed by race and ethnicity. Figure 10 shows the comparison between the cohort total abortion rate and the period total abortion rate for the year in which the cohort reached the mean of the mean age of aborting. As above, it includes data by race for the cohorts 1964 to 1989 and by race and ethnicity for the cohorts 1975 to 1990. The period rates are an excellent translation tool for white women after the 1967 cohort and for non-Hispanic white women and Hispanic women for the entire series of those data. It does not fare as well for minority women or non-Hispanic black women. The period rates are discrepant with the cohort rates for minority women an average of 35 abortions per 1,000 women and 58 abortions per 1,000 women for non-Hispanic black women. The maximum discrepancy for minority women was 104 abortions per 1,000 women, for non-Hispanic black women was 95 abortions per 1,000 women. For both of these groups of women, the cohort rate exceeded the period rate for most of the time series.

[insert Figure 10 about here]

There is, again, no good period proxy for the cohort mean age of aborting. In the analysis for the total population, the period mean age at aborting was below the cohort mean age. Here, the reverse is true; the period mean age at aborting exceeds the cohort mean age. The discrepancies are large enough that the same conclusion applies – no period rate is an adequate

proxy for the cohort mean age of aborting. The cohort mean age of aborting can be easily and accurately forecasted, however, by race.

The lessons from the analyses for the entire population and the population decomposed by race are the same and provide some shortcuts for future research. First, the cohort mean age of aborting is the best tool by which to translate between period and cohort rates. It works remarkably well for white women, non-Hispanic white women and Hispanic white women. It performs less well for the population as a whole and worse yet for minority and non-Hispanic black women but it is sufficient. Second, period mean age of aborting is an insufficient proxy for the cohort mean age of aborting. Given the stability of the mean age of aborting, however, it can easily be forecast. Those forecasts and the accuracy of the cohort mean age of aborting as a translation tool means that researchers can make good estimates of the cohort experience partway through the childbearing years.

#### *Conclusion and Future Research*

Researchers required over 30 years of data to begin the project of cohort analyses of abortion. This is the beginning of that line of inquiry. It has shown two important conclusions. The first is that this is a worthwhile endeavor empirically and is grounded theoretically. Empirically, cohort analyses reveal large differences in abortion experience by cohort. Further, racial disparities in the rates of abortion are larger when considered from a cohort perspective. Abortion is an experience isolated to a short period of a woman's life and the experience itself has been altered by changing laws and access in recent American history. An age-specific event with period shocks is ripe for cohort analyses. The cohort perspective transitions the researcher from thinking about incidence and time to women's whole lives and this transition reveals heretofore undiscovered findings.

The second conclusion of this work is that while researchers have waited over 30 years for these analyses, they need not wait so long anymore. Given the narrow range of the mean age of aborting and its adequacy in translating between period and cohort perspectives, it can be a means by which to convert from period to cohort perspectives well before the cohort completes its childbearing years. The period rates from the cohort's mean age of aborting are not a perfect match to completed cohort rates, particularly for non-Hispanic blacks. They are, however, a means by which to approximate the cohort experience and perform better for other sub-populations. The mean age of aborting has remained relatively constant at around age 23. Hence, once a cohort reaches age 23, the period rates from that year approximate the cohort's completed experience without having to wait the additional 20 years required for them to conclude their childbearing years.

Future research should continue along four avenues. The first is to maintain periodic re-evaluations of the cohort abortion experience of women. Every few years, scholars produce more research on the period abortion rates; that research should now include a cohort perspective. Second, scholars should carefully analyze the appropriateness of tempo-adjustment for abortion. Third, the debate regarding period or cohort causal analyses of demographic rates should extend from mortality and fertility into abortion. Lastly, the two examples of stasis – that the decline in abortion rates affected races and ethnicities similarly and that the abortion intensity has remained stable within the decline – should be interrogated empirically and theoretically. Is this uniformity a result of broad public health campaigns or is it documentation of a process of social influence across races and prior abortion experiences?

### Works Cited

- Bhrolchain, Maire Ni. 1992. "Period Paramount? A Critique of the Cohort Approach to Fertility." *Population and Development Review* 18:599-629.
- Brass, W. 1974. "Perspectives in Population Prediction: Illustrated by the Statistics of England and Wales." *Journal of the Royal Statistical Society. Series A (General)* 137:532-583.
- Easterlin, Richard A. 1987. *Birth and Fortune: The Impact of Numbers on Personal Welfare*. 2nd ed. University Of Chicago Press.
- Goldstein, Joshua R., and Kenneth W. Wachter. 2006. "Relationships between period and cohort life expectancy: Gaps and lags." *Population Studies: A Journal of Demography* 60:257.
- Hajnal, J. 1947. "The analysis of birth statistics in the light of the recent international recovery of the birth-rate." *Population Studies: A Quarterly Journal of Demography* 1:137-164.
- Henshaw, S. K. 1998. "Unintended pregnancy in the United States." *Family Planning Perspectives* 24-46.
- Henshaw, S. K, and K. Kost. 2008. "Trends in the characteristics of women obtaining abortions, 1974 to 2004." *New York, NY: The Guttmacher Institute*.
- Jones, Rachel K., Jacqueline E. Darroch, and Stanley K. Henshaw. 2002. "Patterns in the Socioeconomic Characteristics of Women Obtaining Abortions in 2000-2001." *Perspectives on Sexual and Reproductive Health* 34:226-235.
- Jones, Rachel K., and Kathryn Kost. 2007. "Underreporting of Induced and Spontaneous Abortion in the United States: An Analysis of the 2002 National Survey of Family Growth." *Studies in Family Planning* 38:187-197.
- Keilman, Neil. 2006. "Demographic Translation: From Period to Cohort Perspective and Back." in *Demography: analysis and synthesis*, vol. 1, edited by G. Caselli, G. J Wunsch, and J. Vallin. Elsevier.
- Lee, R. D, and L. R Carter. 1992. "Modeling and forecasting US mortality." *Journal of the American Statistical Association* 87:659-671.
- Lesthaeghe, R., and J. Surkyn. 1988. "Cultural dynamics and economic theories of fertility change." *Population and Development Review* 14:1-45.
- Ryder, N. B. 1964. "The Process of Demographic Translation." *Demography* 74-82.
- Ryder, N. B. 1980. "Components of temporal variations in American fertility." Pp. 15-54 in *Demographic patterns in developed societies*, edited by R.W. Hiorns. Taylor and Francis.
- Ryder, N. B. 1986. "Observations on the history of cohort fertility in the United States." *Population and Development Review* 12:617-643.
- Tietze, Christopher, and John Bongaarts. 1982. "Repeat Abortion in the United States: New Insights." *Studies in Family Planning* 13:373-379.
- Vallin, Jacques, and Graziella Caselli. 2006. "The Hypothetical Cohort as a Tool for Demographic Analysis." in *Demography: analysis and synthesis*, edited by G. Caselli, G. J Wunsch, and J. Vallin. Elsevier.
- Van Imhoff, E. 2001. "On the impossibility of inferring cohort fertility measures from period fertility measures." *Demographic Research* 5:23-64.
- Ventura, S.J., W.D. Mosher, S.C. Curtin, J.C. Abma, and S.K. Henshaw. 2001. "National vital statistics reports: Trends in Pregnancy Rates for the United States, 1976-97: An Update." *National Vital Statistics Reports* 49.

Figures

Figure 1: Age Specific Abortion Rates and Total Abortion Rates per 1,000 women, Observed and Projected Data

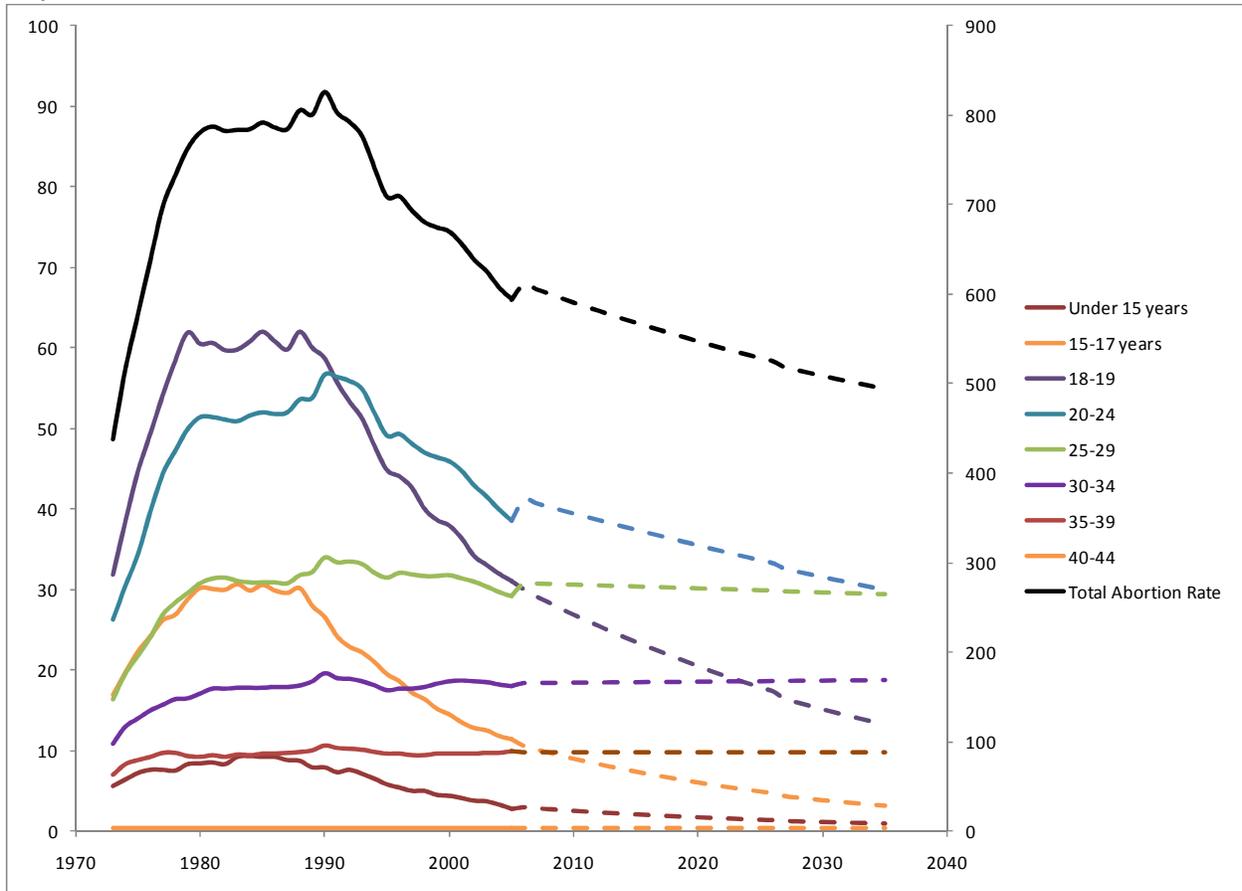


Figure 2: Age Specific Abortion Rates 1980-2005 per 1,000 Women, Observed and Fitted Data

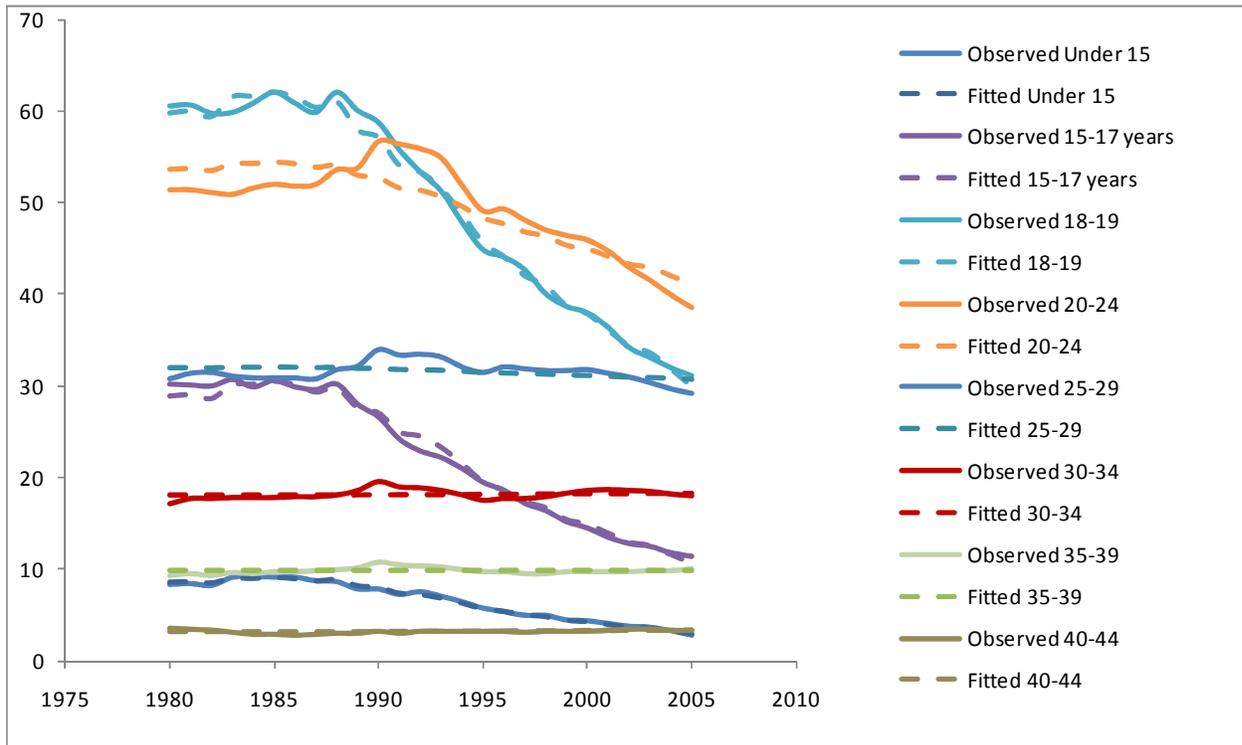


Figure 3: Projected Age Specific Abortion Rates and Total Abortion Rate, mean and 95% bounds

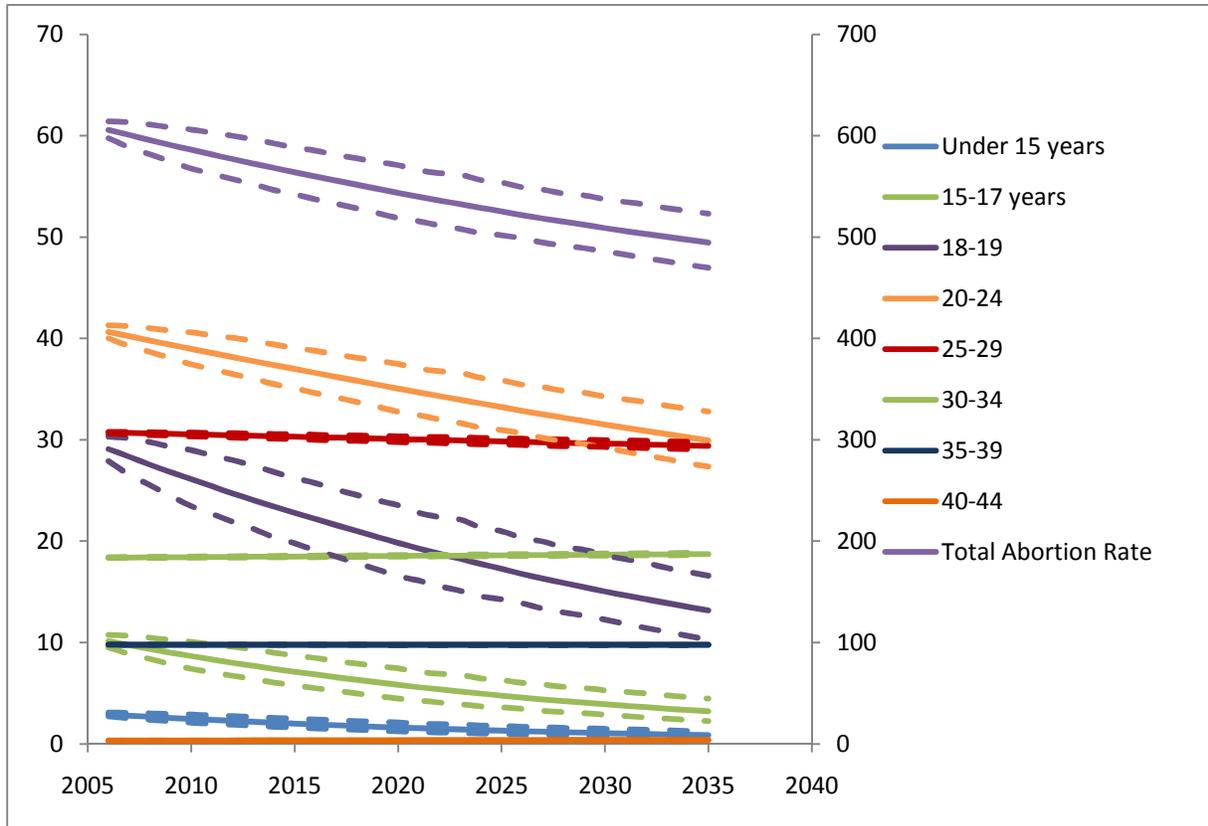


Figure 4: Cohort Total Abortion Rates for birth cohorts 1959 to 1990

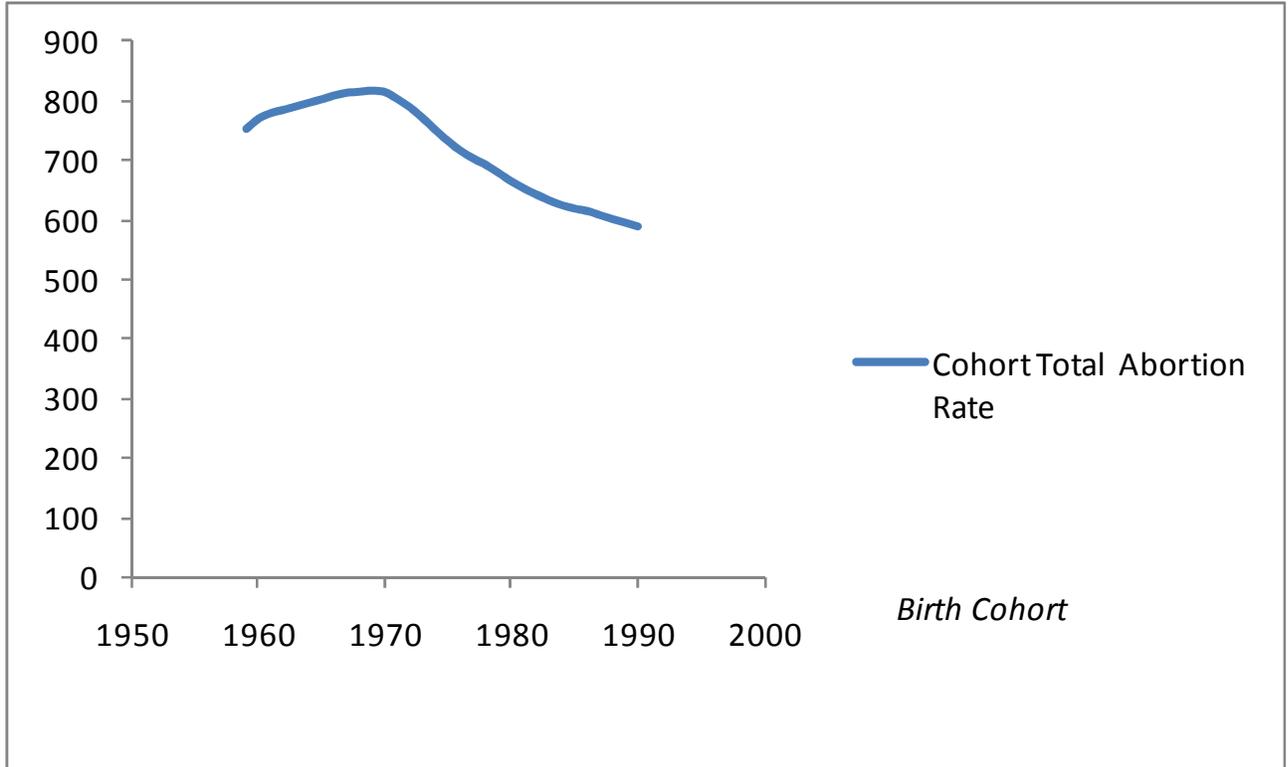


Figure 5: Cohort Total Abortion Rates by Race and Ethnicity for Birth Cohorts 1964 to 1990, linear and log scale

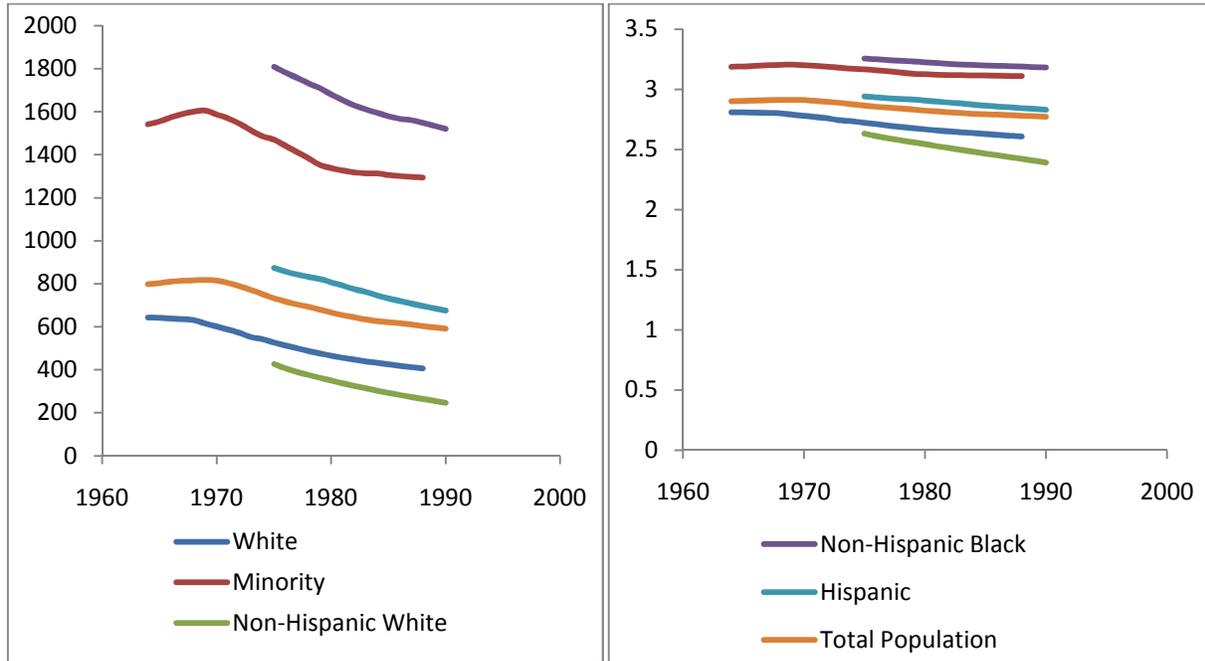


Figure 6: Cohort mean age of aborting by race and ethnicity for birth cohorts 1964 to 1990

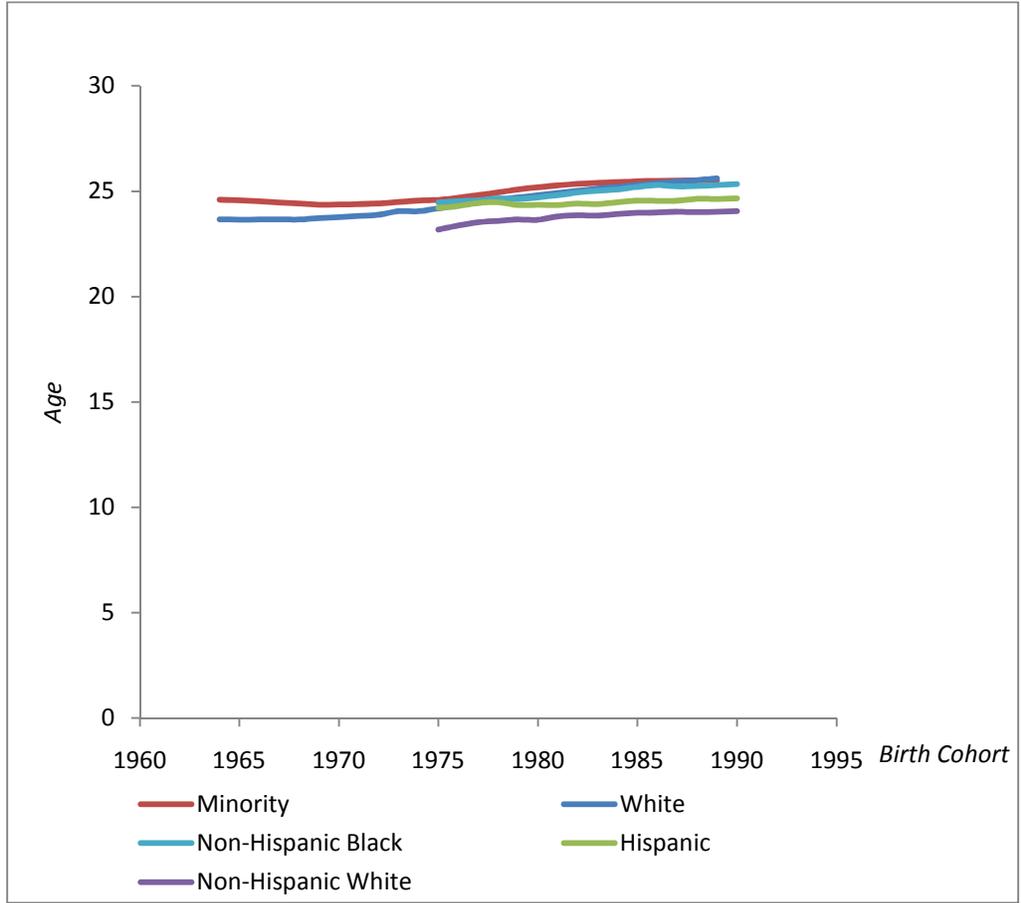


Figure 7: Distribution of Abortion Order and the Total Abortion Rate, period measures, 1973-2004

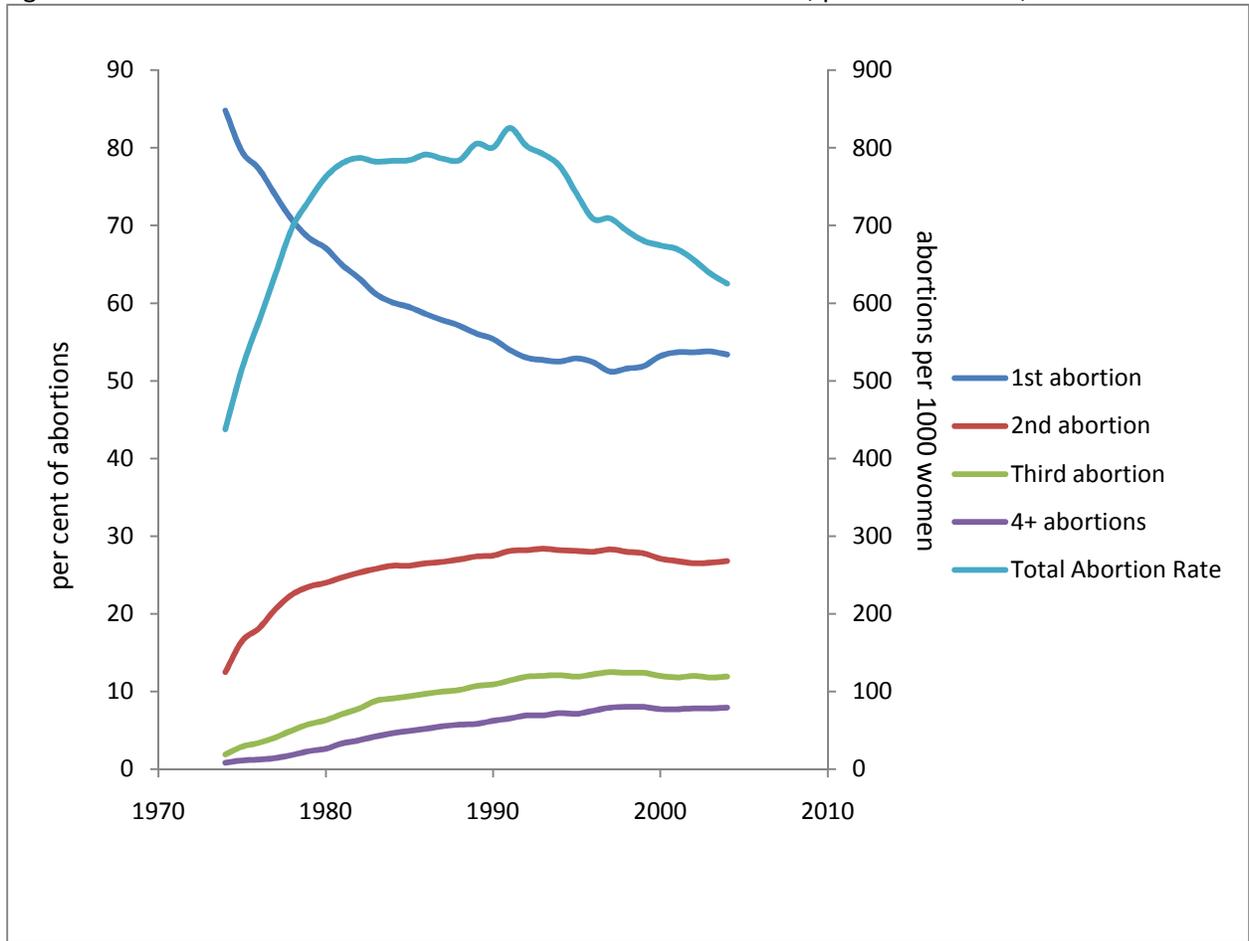


Figure 8: Age Specific Abortion Rates for (1) the 1974 Cohort (2) 1974 (3) 1988 when the 1974 cohort reached childbearing age and (4) 1997 when the cohort reached the mean age of aborting

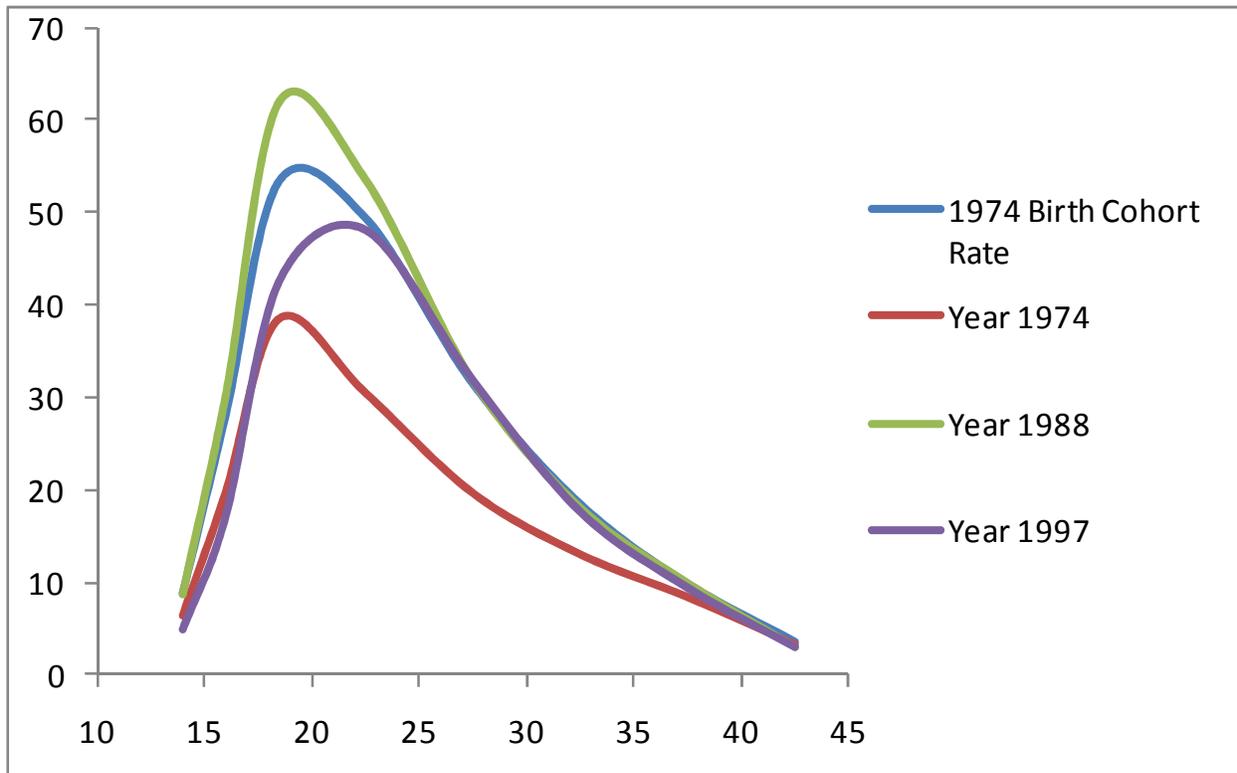


Figure 9: A cohort's cohort total abortion rate and the period total abortion rate for the year in which it reached the average cohort mean age of aborting

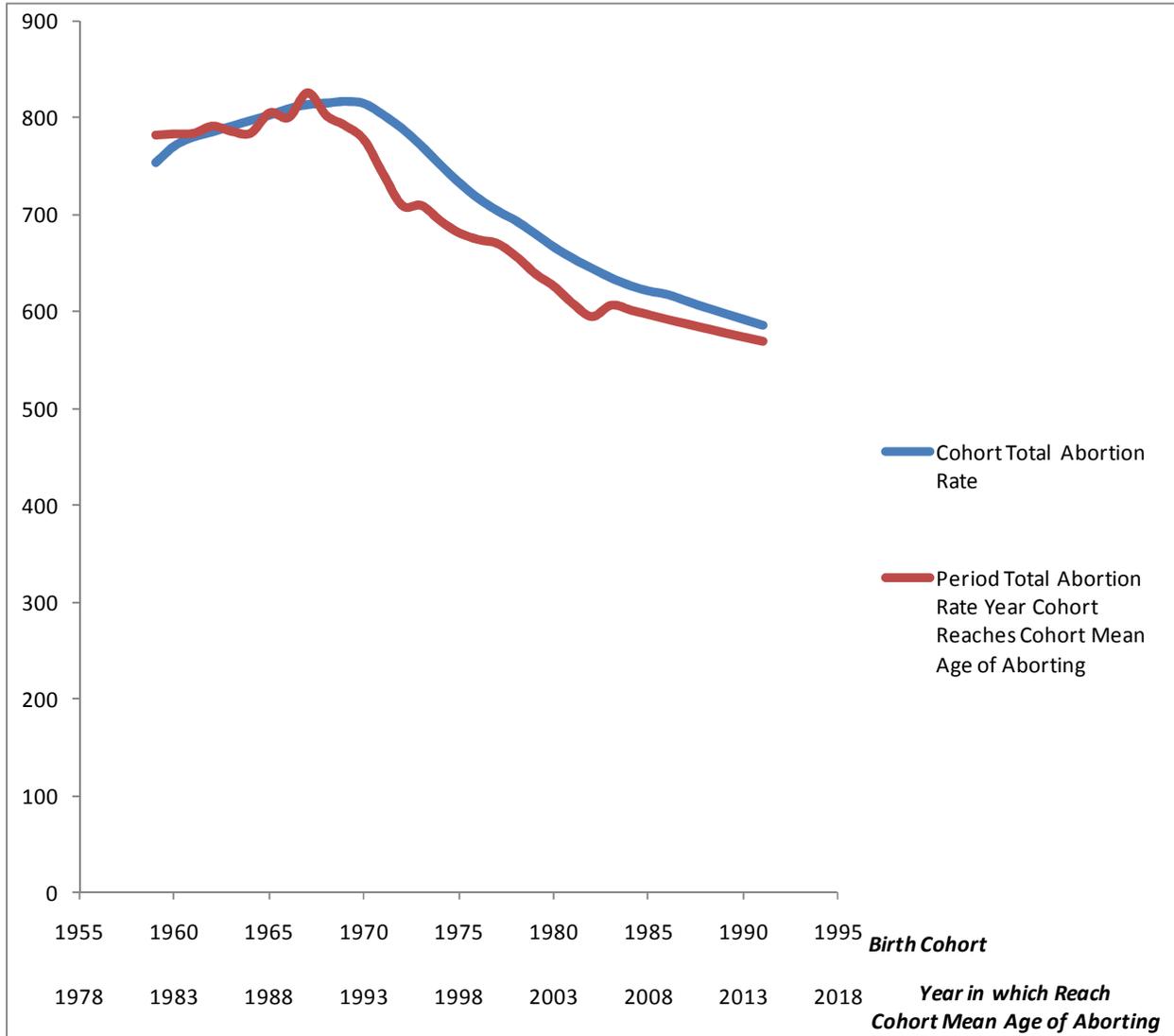


Figure 10: The cohort total abortion rate and the period total abortion rate for the year in which the cohort reached the average cohort mean age of aborting by race and ethnicity for birth cohorts 1964 to 1990.

