The Fertility Response to 9/11

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Introduction

Nine months after the 2001 terrorist attacks on the World Trade Center and the Pentagon, the New York Times printed a story questioning whether an increase in births related to the event was likely to occur (Kleinfield 2002). The idea that catastrophic events may elicit a "baby boom" has precedence in the media. Following a New York City blackout in 1965, the New York Times reported anecdotal evidence that births had indeed increased (Tolchin 1966). While later work by Udry (1970) suggested that births had, in fact, remained constant after the blackout, the thought that significant events could trigger a fertility response remains implanted in the collective consciousness. The World Trade Center bombing, which resulted in huge loss of life and immense national grief, might be expected to arouse such a response. The primary purpose of this study is to analyze whether such a response occurred.

Previous Studies

The change in an individual's fertility behavior as the result of an unexpected event is likely to be a function of the type of event that occurs, the duration of the event, its severity, and its physical proximity to the individual. In addition, the extent to which the event affects macroeconomic variables, such as employment, price levels, or transportation systems, might play a role. Several examples of a fertility response to a social, political, or economic shock or crisis have previously been reported in the literature, with positive, negative and neutral associations observed. Various theoretical bases have been offered to explain the expected change in birthrates or to suggest reasons why this expected change was not observed.

Two previous studies are directly comparable to this one in that the event that occurred was sudden and unexpected and fairly localized (Udry 1970; Rodgers, St. John, and Coleman 2005). In the first such study, Udry examined the number of births following the "Great Blackout" in New York City in 1965. This 10-hour power outage was widely expected to substantially increase the number of births nine months later, as individuals were confined to their homes and forced to interact with one another. Udry, however, found no significant increase or decrease in the number of births in 1966 relative to the previous five years. An electrical blackout is a benign event when compared to sudden shocks such as bombings or extended political shocks such as civil war, which characteristically include a loss of life. It may be the case that the magnitude of this event was not great enough to cause people to consider making significant changes in their lives. In another paper very closely related to the present study, Rodgers, St. John, and Coleman investigated the fertility behavior in Oklahoma City and its environs in the five year period following the 1995 bombing of the Edward R. Murrow Federal Building. The authors discovered a significant and sustained increase in births and birthrates in Oklahoma County, where the bombing occurred, and much smaller changes in the adjacent counties in the metropolitan area. They also found a significant increase in the number of births in Tulsa County, the center of the Tulsa metropolitan area, which although part of the state of Oklahoma, is spatially distant from the site of the bombing. The authors suggest three theories, replacement, terror management, and community influence, to explain their findings. Replacement theory proposes that an increase in births may occur as individuals, either deliberately or subconsciously, renew the population that was lost in a disaster. This theory is related to the idea that an increase in births may provide insurance against future population losses. Terror management theory refers to the effect of conspicuous mortality on potential parents (Solomon, Greenberg, and Pyszczynski 2000). When death becomes prominent, perhaps because of extensive news coverage or a direct relationship with a victim, individuals might alter their behavior, and a person who had been postponing childbirth may decide to have children sooner rather than later. The third theory proffered by Rodgers et al. is the community influence theory, which suggests that increased fertility may be a result of parents' desire to have children in a community that is close and compassionate.

Evans, Hu, and Zhao (2008), in an analysis of the fertility effects of hurricane and storm warnings on individuals along the Atlantic and Gulf Coasts of the United States, find that the level of the response depends upon the severity of the warning. Increased fertility is associated with low level weather advisories, an effect that diminishes at each higher level of warning. A significant negative effect on fertility is found for the most severe storm advisory. These effects are shown to be long-term, suggesting that the perceptions of increased risk that accompany these weather advisories can linger long after the initial period of danger has passed. The authors also observe that the demographic characteristics of those individuals who conceive children during a storm advisory are not consistently different from those individuals who do not. This implies that the fertility effect is not the result of a particular high fertility subgroup significantly altering their behavior.

Significant social change has also been confirmed to affect fertility behavior (Rindfuss, Reed, and St. John 1978; Reinheckel et al. 1998). The period following the 1954 Supreme Court decision in *Brown v. Board of Education* was the setting for the study by Rindfuss et al., who found reductions in the birthrates of white women in nine Southern states. These decreases began almost exactly 12 months after the Court decision, and were in direct contrast to the increasing fertility rates exhibited in the rest of the United States. The authors suggest that fear for the future might have led some Southern women to refrain from having children in the period directly following the landmark decision. Reinheckel et al. investigate the case of German reunification between the years of 1989 and 1990, during which the total fertility rate in the former East Germany fell from 1.50 to .98. This drop was attributed mainly to the need for the East Germans to adapt to a new political and economic system which, unlike the former Communist system, did not reward early and prolific childbearing. This period was almost marked by dramatic shortages in housing and job availability, which would be expected to further inhibit fertility. The authors indicate that the fertility rate began to recover in the mid-1990's, suggesting that the effects of the transition were not permanent and that the former East Germans were adapting to a more Western model of fertility.

Other work has been performed on the fertility behavior of women in countries that have experienced periods of war or political and economic discord (Lindstrom and Berhanu 1999; Agadjanian and Prata 2002). Lindstrom and Bernahu provide evidence that the probability of having children for Ethiopian women was significantly diminished during periods of political strife. Agadjanian and Prata conclude that fertility decreased during the period of Angolan civil war, but increased when the war had ended. This suggests that the individual's outlook for the future is an important determinant of the fertility decision. This study also found that the impact of the war on fertility behavior was diminished for regions that were further from the actual fighting, with the exception of the capital city. There are reasons to believe that the effects of a war, as presented in these papers, might be similar to the effects of a single terrorist event, such as the World Trade Center bombing. Both types of event are likely to instill uncertainty about the future in the population that is undergoing attack and will disrupt their daily routine to some extent. War is unique in that is typically not unexpected and it is not an isolated occurrence, often encompassing several years of fighting. In the cases of Ethiopia and Angola, the periods of conflict were years long and were accompanied by famine and serious disruptions of the economic system. While the events of 9/11 produced some economic shocks in the United States, in the airline industry for example, they did not occur for an extended period of time. Hotchkiss and Pavlova (2004) provide evidence that the 9/11 bombings did not significantly reduce the number of hours that Americans worked per week, either in New York City or on a national scale. These results control for the unemployment rate, which the authors caution may be endogenous, as it encompasses the effects of the terrorist attacks as well as general labor market fluctuations. However, regardless of the impetus for changes in the unemployment rate, the finding that hours at work did not decrease is important, as it suggests that time at home did not increase substantially in the weeks following 9/11.

Additional evidence concerning the expected change in fertility behavior following a catastrophic event can be found in the discipline of psychology. While not directly addressing the potential effect on childbearing, studies have found that the prevalence of Post Traumatic Stress Disorder (PTSD) increased in Manhattan and the other boroughs in the period 1-2 months following the World Trade Center attacks (Galea et al. 2002; Schlenger et al. 2002). To the extent that PTSD disrupts sexual function or intimacy between couples, fertility might be expected to decline somewhat. Ai et al. (2005) suggest that the events of September 11th had both positive and negative effects on individuals. They cite an increase in faith-related characteristics, a greater willingness to turn to others, and an increased sense of belonging as examples of positive outcomes, while feelings of insecurity and vulnerability are representative of possibly negative outcomes. These positive factors are related to the community influence theory proposed by Rodgers et al., which implies that an increase in childbearing might be expected as a result of the event. Mathews and Sear (2008) find that perceptions of heightened mortality risk increases the number of ideal children for men, but not for women, which has ambiguous implications for this present study.

Research on the birth outcomes for women who were currently pregnant during the September 11th attacks suggests that the psychological effects of the catastrophe may have direct effects on fertility rates. Catalano et al. (2006), report that the sex ratio fell to a level of 1.0 in New York City in the month of January 2002, lending credibility to the argument that exogenous shocks are associated with increased male fetal loss. Spandorfer et al. (2003) find that pregnancy loss for IVF pregnancies in New York City was greater for women who had a pregnancy test date after 9/11 than for those who had a pregnancy test date prior to 9/11. In terms of the present study it should be noted that an increase in birthrates in the period 9 months and more following the WTC bombing may be an artifact of increased intrauterine death rates in the 9 months immediately following the attack.

Hypothesis and Expectations

As stated previously, the primary purpose of this study is to determine whether a fertility response occurred following the events of September 11th. Because the most prominent terrorist attack occurred in New York City, it is expected that any corresponding increase or decrease in fertility would be of the greatest magnitude within that city, or possibly in the close vicinity. For this reason, attention is focused here on the New York metropolitan area, which includes New York City, Long Island, and Northern New Jersey, as well as a few adjacent counties in New York State. The September 11th attacks will likely be most salient for those individuals who had direct exposure to victims or their families, who personally witnessed the event, or whose lives were interrupted for a significant duration of time. New York County (Manhattan), the site of the attack, is predicted to exhibit the greatest fertility response. Large numbers of victims came from each of the five New York City boroughs, as well as New York State and New Jersey (Demographic 2002). Except for those individuals who lived in the city, it is not possible to determine the exact counties of residence of the remaining victims. However, the substantial number of victims from outside the city suggests that a fertility response might be anticipated in the suburban counties as well.

Of the three theories furnished by Rodgers et al. in their 2005 Oklahoma City study, two seem relevant here: Insurance/replacement theory and community influence theory. As those authors note in their analysis, the insurance/replacement theory suggests an immediate fertility response in those counties in which large numbers of people died. Since the deaths in this case were spread across many counties, a prompt increase in births and birthrates, in the first year or two after the attack, is expected for the majority of the counties in the study. The community influence theory suggests a longer-term response, as individuals gradually take comfort in the community over time. Thus, a steady increase in births and birthrates would be expected over the entire period of the study.

Alternate theories raised by the existing literature in psychology indicate that the fertility responses of these counties might be muted. The higher prevalence of stress disorders following the terrorist attacks suggests that individuals could be unwilling or unable to conceive during this period. It may turn out to be the case that potential parents decide to move to a "safer" city to begin or continue their childbearing. While migration is less of an issue in the analysis of birthrates than it is the analysis of births, an exodus of probable parents from the population under study may elicit selection bias in the results.

Data and Methodology

This analysis considers adjustments in the general fertility rate (GFR) and the crude birth rate (CBR), as well as changes in the monthly number of births, post-9/11. Although age demarcations for the GFR can vary, it is defined here, for each county, as the number of births in a month divided by the number of person years lived in that month by women between the ages of 15 and 50 (Preston, Heuveline, and Guillot 2001). The CBR is similarly defined as the number of births in a month divided by the number of person years lived in that month by all individuals within the county. The GFR is generally considered a more accurate representation of fertility behavior than the CBR, as the latter is dependent on the proportion of reproductive age women in the population. In addition, the raw number of births in any month is prone to fluctuation based on changes in the county population, an issue not present in the calculation of the rates. Despite these deficiencies, all three measures are considered here in order to present a comprehensive picture of any potential changes in fertility behavior.

Data on the number of births in each month was obtained from the vital statistics registry at the National Center for Health Statistics, which includes county-level figures for all counties with a population of 100,000 or more. Of the 23 counties in the New York-Northern New Jersey-Long Island Metropolitan Statistical Area, two counties, Putnam in New York and Pike in Pennsylvania, did not meet this population threshold and are excluded from this analysis. The number of births in each month in each of the remaining counties was documented for a roughly ten year period encompassing the September 11th attacks, from July 1995 to December 2006. County-level population estimates by gender and age group are produced by the Census Bureau as of July 1st of each year; estimates are not available on a monthly basis. To construct monthly population series, two separate interpolations were performed between each annual estimate, one using the total county population and the other using the population of women aged 15-50. This interpolation process implicitly assumes that the increase (or decrease) in the county population was linear between annual estimates. Since the consequent monthly estimates are established at the first calendar day of each month, the number of person years lived during each month was obtained by averaging the populations in successive months, creating the denominators in the formulas for the GFR and CBR. The 21 resulting series of GFR's and CBR's (one of each per county) extend from July of 1995 until December of 2006, and span 138 periods of monthly observations.

This study utilizes an ordinary least squares regression model with dummy variables to detect differences in the number of births, the GFR, and the CBR in each of the New York metropolitan area counties between the pre-9/11 and post-9/11 time periods. This method is well-founded for time series data that comply with the assumption of stationarity, which implies a constant mean and a constant variance over time. In addition, stationarity requires that the covariance between any two observations in the series is independent of the values of time at which they are observed (Hill, Griffiths, and Lim 2008). Stationarity does not require that the mean value of the series be zero, nor does it preclude the series from containing a time trend. While birth data in general, and birthrates in particular, do not exhibit obvious qualities of stationarity, a Dickey-Full unit root test performed on these series reveals that the assumptions of stationarity are satisfied.

The regression models are estimated separately for each county in the data set and for each of the three measures under consideration and take the forms

$$births_t = \alpha + \beta month_t + \gamma time_t + \delta wtc_t + \varepsilon_t \quad \textbf{(1)}$$

$$gfr_t = \alpha + \beta month_t + \gamma time_t + \delta wtc_t + \varepsilon_t \quad \textbf{(2)}$$

$$cbr_t = \alpha + \beta month_t + \gamma time_t + \delta wtc_t + \varepsilon_t \quad \textbf{(3)},$$

where $month_t$ is an indicator for the calendar month at time t, $time_t$ is the time trend, wtc_t is an indicator for the post-9/11 period, and ε_t is a random error term. Assuming a normal gestation period of 9 ½ months, the earliest time that a fertility response to the bombing might show up in the data is in July of 2002. Therefore the *wtc* indicator is set to 0 for each observation prior to July 2002 and changes to 1 for that month and all subsequent observations. The coefficient on the *wtc* term, δ, can be interpreted as the change in the number of births or the change in the GFR or CBR in the period following the World Trade Center bombing, after accounting for any linear trend over time and correcting for seasonality. The analysis was also run with the *wtc* term replaced by an indicator variable for each year from 2002 through 2006. The coefficients on these annual variables can be interpreted as the change attributable to that particular year.

Empirical and Graphical Results

The results from the time-series analysis of births in the post-9/11 period (Equation 1) are presented in Table 1. The first row shows the coefficients for the entire New York City metropolitan area and reveals that more than 315 additional births per month occurred in the region in the first full year following the bombing than would have been expected from the previous trends in the data. New York City by itself does not show a significant increase in births until 2006. The final shaded column reports the coefficients for the change in births per month for the entire period following the terrorist attack. Neither the city nor the metropolitan area exhibits a significant escalation in the number of births throughout the post-9/11 period, although both coefficients are positive. The results for the individual boroughs within the city and the other counties in the metropolitan area are also displayed. The magnitude of the parameter estimates for the post-9/11 period vary substantially both positively and negatively, but only the coefficients for New York County (Manhattan), NY and Ocean County, NJ are significant. As the site of the World Trade Center, New York County might be expected to show a large fertility response to the bombing, and these results suggest that this is true. The coefficient of 52.9 represents the average number of additional births per month that the county experienced in the period following the bombing, relative to its prior trend. The disaggregation

Table 1: Change in Number of Births in New York Metropolitan Area Counties

	2002	***2003***	***2004***	***2005***	***2006***	***Post-9/11***
New York Metro	-34.7	315.2 **	44.0	-414.8 ***	37.0	53.6
New York City	-112.5	60.7	21.6	-106.7	203.9 ***	85.7
Bronx	-6.9	15.6	-14.8	-25.7	46.3 *	-.2
Kings	-39.8	-19.9	6.3	-27.1	108.0 ***	17.4
New York	-28.9	42.8 **	29.9	-17.2	-3.1	52.9 **
Queens	-39.8	8.0	-6.5	-17.2	45.8	3.3
Richmond	2.8	14.2	6.7	-19.6 *	6.9	12.3
New York Counties						
Nassau	15.1	8.8	-3.8	-33.2 *	7.5	.6
Rockland	1.5	-3.3	-.4	.4	-12.8	-6.2
Suffolk	17.1	38.9 *	17.	-65.9 ***	-25.4	-19.8

Westchester	23.6	32.8 **	8.0	-26.1 *	-42.3 ***	.6
New Jersey Counties						
Bergen	9.8	34.8 ***	18.3	-38.0 ***	-31.5 *	-3.1
Essex	3.1	14.9	12.8	-36.9 **	10.2	5.2
Hudson	-19.9	-8.4	-11.5	1.9	40.4 ***	-.4
Hunterdon	9.2 *	1.4	-4.9	-3.1	-7.1	-6.4
Middlesex	5.8	36.6 **	-13.5	-28.5 *	-7.8	4.6
Monmouth	5.5	28.6 **	-12.2	-17.2	-18.5	-.6
Morris	3.6	24.4 *	5.6	-31.4 **	-32.6 **	-21.8
Ocean	-9.8	11.6	16.5	14.6	-14.0	34.4 ***
Passaic	-3.4	3.4	-3.9	-3.3	-3.8	-3.0
Somerset	18.1 **	14.6 *	-3.9	-12.5	-33.3 ***	-12.7
Sussex	-6.2	5.1	-3.7	-4.4	5.0	1.2
Union	4.4	10.2	1.8	-24.7 **	-.8	-4.5

*Regression analyses control for time trend and seasonality; *** p<.001; ** p<.01; *p<.05.*

of this combined value into its annual components, displayed in the first five columns, shows that a sizable surge in births occurred in New York County in 2003. This is the first full year in which the effects of the bombing might be predicted to appear, and substantiates the claim that a fertility response in Manhattan did occur. There was little change in births in the other four boroughs until several years after the terrorist attacks. Many of the outlying counties also register large birth increases in 2003, and there is no obvious correlation between these counties and their proximity to the World Trade Center site. It was speculated that any immediate fertility response would be of a greater magnitude for those counties which were spatially close to the bombing site in Manhattan, but this does not appear to be the case. None of the other New York City boroughs, and only one of the four closest counties in New Jersey (Bergen County), exhibit an increase in births in 2003. Nearly all individual counties report a diminished number of births three to four years after the bombing. The exceptions are Bronx County and Kings County (Brooklyn) in New York City and Hudson County in New Jersey. It may be worth noting that these three counties are among the geographically closest to the World Trade Center site.

Table 2 and Table 3 lay out the changes in the GFR and the CBR, respectively, for the post-9/11 period. The analysis of the coefficients in Table 1 is somewhat deficient due to variations in total county population. An increase of 100 births in Kings County, which has a population approaching three million, is not equivalent to an increase of 100 births in Hunterdon County, with a population less than 200,000. Because the actual number of births is largely a

Table 2: Change in General Fertility Rate in New York Metropolitan Area Counties

	2002	*2003*	*2004*	*2005*	*2006*	*Post-9/11*
New York Metro	-.034	.048	.007	-.062 *	.071 *	.054 *
New York City	-.070 *	.018	.016	-.019	.149 ***	.104 **
Bronx	-.092	-.017	-.050	.000	.240 ***	.047
Kings	-.075	-.025	.024	-.011	.212 ***	.114 **
New York	-.052	.099 ***	.059	-.052	-.018	.097 **
Queens	-.089 *	.006	.010	.026	.175 ***	.150 ***
Richmond	.000	.094	.045	-.149 *	.109	.108
New York Counties						
Nassau	.024	.015	-.014	-.083	.088	.050
Rockland	-.009	-.084	-.019	.025	-.135	-.102
Suffolk	.011	.066	.018	-.170 ***	.013	-.069
Westchester	.069	.123 **	.030	-.093	-.136 **	.018 **
New Jersey Counties						
Bergen	.029	.153 **	.084	-.161 **	-.114 *	.010 **
Essex	-.033	.033	.055	-.144 **	.144 **	.063
Hudson	-.187 **	-.072	-.048	.076	.377 ***	.143
Hunterdon	.278 *	.029	-.168	-.091	-.183	-.200
Middlesex	-.004	.155 **	-.082	-.135 *	.038	.031
Monmouth	.001	.150 *	-.100	-.094	-.040	.001
Morris	.037	.214 **	.049	-.260 **	-.265 **	-.156
Ocean	-.118	.038	.085	.102	-.075	.152 *
Passaic	-.068	.001	-.029	.003	.041	.016
Somerset	.179 *	.169 *	-.035	-.102	-.327 ***	-.050
Sussex	-.171	.112	-.123	-.127	.148	-.024
Union	-.008	.061	.023	-.153 *	.067	.033

*Regression analyses control for time trend and seasonality; *** p<.001; ** p<.01; *p<.05.*

function of the size of the population of a particular county, birthrates can be used to standardize these results, which allows for direct comparison of the parameter estimates. The results from Tables 2 and 3 are very similar with respect to which counties exhibit significant coefficient values, which is unsurprising if the proportion of reproductive age women in each county is not rapidly shifting. Attention here will thus be focused on the GFR values in Table 2.

As can be seen in the final column of the table, both New York City and the New York

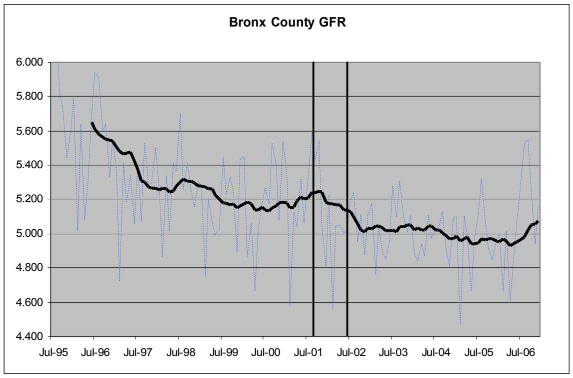
Table 3: Change in Crude Birth Rate in New York Metropolitan Area Counties

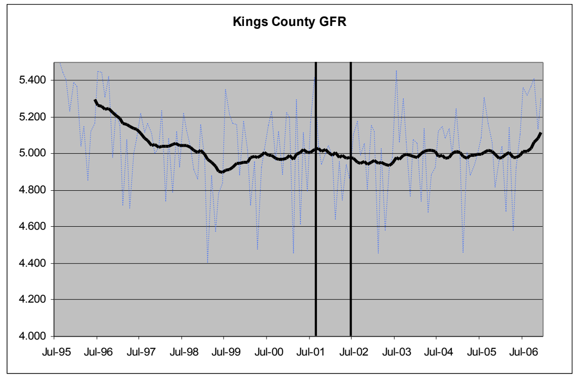
	2002	*2003*	*2004*	*2005*	*2006*	*Post-9/11*
New York Metro	-.009	.013 *	.002	-.016 *	.016 *	.013
New York City	-.018 *	.007	.005	-.007	.036 ***	.026 **
Bronx	-.015	.008	-.008	-.007	.052 **	.021
Kings	-.018	-.005	.006	-.007	.049 ***	.022
New York	-.015	.029 **	.018	-.016	-.006	.028 **
Queens	-.026 *	.002	.002	.005	.041 ***	.033 **
Richmond	-.005	.022	.013	-.033	.036	.037 *
New York Counties						
Nassau	.006	.002	-.006	-.022 *	.016	.001
Rockland	.003	-.010	.000	.003	-.039	-.013
Suffolk	.003	.016	.004	-.041 ***	.000	-.019
Westchester	.016	.029 *	.006	-.023	-.031 *	.003
New Jersey Counties						
Bergen	.005	.036 **	.020	-.036 **	-.022	.007
Essex	-.009	.010	.015	-.037 *	.036 *	.018
Hudson	-.049 **	-.019	-.014	.020	.099 ***	.036
Hunterdon	.061 *	.002	-.041	-.017	-.035	-.044
Middlesex	-.001	.042 **	-.019	-.032	.010	.015
Monmouth	-.000	.037 *	-.023	-.022	-.008	.005
Morris	.003	.047 *	.010	-.060 **	-.053 *	-.035
Ocean	-.026	.012	.025	.029	-.012	.055 ***
Passaic	-.017	.001	-.007	.001	.008	.005
Somerset	.046	.041	-.011	-.028	-.081 ***	-.017
Sussex	-.050	.026	-.029	-.025	.048	.006
Union	-.002	.014	.004	-.038 *	.016	.005

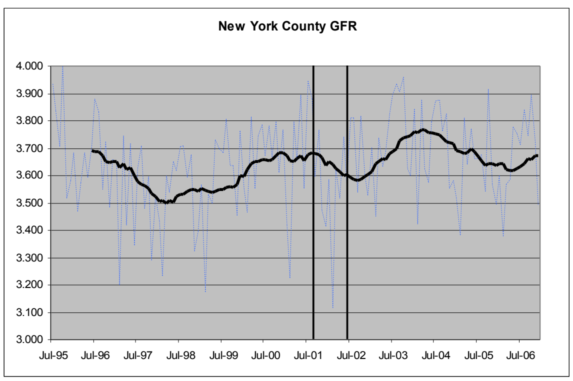
*Regression analyses control for time trend and seasonality; *** p<.001; ** p<.01; *p<.05.*

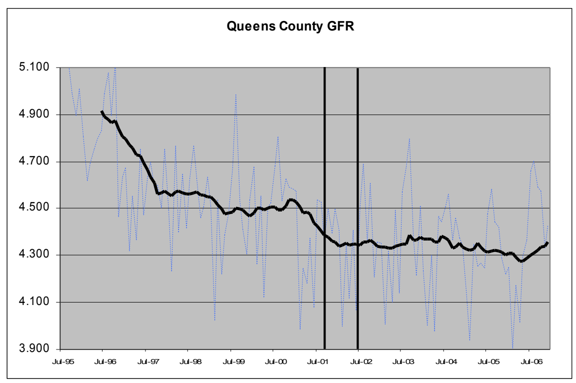
metropolitan area exhibit significant increases in their GFR's in the post-9/11 period. This increase is nearly twice as large for the city relative to the county. All five of the boroughs in the city also show positive hikes in their GFR's, with those of Kings County, New York County, and Queens County statistically significant. The largest proportion of this increase appears to have occurred soon after the bombing, in 2003, in Manhattan, and later in the other boroughs. While these coefficients are not as readily interpretable as those in Table 1, the .099 value for New York County suggests that an additional 99 births per one million reproductive age women per month occurred in 2003 as a result of the terrorist attack. As in the analysis of the number of births, these figures suggest that New York County, where the bombing happened, experienced an immediate fertility response. A similar response is evident in the 2003 coefficients for the outlying counties, particularly those in New Jersey. Several counties show large and significant GFR increases in the first full year during which a response could emerge, with many substantial decreases occurring several years later.

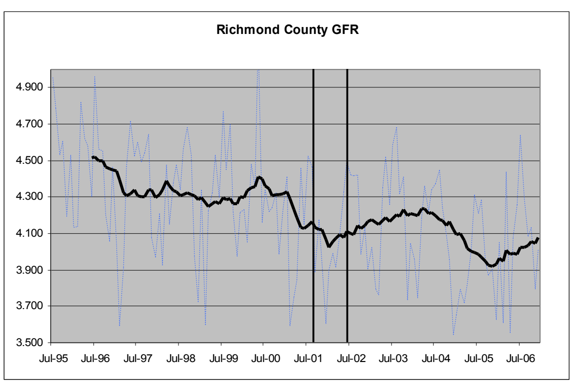
As a supplement to the regression results listed in Table 2 above, the levels and changes in the GFR over time can be depicted visually. The figures below show the GFR's for the entire study period for each of the five boroughs of New York City, as well as for the city as a whole. The blue lines on these graphs show how the GFR changes from one period to the next. The thick, black line is a 12-month moving average of the GFR values. The moving average "smooths" the data, removing some of the volatility inherent in the monthly figures. The first thin vertical line represents the date of the World Trade Center bombing. The second vertical line represents the first approximate date that a fertility response might be expected to begin, 9 ½ months later. From these graphs, the jump in the GFR that occurs in New York County post-9/11 is quite clear. The increase begins almost immediately after the second vertical line, indicating the promptness of the response. Bronx County, Kings County, and Queens County exhibit GFR's that are virtually flat throughout the period of the study. Both Richmond County and New York City as a whole show small jumps in fertility after July 2002, but these increases are not nearly as dramatic as those displayed by New York County.

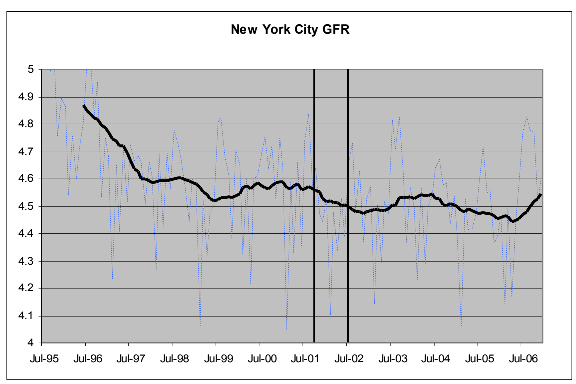












Limitations and Conclusion

The results presented in the previous section, while suggestive, leave ample room for additional explanation. While New York County exhibited a prompt and significant increase in births and birthrates in the post-9/11 period, the outcomes for adjacent and nearby counties only sporadically fits the theoretical model. The large positive effects for several New Jersey counties in 2003, coupled with the large negative effects for these same counties in 2005 and 2006, suggests that other factors may come into play and should be considered in the model. Primary among these other factors may be the overall state of the economy, as measured either by the unemployment rate or changes in the price level. A brief test using the data for Kings County and controlling for the lagged unemployment rate did not reveal significantly changed coefficient estimates, but this result may not carry over to other counties. This analysis also does not attempt to control for migration between the counties in the New York metropolitan area or between the New York area and other areas in the country. This limitation is accounted for somewhat by the use of birthrates, which are insensitive to the size of the population. If the individuals who are leaving the area are those that are more likely to become potential parents, however, this may imply that selection bias is present in the data. Contrary to the community influence theory suggested by Rodgers et al., it may be the case that individuals, rather than choosing to have children based on the compassion in the neighborhood, opt to have children based on the safety of the neighborhood. New York City and the surrounding counties may seem to be too great of a target to ensure the level of safety that these individuals prefer. In future work, it might be advantageous to analyze another metropolitan area that is distinct from New York. This would allow for a control against which to measure the New York results.

Regardless of these shortcomings, the regression analyses presented here indicate that a fertility response to the events of 9/11 did occur in Manhattan, and might have occurred in some of the other boroughs and outlying counties. The graphical results in particular indicate that the experience of Manhattan was very different from that of the other boroughs and that the change in the GFR happened at precisely the time that it would have been expected.

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