

# Millennial Childbearing and the Recession

## Appendix A

### Decomposition of the Difference between Two Rates

The analytic technique we used is called the decomposition of the difference between two rates. This technique is used when three conditions are met: (1) there has been a change in the rate of occurrence of some event overall between two points in time; (2) subgroups of the population exposed to the risk of the event exhibit substantially different rates at time 1; and (3) the composition of the population exposed to the risk of the event has shifted between time 1 and time 2 with respect to these subgroups of the population. Development of this technique emerged to examine differences in rates of job mobility across cities (Kitagawa 1955), differences in rates of labor force participation across time (Das Gupta 1978), and differences in infant mortality rates across race and ethnicity (Kim and Strobino 1984).

We used the technique because there has been a decline in birth rates between 2007 and 2012 for all American women ages 20 to 29 and for non-Hispanic white, non-Hispanic black, and Hispanic women (Martin et al. 2015). It is well-known that in virtually every population of women, those who are married have higher birth rates than those who are not. Between 2007 and 2012 the proportion of the population (overall and in the three racial and ethnic groups) that was married shrank (Martin et al. 2014). Therefore, we undertook to decompose the decline in overall birth rates between 2007 and 2012 into the component that was caused by the change in the proportion of the population that was married and the component that was caused by changes in the birth rates among married and unmarried women.

### Data

The data for our analysis comes from two sources. We used CDC Wonder to obtain (1) the number of births by marital status of the mother (currently married or not currently married) for all US women ages 20 to 29 and for non-Hispanic white, non-Hispanic black, and Hispanic women aged 20 to 29 in 2007 and 2012; and (2) the total number of women, overall and for the three racial and ethnic groups, that were ages 20 to 29 in 2007 and 2012. We used the 2007 and 2012 American Community Survey for our estimates of the

proportion of the population of women who were currently married overall and for the three racial and ethnic groups.

## Variables

Three variables are needed to conduct the decomposition. The first is the probability that a single woman ages 20 to 29 would have a birth in 2007 and in 2012. The second is the probability that a married woman ages 20 to 29 would have a birth in 2007 and 2012. The third is the proportion of the population that was married in 2007 and 2012. We calculated everything separately for ages 20 to 24 and 25 to 29. Tables A.1 and A.2 below contain the worksheets we used to calculate the probabilities that single and married women (respectively) had a birth in 2007 and 2012.

## Analysis

We used the method developed by Das Gupta (1978) in our analysis. Our goal was to break the change in the overall fertility rate of women age  $x$  between time  $T$  and time  $t$  into three components: (1) the change in the proportion of women age  $x$  married between time  $T$  and time  $t$  (we denote these proportions as  $A/a$ ); (2) the change in the probability that a married women age  $x$  would have a birth between time  $T$  and time  $t$  (we denote these probabilities as  $B/b$ ); and (3) the change in the probability that an unmarried women age  $x$  would have a birth between time  $T$  and time  $t$  (we denote these probabilities as  $C/c$ ). For our analysis,  $T=2007$  and  $t=2012$ . Table A.3 has these components for ages 20 to 24 and ages 25 to 29 in 2007 and 2012.

To perform the decomposition, the overall fertility rates for all eight combinations of the proportion and the probabilities that exist must be calculated. For example,  $ABC$  gives the actual fertility rate in 2007,  $aBC$  gives the fertility rate that would occur if the proportion married had been that of 2012 and the marital and nonmarital birth rates were those of 2007, and so on. The values for these fertility rates are given in table A.4.

Finally, the formulas for calculating the contribution of the three factors ( $A$ ,  $B$ , and  $C$ ) to the change in the overall fertility rate are as follows:

Contribution of factor  $A = 1/3 \times (aBC - ABC) + 1/6 \times (abC - AbC) + 1/6 \times (aBc - Abc) + 1/3 \times (abc - Abc)$

Contribution of factor  $B = 1/3 \times (AbC - ABC) + 1/6 \times (abC - aBC) + 1/6 \times (Abc - ABc) + 1/3 \times (abc - aBc)$

Contribution of factor  $C = 1/3 \times (ABc - ABC) + 1/6 \times (Abc - AbC) + 1/6 \times (aBc - aBC) + 1/3 \times (abc - abC)$

TABLE A.1

## Worksheet for Calculation of Birth Probabilities for Marital and Nonmarital Births, 2007 and 2012, Women Ages 20–24.

Column number	1	2	3	4	5	6	7	8	9
	Number of women <sup>a</sup>	Proportion married <sup>b</sup>	Number married (1×2)	Marital births <sup>a</sup>	Proportion unmarried <sup>b</sup>	Number unmarried (1×5)	Nonmarital births <sup>a</sup>	Probability of a married birth (4÷3)	Probability of a single birth (7÷6)
<b>2007</b>									
Total	10270163	0.1748	1794957	437801	0.8252	8475206	644553	0.2439	0.0761
Latino	1854566	0.2527	468730	117603	0.7473	1385836	187659	0.2509	0.1354
White	6245242	0.1804	1126529	266562	0.8196	5118713	259920	0.2366	0.0508
Black	1498025	0.0776	116221	29792	0.9224	1381804	170396	0.2563	0.1233
<b>2012</b>									
Total	11032109	0.1333	1470117	322917	0.8667	9561992	593894	0.2197	0.0621
Latino	2159533	0.1849	399205	80427	0.8151	1760328	160711	0.2015	0.0913
White	6380856	0.1405	896714	200841	0.8595	5484142	243459	0.2240	0.0444
Black	1731162	0.0539	93311	22146	0.9461	1637851	165342	0.2373	0.1010

Source: CDC Wonder; American Community Survey; and authors' own data.

<sup>a</sup> Data from CDC Wonder.

<sup>b</sup> Data from American Community Survey.

TABLE A.2

## Worksheet for Calculation of Birth Probabilities for Marital and Nonmarital Births, 2007 and 2012, Women Ages 25–29.

Column number	1	2	3	4	5	6	7	8	9
	Number of women <sup>a</sup>	Proportion married <sup>b</sup>	Number married (1×2)	Marital births <sup>a</sup>	Proportion unmarried <sup>b</sup>	Number unmarried (1×5)	Nonmarital births <sup>a</sup>	Probability of a married birth (4÷3)	Probability of a single birth (7÷6)
<b>2007</b>									
Total	10229259	0.4428	4529516	818923	0.5572	5699743	389485	0.1808	0.0683
Latino	1926410	0.4717	908688	160387	0.5283	1017722	127555	0.1765	0.1253
White	6194840	0.4874	3019365	534814	0.5126	3175475	141085	0.1771	0.0444
Black	1482405	0.3306	490083	55439	0.6694	992322	101863	0.1131	0.1027
<b>2012</b>									
Total	10549980	0.3762	3968902	393826	0.6238	6581078	393826	0.0992	0.0598
Latino	2039707	0.3923	800177	127372	0.6077	1239530	117102	0.1592	0.0945
White	6194840	0.4127	2556610	486917	0.5873	3638230	154460	0.1905	0.0425
Black	1482405	0.2993	443684	48160	0.7007	1038721	101489	0.1085	0.0977

**Source:** CDC Wonder; American Community Survey; and authors' own data.

<sup>a</sup> Data from CDC Wonder.

<sup>b</sup> Data from American Community Survey.

TABLE A.3

## Values for the Three Components of Change in Overall Fertility by Race and Ethnicity

	20 to 24		25 to 29	
	2007	2012	2007	2012
<b>All Women</b>				
Proportion of women that were married	A 0.1748	a 0.1333	A 0.4428	a 0.3762
Probability of a birth to an married woman	B 0.2439	b 0.2197	B 0.1808	b 0.1839
Probability of a birth to an unmarried woman	C 0.0761	c 0.0621	C 0.0683	c 0.0598
<b>Non-Hispanic White Women</b>				
Proportion of women that were married	A 0.1804	a 0.1405	A 0.4874	a 0.4127
Probability of a birth to an married woman	B 0.2366	b 0.2240	B 0.1801	b 0.1904
Probability of a birth to an unmarried woman	C 0.0508	c 0.0444	C 0.0452	c 0.0425
<b>Non-Hispanic Black Women</b>				
Proportion of women that were married	A 0.0776	a 0.0539	A 0.2043	a 0.1741
Probability of a birth to an married woman	B 0.2563	b 0.2373	B 0.1892	b 0.1866
Probability of a birth to an unmarried woman	C 0.1233	c 0.1010	C 0.0892	c 0.0829
<b>Hispanic Women</b>				
Proportion of women that were married	A 0.2527	a 0.1849	A 0.4717	a 0.3923
Probability of a birth to an married woman	B 0.2509	b 0.2015	B 0.1765	b 0.1592
Probability of a birth to an unmarried woman	C 0.1354	c 0.0913	C 0.1253	c 0.0945

Source: Authors' calculations based on data from CDC Wonder and American Community Survey.

TABLE A.4

## Fertility Rates Used in the Decomposition (per Individual)

Rate <sup>a</sup>	All women		Non-Hispanic White Women		Non-Hispanic Black Women		Hispanic Women	
	20 to 24	25 to 29	20 to 24	25 to 29	20 to 24	25 to 29	20 to 24	25 to 29
ABC (2007)	0.5269	0.5907	0.4215	0.5548	0.6682	0.5482	0.8230	0.7474
aBC	0.4921	0.5532	0.3845	0.5044	0.6524	0.5332	0.7838	0.7270
AbC	0.5057	0.5977	0.4101	0.5800	0.6608	0.5456	0.7605	0.7065
ABc	0.4694	0.5670	0.3953	0.5478	0.5650	0.5230	0.6582	0.6658
abC	0.4759	0.5591	0.3756	0.5257	0.6473	0.5309	0.7381	0.6930
aBc	0.4317	0.5267	0.3570	0.4964	0.5466	0.5070	0.6040	0.6333
Abc	0.4482	0.5740	0.3839	0.5730	0.5577	0.5204	0.5957	0.6250
abc (2012)	0.4155	0.5327	0.3482	0.5177	0.5415	0.5048	0.5583	0.5993

**Source:** Authors' calculations based on data from CDC Wonder and American Community Survey.

**Note:** Row "ABC" shows the fertility rates at the 2007 values for proportion married (A), married birth rate (B), and unmarried birth rate (C). Row "abc" shows the fertility rates at the 2012 values for proportion married (a), married birth rate (b), and unmarried birth rate (c). Other rows show possible combinations of 2007 and 2012 values.

<sup>a</sup>All rates are multiplied by five because a woman lives five years from 20 to 24 and from 25 to 29.

## References

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