Appendix A

AI. Trends in Low Birth Weight by Parity and Race

A key assumption in difference-in-difference designs is that trends in those exposed to an intervention are similar or roughly parallel to those unexposed in the periods leading up to the change. In the three panels below we show the rate of low birth weight by race and parity for all single unmarried women in Figure A1a, white women in Figure A1b, and Black women in Figure A1c. The horizontal axis shows what HMS refer to as the effective tax year which defines a woman's exposure to the EITC. What is apparent among all women and especially Black women is the disparity in the time-series pattern of low birth weight among women of parity 5 and 6+ relative to women of parity 2, 3 and 4. This becomes important in our placebo analysis in the text. Women of parity 3 and higher all received the same increase in the EITC after 1993. A natural placebo test is whether the EITC had a differential impact on low birth weight between women of parity 3 and 4 as well as women of parity 4+. A concern of including women of parity 5+ is the differential trends in low birth weight between them and women of parity 3. Thus, in all our placebo tests we compare women of parity 4 to parity 3 separately from women of parity 4+ and 4.

The other noticeable pattern is the curvilinear trajectory of the series with peaks among women of parity 2, 3 and 4 around 1988 followed by steady declines. These patterns become important in the DD analysis. They suggest that rates of low birth weight were declining well before the 1993 expansion among Black women of parities 2, 3 and 4. Although the scale of the vertical axis makes it difficult to discern small changes, there is no clear discontinuity in low birth weight after 1993 among women of parity 3 and 4 relative to parity 2. Second, the curvilinear pattern becomes relevant when HMS estimate the effect of the EITC expansions in 1986, 1990 and 1993 together. As we show in Appendix A section IV, estimates from that analysis are sensitive to the inclusion of trend terms interacted with parity.

Figure A1A. LBW by Parity, Single All w/ <=HS

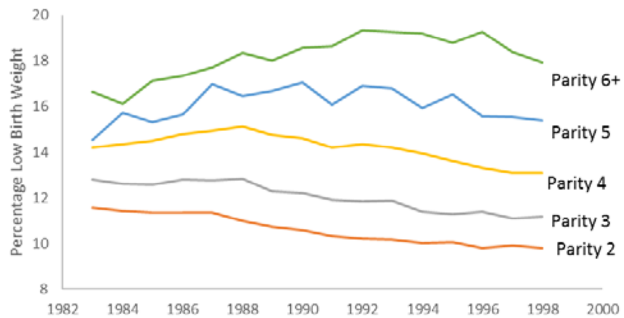


Figure A1B. LBW by Parity, Single White w/ <=HS

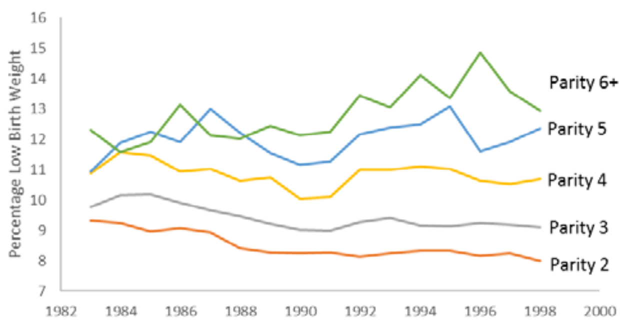
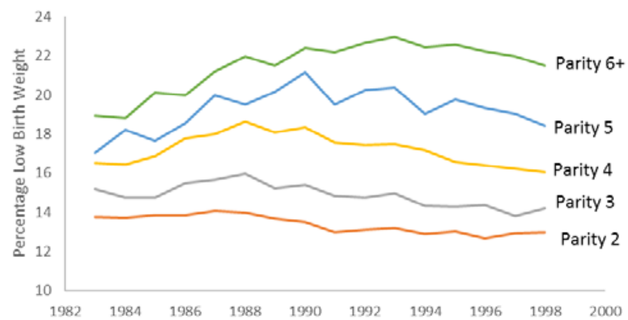


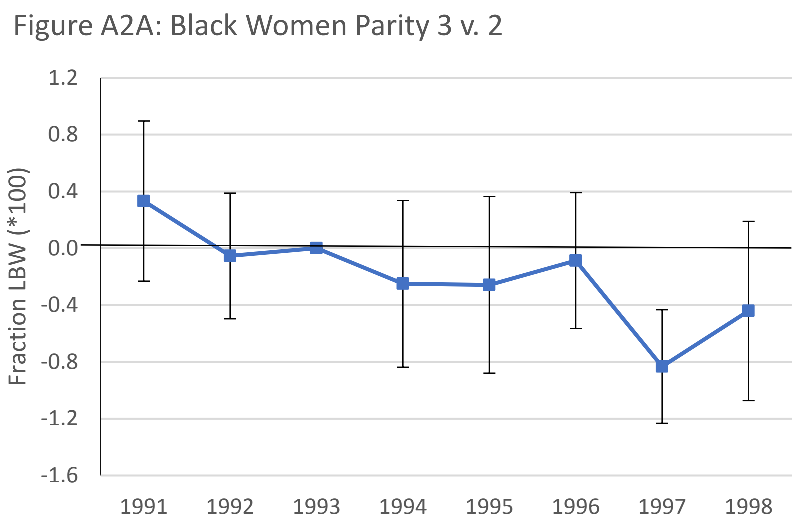
Figure A1C. LBW by Parity, Black Women w/ <=HS

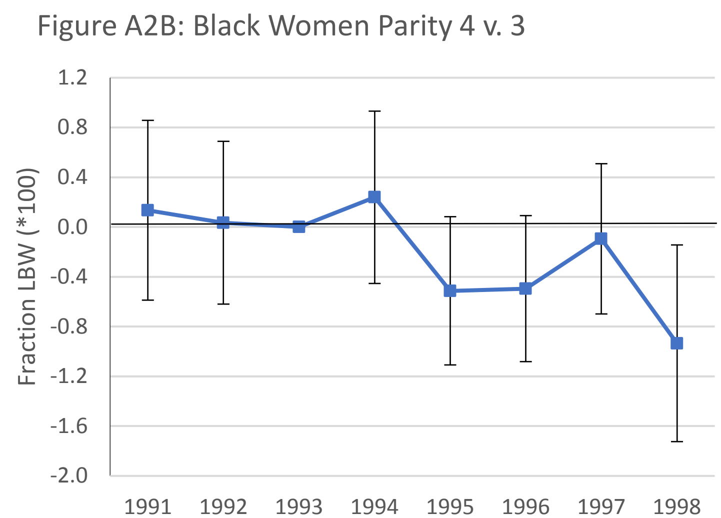


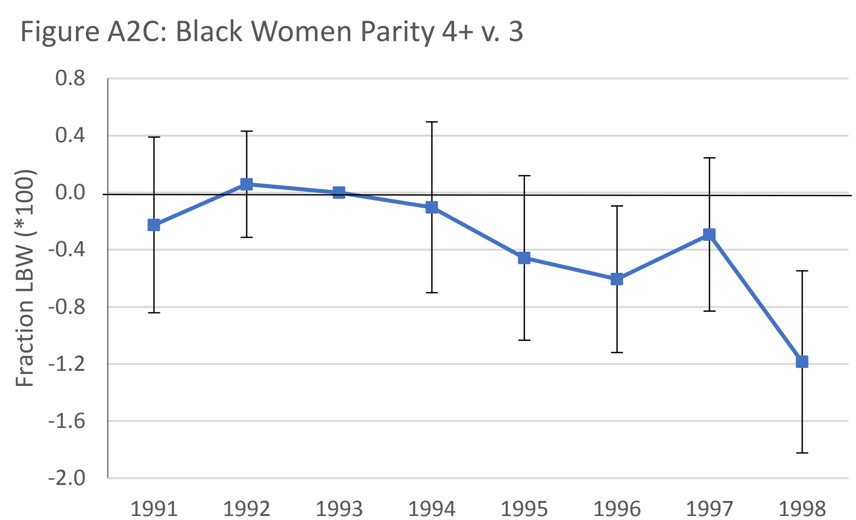
AII. Event-study plots of the placebo tests

As noted in the text, women of parity 3, 4 and 4+ all experienced the same increase in the EITC after 1993. Consequently, there should be no differential effect of the EITC on the rate of low birth weight between women of parity 4 or 4+ relative to parity 3. As we show in the text, Black women fail this placebo test. It is important, however, to insure that the failed placebo tests are not the result of differential trends in low birth weight prior to the expansion. In Figures A2 we estimate event-study regressions of the low birth weight among black women for HMS's study period of 1991-1998. Figures A2a, A2b and A2c compare black women of parity 3 versus 2, parity 4 versus 3 and parity 4+ versus 3, respectively. The pattern in each figure is the same: no differential pre-trends followed by similar declines in low birth weight for each comparison. The graphs demonstrate that the failed placebo tests between women of parity 4 and 4+ versus parity 3 are not the result of differential trends in low birth weight in the pre-period. We discuss potential confounders in Sections V of the text.

Figure A2: Event-study estimates of low birth of for all single Black women with no more than a high school degree of 3 v. 2, 4 v. 3 and 4+ v. 4, (1993=0)







AIII. Possible Mechanisms: Prenatal Care

We find prenatal care to be an implausible explanation. First, the association between prenatal care and birth outcomes in the public health literature is modest at best based on observational studies (Corman, Dave and Reichman, forthcoming).   The randomized studies of prenatal or augmented prenatal care have reported almost uniformly, no association with improved infant health (Collaborative Group on Preterm Birth Prevention 1993; Goldenberg and Rouse 1998; Goldenberg and Culhane 2007; Alexander and Kotelchuck 2001; Klerman et al. 2001; Carroli et al. 2001; Corman Dave and Reichman, forthcoming). The multicenter RCT of preterm prevention is a particularly germane example (Collaborative Group on Preterm Birth Prevention 1993). The intervention targeted women at high risk for preterm birth. The treatment group received weekly examinations beginning in weeks 20-24 until delivery. Patients in the treatment group were also trained to recognize the signs of preterm labor. The intervention conferred no benefit despite a level of support that far exceeded routine prenatal care. In a more recent review of the determinants of preterm birth, the author wrote,

> *Strategies to prevent preterm birth have traditionally emphasized early prenatal care as providing an opportunity to identify and treat prematurity-related risk factors, but this approach has not reduced the incidence of preterm birth. Improved access to prenatal care is associated with lower rates of preterm birth, but the linkage is apparently related more to the high rates among women who receive no prenatal care than to the content of care received* (Iams 2014, p. 256)

Even based on the questionable estimates of prenatal care effectiveness in the public health literature, the change in prenatal care associated with the EITC is inconsequential. For instance, in Table A1 below we replicate HMS's prenatal care results for all women of parity 3+ versus parity 2 (HMS, Table 7).   HMS report that the EITC is associated with an increase of 0.652 percentage points in prenatal care initiation before the third trimester. This is less than a one-percent increase evaluated at the mean of 89.42 percent, a change so small as to be clinically irrelevant.

Lastly, trends in prenatal care vary by parity and the effect of prenatal care fails the placebo test. As we noted in the text, women of parity 3, 4 and 4+ all receive the same increase in the EITC after 1993. There should be, therefore, no differential change in prenatal care between women of parity 4 versus 3 or parity 4+ versus 3. Again, refer to Table A1. The EITC is associated with a 0.493 percentage point increase between all women of 4 versus parity 3 and a 0.659 percentage point increase among black women. These changes are small and not clinically important, but they point to differential trends in prenatal care by parity that are consistent with the differential trends in low birth weight and prenatal smoking discussed in the text. Also of note is the lack of an association between the EITC and prenatal care among white or Hispanic women of parity 3+ versus 2. This is consistent with the lack of an association between the EITC and low birth weight between white and Hispanic women of parity 4 versus 3.

Table A1- Difference-in-differences Estimates of OBRA93 on the Percent Births in Which Prenatal Care Was Initiated in the 2nd Trimester or Earlier for Single Women with a High School Education or Less by Parity and Race/Ethnicity

Model	All (1^)	Black (2)	White (3)	Hispanic (4)
Parity 3+ vs. 2				
Parity3 * After	0.651 (0.175)***	1.244 (0.029)***	0.119 (0.133)	0.161 (0.174)
Mean Dep Variable	89.42	87.48	90.73	89.13
Observations	35,141	10,132	16,174	10,830
Parity 3 vs. 2				
Parity3 * After	0.426 (0.111)***	0.937 (0.167)***	0.095 (0.102)	0.067 (0.0137)
Mean Dep Variable	91.11	89.99	91.8	90.16
Observations	23,717	6,775	10,928	7,347
Parity 4 vs. 3				
Parity4 * After	0.493 (0.103)***	0.659 (0.192)***	0.209 (0.138)	0.222 (0.227)
Mean Dep Variable	88.73	87.02	89.97	88.89
Observations	21,811	6,237	10,327	6,549
Parity 4+ vs. 3				
Parity4+ * After	0.504 (0.177)***	0.651 (0.306)**	0.194 (0.120)	0.075 (0.166)
Mean Dep Variable	87.08	84.72	88.91	87.85
Observations	38,231	11,177	18,457	10,906

^ The dependent variable is the percent of births to women who initiated prenatal care prior to the third trimester as recorded on the birth certificates. All estimates use data posted by HMS. Each estimate is from a separate regression as described by Equation (1) in the text. The standard errors have been adjusted for clustering at the state level following HMS.

References

Alexander, Greg R., and Milton Kotelchuck. 2001. “Assessing the Role and Effectiveness of Prenatal Care: History, Challenges, and Directions for Future Research.” *Public Health Reports (1974-)* 116 (4): 306–16.

Corman, Hope, Dhaval Dave and Nancy Reichman. Forthcoming. “Effect of Prenatal Care on Birth Outcomes: Reconciling a Messy Literature” *Southern Economic Journal*.

Carroli, Guillermo, José Villar, Gilda Piaggio, Dina Khan-Neelofur, Metin Gülmezoglu, Miranda Mugford, Pisake Lumbiganon, Ubaldo Farnot, and Per Bersgjø. 2001. “WHO Systematic Review of Randomised Controlled Trials of Routine Antenatal Care.” *The Lancet* 357 (9268): 1565–70. https://doi.org/10.1016/S0140-6736(00)04723-1.

Collaborative Group on Preterm Birth. 1993. Multicenter randomized controlled trail of a preterm birth prevention program. *American Journal of Obstetrics and Gynecology* 169(2 pt):352-366.

Goldenberg, Robert L., and Jennifer F. Culhane. 2007. “Low Birth Weight in the United States.” *The American Journal of Clinical Nutrition* 85 (2): 584S–590S. https://doi.org/10.1093/ajcn/85.2.584S.

Goldenberg, Robert L., and Dwight J. Rouse. 1998. “Prevention of Premature Birth.” *New England Journal of Medicine* 339 (5): 313–20. https://doi.org/10.1056/NEJM199807303390506.

Iams, Jay D. “Prevention of Preterm Parturition.” Edited by Caren G. Solomon. *New England Journal of Medicine* 370, no. 3 (January 16, 2014): 254–61. https://doi.org/10.1056/NEJMcp1103640.

Klerman, L. V., S. L. Ramey, R. L. Goldenberg, S. Marbury, J. Hou, and S. P. Cliver. 2001. “A Randomized Trial of Augmented Prenatal Care for Multiple-Risk, Medicaid-Eligible African American Women.” *American Journal of Public Health* 91 (1): 105–11.

AIV. The EITCs of 1986, 1990 and 1993

As noted in the text, HMS expand their analysis of the EITC and low birth weight by combining the EITC expansions in 1986 and 1990 with that of 1993.[1] To evaluate the impact of all three expansions, HMS again aggregate individual-level birth certificate data to cells defined by state, year, parity, maternal education, race, ethnicity and age from 1983 to 1998 (HMS, Appendix B). They limit the sample to single, unmarried women who gave birth. To account for the multiple expansions HMS estimate the following two-way fixed effects specification:

$$(2)\ Y_{pjst} = \alpha + \delta Maxcredit_{pt} + \pi X_{st} + \ \rho_p + \ \varphi_j \varphi_k + \delta_t + \tau_s + \epsilon_{pjst}$$

Y_{pjst} is the rate of low birth by parity (p), demographic groups (j), state (s) and year (t). X is a set of state policies: Medicaid/SCHIP, welfare reform and the state unemployment rate. $Maxcredit_{pt}$ is the maximum tax credit available to eligible filers that varies by parity and year. HMS include an additional term (p_p* T) to control for linear trends by parity. We replicate HMS's analysis in the top Panel of Table A2 below. The coefficient for all women indicates that a $1000 increase in the maximum available credit is associated with -0.304 percentage point decline in the rate of low birth weight. The effects for white women are substantially smaller [-0.117, column (4)], while those for black women are much larger [-0.518, column (7)].

The estimates in Table A2 are also sensitive to the inclusion of trend terms by parity. Inclusion of a linear trend term almost triples the estimated effect for black women from -0.518 to -1.357 percentage points (columns 7 and 8), whereas a quadratic trend in parity eliminates any effect of the EITC on low birth weight (column 9). Trend terms interacted with parity may over fit the data, but as we show in Appendix A, Figure A1, the time-series pattern in low birth weight is clearly curvilinear especially

[1] The Tax Reform Act, 1986; Omnibus Budget Reconciliation Act, 1990; and the Omnibus Budget Reconciliation Act, 1993 (Nichols and Rothstein 2016).

among black women.   At a minimum, the effect of the EITC expansions on low birth weight is observationally equivalent to nonlinear trends in low birth weight by parity unrelated to the EITC.

In the lower panel of Table A2 we re-estimate the same model but limit the sample to the effective years 1983-1993. In this subsample there is no association between the $Maxcredit_{pt}$ and low birth weight for all women and all black women. Inclusion of a linear trend in parity eliminates any effect for white women. The lack of an association between the EITC expansions in 1986 and 1990 is not surprising given that take-up and the magnitude of the available tax credits were substantially less in these early expansions. The point, however, is that the estimated effect from the extended analysis is driven by the 1993 expansion, which we have argued lacks convincing evidence of a causal effect.

Table A2- Maximum Credit Estimates of EITC on Low Birth Weight, Single Women with a High School Education by Race									
Model	All			White			Black		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: 1983-1998									
Maximum Credit ($1,000 of 95$)	-0.304*** (0.066)	-0.772*** (0.128)	-0.075 (0.150)	-0.117** (0.053)	-0.075 (0.107)	0.005 (0.159)	-0.518*** (0.114)	-1.357*** (0.179)	-0.0214 (0.220)
Parity X linear time		X	X		X	X		X	X
Parity X quadratic time			X			X			X
P-value, trends terms		0.000	0.000		0.000	0.000		0.000	0.000
Mean LBW	11.21	11.21	11.21	8.81	8.81	8.81	14.76	14.76	14.76
Observation	81,782	81,782	81,782	37,335	37,335	37,335	23,746	23,746	23,746
Panel B: 1983-1993									
Maximum Credit ($1,000 of 95$)	-0.087 (0.147)	-0.330 (0.360)	0.527* (0.291)	-0.467*** (0.119)	0.004 (0.362)	0.072 (0.361)	0.147 (0.284)	-0.359 (0.552)	1.14 (0.478)**
Parity X linear time		X	X		X	X		X	X
Parity X quadratic time			X			X			X
P-Value, trend terms		0.000			0.000	0.000		0.000	0.000
Mean LBW	11.43	11.43	11.43	8.83	8.83	8.83	14.88	14.88	14.88
Observation	55,003	55,003	81,782	24,805	24,805	24,805	16,220	16,220	16,220

AV. Crack Cocaine as a possible Confound

In this Section of the Appendix we use birth certificate data from the New York City Department of Health and Mental Hygiene to show trends in low birth weight, prenatal exposure to narcotics by race and parity. From 1980 to 1987 there was an indication for prenatal exposure to narcotics as a medical risk factor on the New York City birth certificate. Beginning in 1988, the indication was refined to include separate codes for heroin, cocaine and marijuana. We tabulate the percent of births with an indication of narcotic use during pregnancy from 1980-1987 and splice it with the percent of births with an indication of cocaine and heroin from 1988 to 2000 by race and parity.[2] In Appendix Figure A3 Panel A we show the percent of low birth weight births and the percent of births exposed prenatally to illicit drugs. The data pertain to black women only with separate series for women of parity 2 and parity 3+. The data demonstrate that the change in prenatal drug use rose faster among black women of parity 3+ relative to parity 2 beginning around 1985 as did the rate of low birth weight. In Panel B we mimic HMS's event-study by showing the differential change in low birth weight and drug use normalized to 1993. We show the same two panel for white women in Appendix Figure A4. The data for white women are noisier with a less obvious distinction in low birth weight and drug use by parity.

Next, we overlay the differential rate of prenatal drug use between black women of parity 3+ relative to parity 2 with the NYC homicide rate of black males 15 to 24 (Appendix Figure A5). As noted in the text (Section III) numerous social scientists have linked the rise in homicide among young black males to growth in crack cocaine markets in urban areas. The New York City homicide rate among young black males closely tracks the rise in prenatal exposure to cocaine as well the rate of low birth weight among black women. To link the patterns in New York City to national data, we use plot the

[2] Screens for exposure to cocaine as reported on birth certificates are based on self-reports and may include a physician's indication based on the medical chart. There is little doubt that the true prevalence is underreported (Behnke et al. 2013).

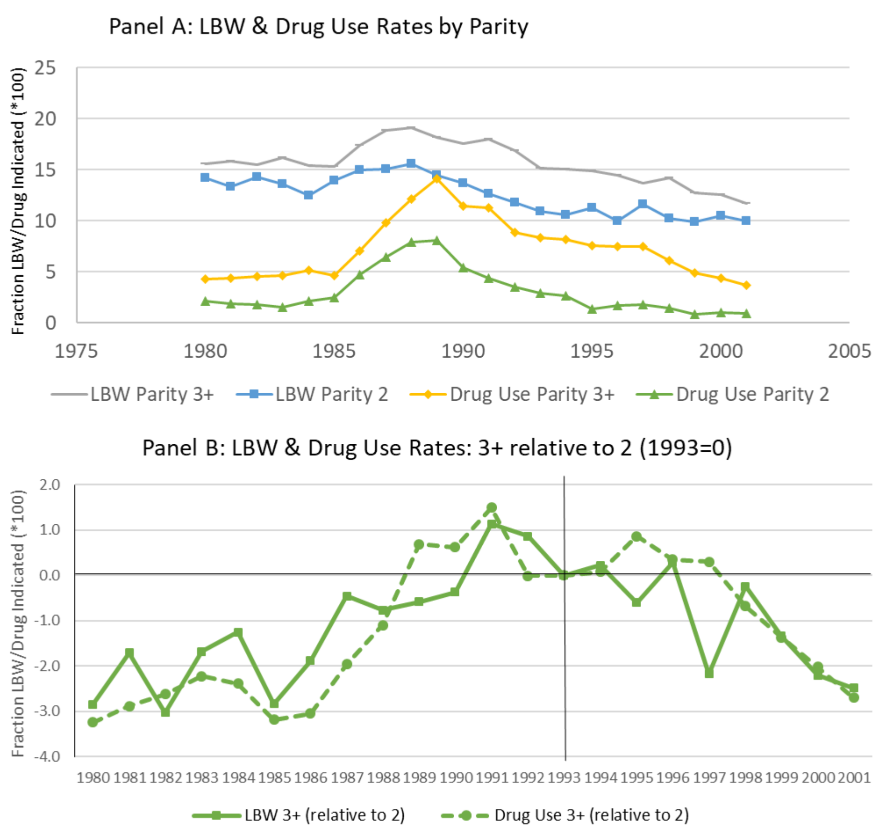
differential rate of low birth weight of black women with a high school degree or less between women of parity 3+ and parity 2 using national data from HMS and the national rate of homicide among black males 15-24 years of age (Appendix Figure A6, Panel A). In Panel B we show the same figure for white women. All series are normalized to 1993 so as to make them comparable to HMS's event study figures. The point is twofold: First, low birth weight, drug use and homicide rates begin to rise after 1985, peak around 1991 and decline thereafter. Second, to the extent that the rise in homicide rates reflects the spread of crack-cocaine markets, they are consistent with the clinical literature, which reported greater exposure among black women of higher relative to lower parity (Vega et al. 1993).

There are no comparable data of prenatal exposure to cocaine by race and parity from other parts of the country. However, as noted in footnote 16 of the text, we cite studies of prenatal exposure to cocaine and birth outcomes from hospitals and clinics in Boston, Chicago, Pittsburgh, and Florida. The unprecedented prevalence study in scale and accuracy by Vega et al. (1993) confirms that the differential exposure to cocaine by race was not limited to New York City was evident across the entire state of California.

Re-estimating the DDs with Homicide Rates

In this section we use the national homicide rate among black males 15-24 as a proxy for the spread of crack-cocaine markets in the 1980s and 1990s. We add the homicide rate interacted with the women of parity 3+ to HMS's DD specification of low birth weight between women of parity 3+ and 2. The results in Appendix Table A3 (Panel A) show that there is no longer any association between 1993 EITC expansion and low birth weight among black women of parity 3+ relative to parity 2. The null results for white and Hispanic women reported by HMS remain as such. We then estimate comparisons between women of parity 4 and 4+ relative to parity 3. Recall that this placebo test found substantial differences between these two groups of black women when there should have been none. As we show in Panels B and C of Appendix Table A3, inclusion of the black homicide rate among young black males interacted with parity eliminates this association as well. Put differently, inclusion of the homicide rate interacted with parity in the DD regressions appears to eliminate the omitted variable bias suggested by failed placebo tests reported in the Table 2 of the text. We cannot draw any causal conclusions from this exercise. Nevertheless, the patterns we have detailed by race and parity are consistent with the possible confounding of the EITC and low birth weight in HMS's analysis.

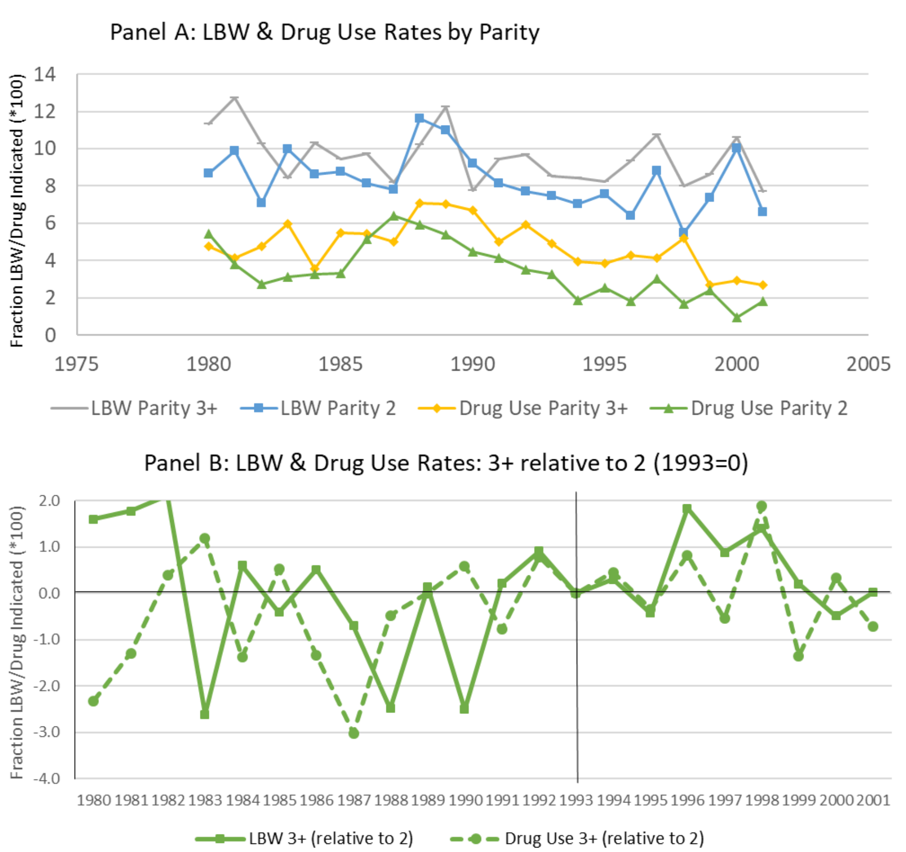
Figure A3: Percent of Births Exposed Prenatally to Narcotics and Cocaine (Drug Use) and Percent Low Birth Weight (LBW) Among Single Black Women with at most a High School Diploma in New York City by Year and Parity



Source: Authors' tabulations of NYC Birth Certificates (1980-2001)

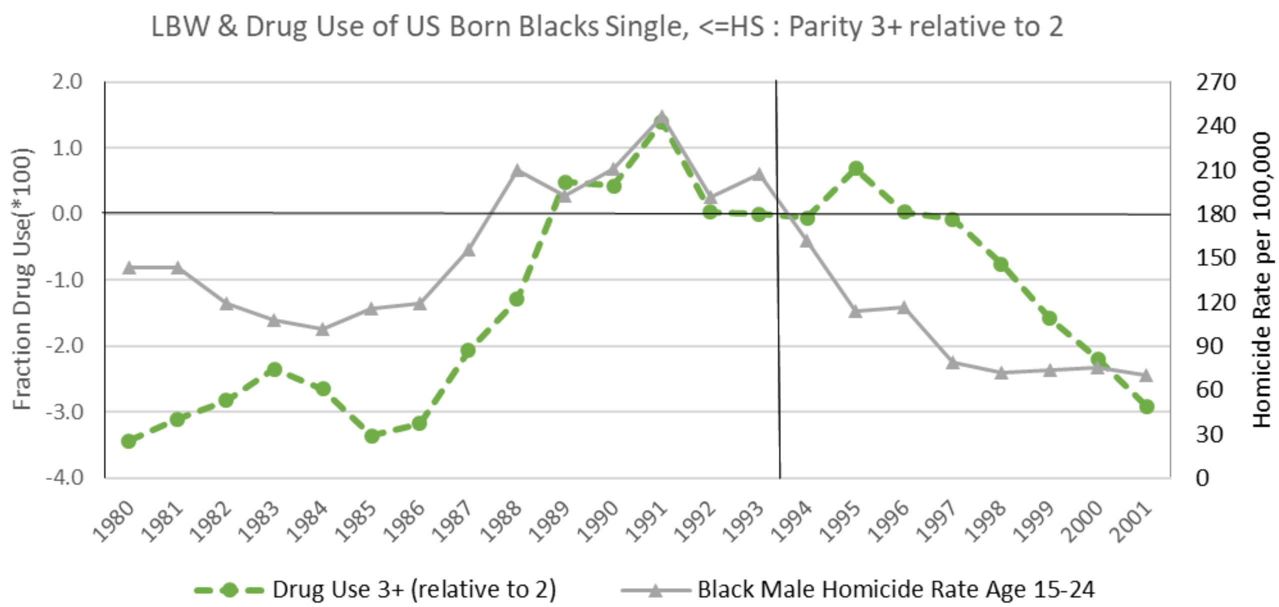
Notes: Panel A shows the absolute rate of low birth weight and prenatal use of narcotics from 1980-1987 and heroin and cocaine from 1988-1998 based on indications on the birth certificate. We refer to this as prenatal drug use. Panel B shows the same for parity 3+ relative to 2 using 1993 as the reference year.

Figure A4: Percent of Births Exposed Prenatally to Narcotics and Cocaine (Drug Use) and Percent Low Birth Weight (LBW) Among Single White Women with at most a High School Diploma in New York City by Year and Parity



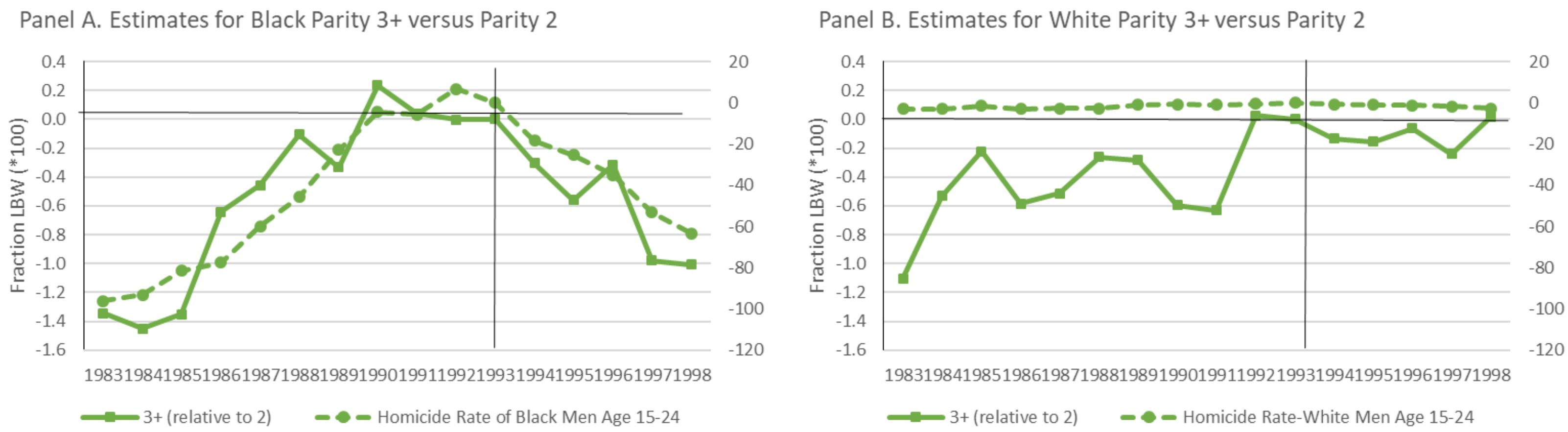
Source: Authors' tabulations of NYC Birth Certificates (1980-2001). See Note to Figure 3.

Figure A5: Homicide Rates of Black Males 15-24 Years of Age Separately in New York City with the Percent of Births Exposed Prenatally to Narcotics and Cocaine (Drug Use, (1993=0)) Among Single Black Women of Parity 3+ Relative to Parity 2 with at most a High School Diploma in New York City



Source: Authors' tabulation of NYC birth certificates and Multiple Cause of Death Files (1980-1988) and Compressed Mortality Files (1989-2001). We thank Tim Moore for data on homicides (see Evans, Garthwaite and Moore 2018).

Figure A6: Event-Time Estimates of Low Birth Weight of Women of Parity 3+ Relative to Parity 2 Among Single Women with at most a High School Diploma Overlaid with National and Homicide Rates for Males Ages 15-24 for Black Women (Panel A) and White Women (Panel B), (1993=0)



Source: HMS (2015) and Multiple Cause of Death Files (1980-1988) and Compressed Mortality Files (1989-2001). We thank Tim Moore for data on homicides (see Evans, Garthwaite and Moore 2018).

Notes: Both panels contrast women of parity 3+ versus parity 2. They exclude California, New York, Texas and Washington because those states are missing education in some years preceding effective year 1991

Table A3- Difference-in-differences Estimates of OBRA93 on Low Birth Weight Single Women with a High School Education or Less Controlling for the Black Homicide Rate, Ages 15-24

Model	All (1^)	Black (2)	White (3)	Hispanic (4)
Panel A: Parity 3+ v. 2				
Parity3 * After	-0.080 (0.109)	0.013 (0.218)	-0.032 (0.146)	-0.145 (0.226)
Mean of dep var	11.3	15.4	9.9	8.7
Observations	35,467	10,273	16,247	10,951
Pane B: Parity 4 v. 3				
Parity4 * After	0.109 (0.224)	0.215 (0.293)	0.149 (0.379)	0.147 (0.672)
Mean of dep var	11.1	15.2	8.6	6.8
Observations	22,021	6,326	10,381	6,625
Pane C: Parity 4+ v. 3				
Parity4 * After	0.250 (0.118)	0.295 (0.259)	0.370 (0.291)	0.160 (0.426)
Mean of dep var	11.8	16.1	10.3	8.1
Observations	23,237	6,759	10,689	7,422

^ All estimates are from Equation (1) in the text. Each include the annual national homicide rate for Black males 15-24 interacted with Parity 3+ (Panel A) or parity 4+ (Panel B). Standard errors are clustered at the state level following HMS.