

Natural Disasters and Early Human Development: Hurricane Catarina and Infant Health in Brazil*

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Online Appendix
(Not for publication)

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A Link to Data Sources

The main data sources used in this analysis are:

Live births

- Information: birth outcomes, sociodemographic characteristics of the child and the mother.
- Source: Information System on Live Births (Sistema de Informações sobre Nascidos Vivos – SINASC).
- Access:
<http://www2.datasus.gov.br/DATASUS/index.php?area=0901&item=1&acao=28&pad=3165>
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Fetal and infant deaths

- Information: fetal and infant deaths by day of death and municipality of residence.
- Source: Information System on Deaths (Sistema de Informações sobre Mortalidade – SIM).
- Access:
<http://www2.datasus.gov.br/DATASUS/index.php?area=0901&item=1&acao=26&pad=3165>
[5](#)

Healthcare services

- Information: hospital admissions due to infections and complications during pregnancy; information on prenatal appointments and obstetric ultrasound scan appointments.
- Source: Hospital Information System (Sistema de Informações Hospitalares – SIH) and Outpatient Information System (Sistema de Informações Ambulatoriais – SIA).
- Access: SIH: <http://www2.datasus.gov.br/DATASUS/index.php?area=0202&id=11633>; SIA: <http://www2.datasus.gov.br/DATASUS/index.php?area=0202&id=19122>

GDP

- Information: municipality-year level data on GDP.
- Source: Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE).
- Access: <https://www.ibge.gov.br/estatisticas/downloads-estatisticas.html>

Employment

- Information: municipality-year level data on formal employment.

- Source: Annual Register of Social Information (Relação Anual de Informações Sociais – RAIS).
- Access: <http://bi.mte.gov.br/bgcaged/login.php> (Public access using login “basico” and password “12345678”)

Damage reports

- Information: municipality-level data on damages due to Hurricane Catarina.
- Source: Integrated System of Information on Disasters (Sistema Integrado de Informações sobre Desastres – S2iD) of Civil Defence.
- Access: <https://s2id.mi.gov.br/>

Development indicators

- Information: municipality-level data on development statistics.
- Source: The 2013 Human Development Atlas (Atlas do Desenvolvimento Humano 2013) of United Nations Development Programme in Brazil.
- Access: <https://www.br.undp.org/content/brazil/pt/home/idh0/atlas-do-desenvolvimento-humano/atlas-dos-municipios.html>

Natural disasters in the Americas

- Information: country-level data on natural disasters used to construct Figure C.1.
- Source: The Emergency Disasters Database (EM-DAT) maintained by the Centre for Research on the Epidemiology of Disasters (CRED).
- Access: <https://www.emdat.be/>

Population Estimates (2001–2005)

- Information: municipality-year level data, by gender and age groups.
- Source: DATASUS/Ministry of Health.
- Access: <http://tabnet.datasus.gov.br/cgi/defthtm.exe?popsvs/cnv/popbr.def>

B Additional Tables

Table B.1: Damages to municipalities in Santa Catarina due to hurricane

	Quantity	% of total
	(1)	(2)
A. Municipalities		
Municipalities directly affected	21	7.2
Distance to hurricane (Km)	28.2–88.8	(Mean=55.77)
Total number of municipalities	293	
B. Population affected		
Had to temporarily leave the dwelling	25,283	5.9
Need shelter	1,320	0.3
Injured or sick	421	0.1
Missing or dead	3	0.7 x 10 ³
Total population affected	27,025	6.4
Population of affected municipalities (2000, IBGE)	425,444	
C. Damages to infrastructure		
Dwellings	71,646	11.1
Public buildings	434	0.1
Private buildings	9,350	1.5
Total buildings damaged	81,430	12.7
Domiciles in affected municipalities (2000, IBGE)	643,208	
D. Direct costs of damages (in 1000 USD PPP)		
Buildings/infrastructure	91,781	2.36
Environment	8,772	0.23
Crops	103,284	2.65
Livestock	2,243	0.06
Other Economic Losses	55,057	0.13
Essential services	16,578	0.43
Total cost	227,715	5.84
GDP of affected municipalities (2003, IBGE)	3,895,940	

Notes: Data on damages comes from the Assessment Reports of Civil Defense (Relatórios de Avaliação de Danos – AVADAN) that can be accessed in the following here: <https://s2id.mi.gov.br/>. Data on population, domiciles, and GDP comes from the 2000 Demographic Census of the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE). Essential services include transportation, communication, water supply, electricity supply, sewage, garbage. Costs of damages and GDP are deflated to 2005 using the General Price Index (IGP-DI, FGV), and converted to USD PPP (World Development Indicators-WDI).

Table B.2: Impact of hurricane on baby and mother characteristics (extended model)

	Girl	White	15-24 y/o	Completed HS	Married	First birth	Same municipality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DDD (2001)	-0.025 [-0.057,0.007]	0.001 [-0.018,0.019]	0.028 [-0.007,0.063]	-0.008 [-0.040,0.024]	0.021 [-0.032,0.075]	0.012 [-0.192,0.216]	-0.039 [-0.078,0.001]
DDD (2002)	-0.023 [-0.061,0.015]	0.004 [-0.014,0.022]	0.026 [-0.016,0.068]	-0.004 [-0.028,0.020]	0.039 [-0.014,0.091]	0.103 [-0.188,0.393]	-0.017 [-0.063,0.028]
DDD (2004)	-0.005 [-0.038,0.029]	0.005 [-0.015,0.024]	0.001 [-0.037,0.038]	-0.015 [-0.051,0.020]	-0.007 [-0.112,0.098]	0.077 [-0.092,0.246]	-0.002 [-0.049,0.044]
DDD (2005)	-0.027 [-0.061,0.007]	0.002 [-0.016,0.021]	0.009 [-0.034,0.053]	0.021 [-0.020,0.062]	0.016 [-0.041,0.073]	0.03 [-0.136,0.195]	-0.004 [-0.045,0.037]
Dep var mean	0.49	0.94	0.48	0.16	0.76	1.13	0.65
Dep var SD	0.50	0.24	0.50	0.36	0.43	1.45	0.48
Municipalities	87	87	87	87	87	87	87
Observations	133,466	133,466	133,466	133,466	133,466	133,466	133,466

Notes: This table presents estimated triple-differences coefficients for our selection equations. Same municipality denotes whether the mother's municipality of residence is the same as the municipality where the baby is born. All regressions include municipality, month, and year fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.3: Impact of hurricane on mother's mobility (extended model)

	Age 15-24	Age 25-49	No HS	Completed HS	Not married	Married	Parity<1	Parity≥1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DDD (2001)	-0.057 [-0.116,0.002]	-0.019 [-0.052,0.015]	-0.045* [-0.081,-0.008]	0.013 [-0.080,0.106]	-0.045 [-0.134,0.045]	-0.032 [-0.069,0.005]	-0.013 [-0.061,0.035]	-0.048* [-0.086,-0.009]
DDD (2002)	-0.032 [-0.080,0.016]	-0.004 [-0.055,0.046]	-0.020 [-0.060,0.021]	-0.019 [-0.124,0.086]	0.042 [-0.025,0.109]	-0.027 [-0.076,0.022]	0.055 [-0.012,0.121]	-0.055* [-0.097,-0.013]
DDD (2004)	0.003 [-0.058,0.064]	-0.003 [-0.045,0.038]	0.001 [-0.045,0.047]	-0.032 [-0.103,0.039]	0.012 [-0.070,0.095]	-0.002 [-0.051,0.047]	0.049 [-0.016,0.114]	-0.030 [-0.080,0.019]
DDD (2005)	-0.001 [-0.051,0.049]	-0.002 [-0.048,0.044]	0.006 [-0.035,0.047]	-0.058 [-0.166,0.051]	0.015 [-0.045,0.075]	-0.019 [-0.075,0.037]	0.043 [-0.010,0.096]	-0.031 [-0.080,0.018]
Dep var mean	0.655	0.652	0.653	0.658	0.733	0.629	0.659	0.650
Dep var SD	0.475	0.476	0.476	0.474	0.442	0.483	0.474	0.477
Municipalities	87	87	87	87	87	87	87	87
Observations	63,993	69,473	113,578	19,888	44,130	89,336	55,942	77,524

Notes: The dependent variable is a binary indicator that equals 1 if the mother's municipality of residence is the same as the municipality where the baby is born and zero otherwise. All regressions include municipality, month, and year fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * p < 0.05, ** p < 0.01, *** p < 0.001.

Table B.4: Impact of hurricane on employment and GDP

	ln employed	ln GDP	Share relative to total GDP		
			Industry	Agriculture	Services
	(1)	(2)	(3)	(4)	(5)
DD (2002)	-0.035 [-0.114,0.044]	-0.046 [-0.091,0.000]	0.655 [-0.269,1.580]	-1.126 [-2.571,0.319]	0.464 [-0.632,1.560]
DD (2004)	0.000 [-0.047,0.048]	0.015 [-0.038,0.068]	0.300 [-0.673,1.273]	0.073 [-1.546,1.692]	-0.130 [-1.396,1.136]
DD (2005)	0.030 [-0.030,0.089]	0.007 [-0.046,0.061]	-0.175 [-1.340,0.990]	0.451 [-1.094,1.996]	-0.464 [-1.737,0.809]
Dep var mean	7.13	11.26	20.67	30.18	42.18
Dep var SD	1.44	1.17	14.57	20.84	12.57
Municipalities	87	87	87	87	87
Observations	348	348	348	348	348

Notes: This table examines the effect of the hurricane on the number of employed formal workers, GDP, and the share of various sectors as a proportion of GDP. All regressions include municipality and year fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.5: Impact of hurricane on birth outcomes (w/ municipality specific year-month trends)

	Birth weight (grams)			Low birth weight (<2,500g)			High birth weight (>4,000g)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD	-41.55*	-77.77**	-5.67	1.13	3.47**	-1.10	-1.53	-2.92**	-0.10
	[-82.14,-0.97]	[-132.42,-23.13]	[-59.30,47.96]	[-0.70,2.95]	[1.06,5.89]	[-3.33,1.13]	[-3.37,0.31]	[-5.06,-0.78]	[-3.29,3.09]
Dep var mean	3250	3213	3285	6.39	6.86	5.95	5.86	4.51	7.13
Dep var SD	513.92	506.73	518.14	24.46	25.28	23.66	23.49	20.74	25.73
	Short gestational length (<37 weeks)			Long gestational length (>41 weeks)			Apgar score (0-10)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD	0.14	1.83	-1.44	-0.37	-0.29	-0.53	-0.03	0.03	-0.08
	[-1.63,1.90]	[-0.47,4.14]	[-3.84,0.96]	[-1.33,0.60]	[-1.54,0.96]	[-1.84,0.79]	[-0.12,0.07]	[-0.08,0.14]	[-0.20,0.04]
Dep var mean	5.27	5.53	5.03	1.06	1.11	1.02	9.09	9.05	9.11
Dep var SD	22.35	22.85	21.87	10.25	10.46	10.06	0.79	0.80	0.78
Municipalities	87	87	87	87	87	87	87	87	87
Births	52,979	25,407	27,572	52,979	25,407	27,572	52,979	25,407	27,572

Notes: This table presents the estimated triple-differences coefficients for the baseline model, modified to include municipality specific year-month trends (in addition to municipality, month, and year fixed effects). Coefficients for regressions with binary outcome variables (low birth weight, high birth weight, short gestational length, long gestational length) have been multiplied by 100. Birth weight is measured in grams. Low birth weight is defined as being born weighing less than 2,500 grams. High birth weight is defined as being born weighing over 4,000 grams. Babies with short gestational length are those with less than 37 completed weeks of gestation. Babies with long gestational length are those with over 41 completed weeks of gestation. All regressions include the following controls: gender of the baby, race of the baby (white or other), age bins for the mother (in 5 year intervals), marital status of the mother (married or not), indicators for mother's educational attainment (completed high school or not), 3 indicators for parity at current birth (2nd birth, 3rd birth, or 4th and above), and an indicator for whether the mother's municipality of residence is the same as the municipality where the baby is born. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * p < 0.05, ** p < 0.01, *** p < 0.001.

Table B.6: Impact of hurricane on birth outcomes (excluding preterm babies)

	Birth weight (grams)			Low birth weight (<2,500g)			High birth weight (>4,000g)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD	-35.62 [-76.95,5.71]	-69.10* [-122.53,-15.67]	-3.35 [-56.25,49.56]	0.16 [-1.38,1.70]	1.91 [-0.34,4.15]	-1.49 [-3.32,0.34]	-1.81 [-3.78,0.15]	-3.21** [-5.49,-0.93]	-0.36 [-3.69,2.97]
Dep var mean	3301	3266	3334	3.42	3.61	3.24	6.17	4.74	7.49
Dep var SD	455.74	443.21	464.8	18.18	18.66	17.71	24.06	21.26	26.33
Municipalities	87	87	87	87	87	87	87	87	87
Births	50,209	24,011	26,198	50,209	24,011	26,198	50,209	24,011	26,198

Notes: This table presents the estimated triple-differences coefficients for the baseline model, excluding preterm babies. Coefficients for regressions with binary outcome variables (low birth weight, high birth weight, short gestational length, long gestational length) have been multiplied by 100. Birth weight is measured in grams. Low birth weight is defined as being born weighing less than 2,500 grams. High birth weight is defined as being born weighing over 4,000 grams. Babies with short gestational length are those with less than 37 completed weeks of gestation. Babies with long gestational length are those with over 41 completed weeks of gestation. All regressions include the following controls: gender of the baby, race of the baby (white or other), age bins for the mother (in 5 year intervals), marital status of the mother (married or not), indicators for mother's educational attainment (completed high school or not), 3 indicators for parity at current birth (2nd birth, 3rd birth, or 4th and above), and an indicator for whether the mother's municipality of residence is the same as the municipality where the baby is born. All regressions include municipality, month, and year fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.7: Impact of hurricane on birth outcomes (inc. indicator for Dec)

	Birth weight (grams)			Low birth weight (<2,500g)			High birth weight (>4,000g)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD (Mar28-Nov)	-44.51*	-84.21**	-5.63	0.97	3.41**	-1.38	-1.56	-3.08**	-0.05
	[-84.67,-4.35]	[-139.84,-28.57]	[-57.50,46.24]	[-0.75,2.70]	[0.86,5.95]	[-3.40,0.65]	[-3.53,0.41]	[-5.22,-0.93]	[-3.32,3.21]
DDD (Dec)	-28.15	-52.07	3.86	2.50	2.97	1.90	-2.47	-2.39	-2.15
	[-126.97,70.67]	[-176.10,71.96]	[-123.81,131.52]	[-2.00,7.01]	[-2.12,8.07]	[-4.24,8.03]	[-5.41,0.48]	[-6.08,1.30]	[-7.13,2.83]
Dep var mean	3250	3213	3285	6.39	6.86	5.95	5.86	4.51	7.13
Dep var SD	513.92	506.73	518.14	24.46	25.28	23.66	23.49	20.74	25.73
	Short gestational length (<37 weeks)			Long gestational length (>41 weeks)			Apgar score (0-10)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD (Mar28-Nov)	0.21	2.10	-1.59	-0.27	-0.13	-0.44	-0.02	0.02	-0.07
	[-1.70,2.12]	[-0.42,4.62]	[-4.07,0.90]	[-1.19,0.65]	[-1.37,1.11]	[-1.73,0.86]	[-0.12,0.08]	[-0.09,0.13]	[-0.18,0.05]
DDD (Dec)	-0.62	-1.92	0.34	-1.14	-1.10	-1.41	-0.06	0.07	-0.17
	[-3.61,2.36]	[-5.97,2.13]	[-4.54,5.22]	[-2.59,0.30]	[-2.98,0.77]	[-3.23,0.40]	[-0.20,0.08]	[-0.09,0.22]	[-0.39,0.04]
Dep var mean	5.27	5.53	5.03	1.06	1.11	1.02	9.09	9.05	9.11
Dep var SD	22.35	22.85	21.87	10.25	10.46	10.06	0.79	0.80	0.78
Municipalities	87	87	87	87	87	87	87	87	87
Births	52,979	25,407	27,572	52,979	25,407	27,572	52,979	25,407	27,572

Notes: This table presents estimates of a modified version of the baseline equation that includes additional indicators and interactions for babies born in December 2004. Coefficients for regressions with binary outcome variables (low birth weight, high birth weight, short gestational length, long gestational length) have been multiplied by 100. Controls and fixed effects are the same as in the baseline model. Standard errors are clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.8: Robustness to spatial and serial correlation using Conley (1998) spatial HAC errors

	Birth weight (grams)			Low birth weight (<2500g)			High birth weight (>4000g)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD (Baseline)	-43.22*	-81.58**	-4.92	1.12	3.38**	-1.06	-1.66	-3.03**	-0.26
	[-83.34,-3.10]	[-135.19,-27.97]	[-57.64,47.80]	[-0.71,2.95]	[0.95,5.82]	[-3.29,1.16]	[-3.50,0.18]	[-5.13,-0.93]	[-3.43,2.91]
Cut-off distances									
25km	[-78.13,-8.31]	[-128.12,-35.05]	[-54.26,44.42]	[-0.63,2.88]	[1.09,5.67]	[-3.33,1.21]	[-3.41,0.10]	[-5.23,-0.83]	[-2.82,2.30]
50km	[-72.51,-13.93]	[-128.28,-34.89]	[-48.82,38.98]	[-0.35,2.60]	[1.22,5.54]	[-3.02,0.89]	[-3.28,-0.04]	[-5.16,-0.90]	[-2.46,1.94]
75km	[-69.62,-16.82]	[-127.63,-35.54]	[-46.32,36.48]	[-0.15,2.40]	[1.29,5.48]	[-2.69,0.56]	[-3.14,-0.17]	[-5.09,-0.97]	[-2.27,1.75]
100km	[-66.46,-19.98]	[-126.80,-36.37]	[-43.73,33.89]	[-0.10,2.34]	[1.32,5.44]	[-2.50,0.37]	[-3.05,-0.27]	[-5.07,-0.99]	[-2.05,1.53]
	Short gestational length (<37 weeks)			Long gestational length (>41 weeks)			Apgar score (0-10)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD (Baseline)	0.15	1.77	-1.40	-0.36	-0.23	-0.54	-0.02	0.03	-0.08
	[-1.62,1.92]	[-0.52,4.07]	[-3.81,1.01]	[-1.28,0.57]	[-1.45,0.99]	[-1.82,0.75]	[-0.12,0.07]	[-0.08,0.14]	[-0.20,0.05]
Cut-off distances									
25km	[-1.45,1.74]	[-0.31,3.85]	[-3.86,1.05]	[-1.25,0.53]	[-1.49,1.03]	[-1.64,0.57]	[-0.11,0.06]	[-0.08,0.13]	[-0.19,0.03]
50km	[-1.09,1.38]	[-0.08,3.62]	[-3.49,0.68]	[-1.25,0.54]	[-1.40,0.94]	[-1.61,0.53]	[-0.11,0.06]	[-0.08,0.14]	[-0.19,0.04]
75km	[-0.87,1.17]	[0.25,3.29]	[-3.23,0.42]	[-1.29,0.57]	[-1.38,0.92]	[-1.58,0.51]	[-0.10,0.06]	[-0.08,0.13]	[-0.18,0.03]
100km	[-0.73,1.02]	[0.43,3.11]	[-3.10,0.29]	[-1.33,0.61]	[-1.41,0.95]	[-1.58,0.51]	[-0.09,0.04]	[-0.07,0.12]	[-0.17,0.02]
Municipalities	87	87	87	87	87	87	87	87	87
Observations	52,979	25,407	27,572	52,979	25,407	27,572	52,979	25,407	27,572

Notes: This table compares standard 95% confidence intervals (in square brackets) with confidence intervals based on spatial heteroscedasticity and autocorrelation consistent errors (Conley, 1999). We use different cutoffs for neighboring municipalities: 25km, 50km, 75km and 100km. Controls and fixed effects are the same as in the main paper. * p < 0.05, ** p < 0.01, *** p < 0.001.

Table B.9: Impact of hurricane on birth outcomes (extended model)

	Birth weight (grams)			Low birth weight (<2500g)			High birth weight (>4000g)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD (2001)	-24.30	-41.70	-3.20	1.56	2.06	0.93	0.05	-0.71	0.89
	[-74.9,26.4]	[-104.4,21.0]	[-65.1,58.7]	[-0.72,3.84]	[-0.80,4.92]	[-1.52,3.39]	[-1.68,1.78]	[-3.44,2.03]	[-1.38,3.16]
DDD (2002)	-46.30	-57.5*	-32.00	0.65	0.88	0.30	-0.53	-1.02	0.01
	[-96.8,4.22]	[-113.6,-1.40]	[-106.3,42.3]	[-1.33,2.62]	[-1.88,3.65]	[-2.25,2.84]	[-2.20,1.13]	[-2.80,0.75]	[-2.94,2.96]
DDD (2004)	-42.4*	-79.7**	-4.34	1.16	3.34**	-1.00	-1.62	-2.96**	-0.29
	[-82.3,-2.52]	[-132.6,-26.8]	[-57.1,48.4]	[-0.67,2.98]	[0.90,5.78]	[-3.21,1.21]	[-3.45,0.20]	[-5.07,-0.85]	[-3.45,2.88]
DDD (2005)	-33.70	-40.10	-23.00	1.64	1.69	1.37	-1.86	-2.80*	-0.95
	[-79.3,11.9]	[-93.1,13.0]	[-84.7,38.8]	[-0.14,3.43]	[-0.72,4.09]	[-0.78,3.53]	[-3.87,0.14]	[-5.57,-0.035]	[-4.09,2.19]
Dep var mean	3250	3213	3285	6.392	6.859	5.954	5.86	4.505	7.128
Dep var SD	513.92	506.73	518.14	24.46	25.28	23.66	23.49	20.74	25.73
	Short gestational length (<37 weeks)			Long gestational length (>41 weeks)			Apgar score (0-10)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD (2001)	0.56	1.36	-0.34	-0.53	-0.31	-0.75	-0.06	-0.07	-0.06
	[-1.44,2.56]	[-0.76,3.47]	[-3.06,2.38]	[-1.56,0.49]	[-1.86,1.24]	[-2.08,0.58]	[-0.17,0.047]	[-0.21,0.074]	[-0.17,0.060]
DDD (2002)	0.31	1.47	-1.01	-0.65	-0.71	-0.60	-0.02	-0.01	-0.03
	[-1.47,2.08]	[-1.38,4.32]	[-3.04,1.02]	[-1.50,0.19]	[-1.98,0.55]	[-1.59,0.39]	[-0.12,0.070]	[-0.13,0.10]	[-0.13,0.070]
DDD (2004)	0.21	1.87	-1.46	-0.33	-0.24	-0.47	-0.02	0.03	-0.08
	[-1.55,1.97]	[-0.41,4.16]	[-3.85,0.93]	[-1.25,0.58]	[-1.45,0.97]	[-1.73,0.80]	[-0.12,0.075]	[-0.077,0.14]	[-0.20,0.047]
DDD (2005)	1.40	1.34	1.32	-0.96	-1.21	-0.68	0.04	0.07	0.01
	[-0.94,3.74]	[-1.19,3.87]	[-1.96,4.61]	[-2.08,0.17]	[-2.83,0.41]	[-1.85,0.49]	[-0.048,0.12]	[-0.041,0.18]	[-0.092,0.10]
Dep var mean	5.272	5.527	5.034	1.063	1.107	1.021	9.085	9.054	9.114
Dep var SD	22.35	22.85	21.87	10.25	10.46	10.06	0.79	0.8	0.78
Municipalities	87	87	87	87	87	87	87	87	87
Births	133,466	63,993	69,473	133,466	63,993	69,473	133,466	63,993	69,473

Notes: This table presents the estimated triple-differences coefficients for the extended model, where 2003 is the omitted year. Coefficients for regressions with binary outcome variables (low birth weight, high birth weight, short gestational length, long gestational length) have been multiplied by 100. Controls and fixed effects are the same as in the baseline model. Standard errors are clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.10: Impact of hurricane on birth outcomes (excluding those born in 2005)

	Birth weight (grams)			Low birth weight (<2,500g)			High birth weight (>4,000g)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD (2001)	-24.70	-41.70	-3.43	1.58	2.06	0.94	0.05	-0.69	0.91
	[-75.5,26.0]	[-104.5,21.0]	[-65.5,58.7]	[-0.71,3.87]	[-0.82,4.94]	[-1.51,3.40]	[-1.69,1.79]	[-3.44,2.06]	[-1.37,3.18]
DDD (2002)	-46.10	-57.1*	-31.90	0.63	0.86	0.27	-0.51	-0.99	0.04
	[-96.9,4.67]	[-113.4,-0.75]	[-106.5,42.8]	[-1.35,2.62]	[-1.92,3.65]	[-2.28,2.82]	[-2.18,1.16]	[-2.78,0.79]	[-2.91,2.99]
DDD (2004)	-42.6*	-79.3**	-4.46	1.13	3.28**	-1.03	-1.62	-2.92**	-0.25
	[-82.8,-2.50]	[-132.5,-26.1]	[-57.5,48.5]	[-0.70,2.96]	[0.84,5.73]	[-3.24,1.18]	[-3.44,0.20]	[-5.05,-0.80]	[-3.43,2.92]
Dep var mean	3250	3213	3285	6.392	6.859	5.954	5.86	4.505	7.128
Dep var SD	513.92	506.73	518.14	24.46	25.28	23.66	23.49	20.74	25.73
	Short gestational length (<37 weeks)			Long gestational length (>41 weeks)			Apgar score (0-10)		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD (2001)	0.55	1.29	-0.30	-0.54	-0.28	-0.78	-0.06	-0.06	-0.05
	[-1.45,2.55]	[-0.83,3.41]	[-3.04,2.44]	[-1.56,0.48]	[-1.82,1.26]	[-2.11,0.55]	[-0.17,0.048]	[-0.20,0.077]	[-0.17,0.061]
DDD (2002)	0.29	1.38	-0.95	-0.67	-0.71	-0.62	-0.02	-0.01	-0.03
	[-1.50,2.08]	[-1.48,4.25]	[-3.00,1.10]	[-1.52,0.18]	[-1.98,0.56]	[-1.60,0.36]	[-0.12,0.072]	[-0.13,0.10]	[-0.13,0.071]
DDD (2004)	0.21	1.85	-1.42	-0.34	-0.24	-0.48	-0.02	0.03	-0.08
	[-1.56,1.97]	[-0.43,4.14]	[-3.83,0.99]	[-1.26,0.57]	[-1.44,0.97]	[-1.76,0.80]	[-0.12,0.075]	[-0.078,0.14]	[-0.20,0.049]
Dep var mean	5.272	5.527	5.034	1.063	1.107	1.021	9.085	9.054	9.114
Dep var SD	22.35	22.85	21.87	10.25	10.46	10.06	0.79	0.8	0.78
Municipalities	87	87	87	87	87	87	87	87	87
Births	107,005	51,726	55,279	107,005	51,726	55,279	107,005	51,726	55,279

Notes: This table presents the estimated triple-differences coefficients for the extended model, excluding babies born in 2005. 2003 is the omitted year. Coefficients for regressions with binary outcome variables (low birth weight, high birth weight, short gestational length, long gestational length) have been multiplied by 100. Controls and fixed effects are the same as in the baseline model. Standard errors are clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * p < 0.05, ** p < 0.01, *** p < 0.001.

Table B.11: Impact of hurricane on fertility by mother characteristics

	Low educ	High educ	Married	Not married
	(1)	(2)	(3)	(4)
DDD (2001)	2.01 [-1.53,5.56]	0.33 [-1.28,1.94]	1.84 [-1.49,5.18]	0.18 [-1.69,2.04]
DDD (2002)	1.92 [-0.25,4.09]	0.59 [-1.09,2.27]	2.65* [0.25,5.05]	-0.21 [-1.80,1.38]
DDD (2004)	1.60 [-0.49,3.68]	0.27 [-1.25,1.78]	0.97 [-2.87,4.81]	-0.43 [-2.77,1.92]
DDD (2005)	-1.97 [-5.52,1.58]	0.19 [-0.70,1.08]	0.35 [-1.60,2.30]	-1.39 [-3.34,0.55]
Dep var mean	22.52	4.09	20.33	6.56
Dep var SD	46.39	13.72	41.28	20.10
Municipalities	87	87	87	87
Observations	5,220	5,220	5,220	5,220

Notes: This table presents the estimated effects of the hurricane on the number of births by mother subgroup. Each observation is defined by a municipality, year, and “adjusted” month for that subgroup. Adjusted months are the same as calendar months except that the month of April is defined to include March 28 to March 31 so that the post-hurricane dates are captured correctly. All regressions include municipality, year, and “adjusted”-month fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.12: Impact of hurricane on births and deaths (w/ municipality specific year- month trends)

	Fetal Death rate			Live Birth Rate		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)
DDD	-0.28 [-13.71,13.15]	15.73* [3.67,27.80]	-27.76 [-61.89,6.38]	0.07 [-0.53,0.68]	-0.55 [-1.99,0.89]	0.39 [-0.31,1.09]
Dep var mean	5.31	3.05	7.67	4.08	6.08	3.08
Dep var SD	28.43	17.51	51.43	1.66	3.50	1.66
	Neonatal Death Rate			Post-neonatal Death Rate		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)
DDD	1.04 [-6.60,8.68]	4.59 [-6.50,15.68]	-1.07 [-11.77,9.63]	4.18 [-0.00,8.36]	5.20 [-2.05,12.45]	4.24 [-0.96,9.44]
Dep var mean	5.27	6.28	3.77	1.73	1.63	1.54
Dep var SD	24.29	36.25	22.56	13.77	19.80	14.42
Municipalities	87	87	87	87	87	87
Observations	2,037	1,897	1,932	2,037	1,897	1,932

Notes: This table presents the estimated effects of the hurricane on birth and death rates using the baseline model, modified to include municipality specific year-“adjusted” month trends (in addition to municipality, “adjusted”-month, and year fixed effects). Each observation is defined by a municipality, year, and ‘adjusted’ month.

Adjusted months are the same as calendar months except that the month of April is defined to include March 28 to March 31 so that the post-hurricane dates are captured correctly. Fetal death rate is the number of fetal deaths divided by the number of resident live births plus fetal deaths (for the same unit) multiplied by 1,000. Birth rate is the number of live births divided by the number of women in that cohort in 2003 multiplied by 1,000. Neonatal death rate is the number of deaths occurring within 28 days of births divided by the number of live births multiplied by 1,000. Post neonatal death rate is the number of deaths occurring between 28 and 364 days of birth divided by the number of live births multiplied by 1,000. All regressions include municipality, year, and “adjusted”-month fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * p < 0.05, ** p < 0.01, *** p < 0.001.

Table B.13: Impact of hurricane on birth and death rates (Extended model)

	Fetal Death rate			Live Birth Rate		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)
DDD (2001)	-15.51 [-36.89, 5.88]	9.04 [-22.61, 40.69]	-36.93* [-65.54, -8.31]	0.27 [-0.29, 0.83]	0.48 [-0.75, 1.71]	0.16 [-0.50, 0.82]
DDD (2002)	-0.62 [-11.09, 9.85]	12.18 [-9.23, 33.59]	-19.37 [-43.45, 4.70]	0.32 [-0.31, 0.95]	0.39 [-0.94, 1.72]	0.29 [-0.40, 0.99]
DDD (2004)	-0.52 [-13.87, 12.82]	17.18** [4.48, 29.88]	-24.9 [-55.44, 5.63]	0.08 [-0.50, 0.67]	-0.55 [-1.97, 0.87]	0.4 [-0.28, 1.09]
DDD (2005)	7.25 [-8.50, 23.00]	11.34 [-15.79, 38.47]	-9.2 [-33.30, 14.90]	-0.16 [-0.77, 0.45]	-0.31 [-1.71, 1.10]	-0.09 [-0.68, 0.51]
Dep var mean	5.31	3.05	7.67	4.08	6.08	3.08
Dep var SD	28.43	17.51	51.43	1.66	3.50	1.66
	Neonatal Death Rate			Post-neonatal Death Rate		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)
DDD (2001)	-2.36 [-11.75, 7.02]	-3.89 [-14.88, 7.10]	-0.11 [-11.73, 11.51]	4.39 [-2.37, 11.14]	4.7 [-6.51, 15.90]	3.35 [-2.75, 9.44]
DDD (2002)	-3.7 [-16.84, 9.44]	12.07 [-7.33, 31.48]	-14.65 [-33.71, 4.41]	0.95 [-4.43, 6.32]	3.86 [-2.22, 9.94]	0.78 [-6.40, 7.96]
DDD (2004)	1.11 [-6.34, 8.56]	3.67 [-7.58, 14.92]	-0.75 [-10.98, 9.48]	4.16* [0.05, 8.28]	3.74 [-3.44, 10.92]	4.3 [-0.75, 9.35]
DDD (2005)	7.56 [-8.51, 23.62]	-0.97 [-13.48, 11.54]	10.36 [-9.73, 30.45]	4.24* [0.88, 7.60]	2.83 [-0.73, 6.39]	5.21* [0.44, 9.97]
Dep var mean	5.27	6.28	3.77	1.73	1.63	1.54
Dep var SD	24.29	36.25	22.56	13.77	19.80	14.42
Municipalities	87	87	87	87	87	87
Observations	5,099	4,772	4,830	5,099	4,772	4,830

Notes: This table presents the estimated effects of the hurricane on birth and death rates. Each observation is defined by a municipality, year, and “adjusted” month. Adjusted months are the same as calendar months except that the month of April is defined to include March 28 to March 31 so that the post-hurricane dates are captured correctly. Fetal death rate is the number of fetal deaths divided by the number of resident live births plus fetal deaths (for the same unit) multiplied by 1,000. Birth rate is the number of live births divided by the number of women in that cohort in 2003 multiplied by 1,000. Neonatal death rate is the number of deaths occurring within 28 days of births divided by the number of live births multiplied by 1,000. Post neonatal death rate is the number of deaths occurring between 28 and 364 days of birth divided by the number of live births multiplied by 1,000. All regressions include municipality, year, and “adjusted”-month fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.14: Impact of hurricane on birth and death rates (excluding those born in 2005)

	Fetal Death rate			Live Birth Rate		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)
DDD (2001)	-15.53 [-36.92, 5.86]	9.43 [-22.30, 41.15]	-37.01* [-65.74, -8.28]	0.25 [-0.31, 0.82]	0.45 [-0.78, 1.68]	0.15 [-0.51, 0.82]
DDD (2002)	-0.55 [-11.05, 9.96]	12.64 [-8.81, 34.08]	-19.35 [-43.42, 4.72]	0.31 [-0.32, 0.93]	0.36 [-0.96, 1.68]	0.28 [-0.41, 0.98]
DDD (2004)	-0.47 [-13.83, 12.89]	18.14** [5.55, 30.73]	-25.09 [-55.84, 5.65]	0.07 [-0.51, 0.65]	-0.57 [-2.00, 0.85]	0.4 [-0.28, 1.08]
Dep var mean	5.31	3.05	7.67	4.08	6.08	3.08
Dep var SD	28.43	17.51	51.43	1.66	3.50	1.66
	Neonatal Death Rate			Post-neonatal Death Rate		
	All mothers	15-24 y/o	25-49 y/o	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)
DDD (2001)	-2.28 [-11.67, 7.10]	-3.58 [-14.57, 7.41]	-0.26 [-11.87, 11.35]	4.41 [-2.34, 11.16]	4.87 [-6.42, 16.15]	3.38 [-2.71, 9.48]
DDD (2002)	-3.53 [-16.68, 9.62]	12.13 [-7.32, 31.57]	-14.69 [-33.83, 4.44]	0.96 [-4.42, 6.33]	4.01 [-2.11, 10.12]	0.81 [-6.36, 7.99]
DDD (2004)	1.33 [-6.11, 8.77]	3.69 [-7.42, 14.80]	-0.67 [-10.87, 9.54]	4.18* [0.07, 8.29]	3.96 [-3.15, 11.08]	4.35 [-0.71, 9.40]
Dep var mean	5.27	6.28	3.77	1.73	1.63	1.54
Dep var SD	24.29	36.25	22.56	13.77	19.80	14.42
Municipalities	87	87	87	87	87	87
Observations	4,081	3,808	3,877	4,081	3,808	3,877

Notes: This table presents the estimated effects of the hurricane on birth and death rates. Each observation is defined by a municipality, year, and “adjusted” month. Adjusted months are the same as calendar months except that the month of April is defined to include March 28 to March 31 so that the post-hurricane dates are captured correctly. Fetal death rate is the number of fetal deaths divided by the number of resident live births plus fetal deaths (for the same unit) multiplied by 1,000. Birth rate is the number of live births divided by the number of women in that cohort in 2003 multiplied by 1,000. Neonatal death rate is the number of deaths occurring within 28 days of births divided by the number of live births multiplied by 1,000. Post neonatal death rate is the number of deaths occurring between 28 and 364 days of birth divided by the number of live births multiplied by 1,000. All regressions include municipality, year, and “adjusted”-month fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.15: Robustness to survivor bias using Lee (2009) bounding methodology

	BW	LBW	HBW	SGA	LGA	Apgar
	(1)	(2)	(3)	(4)	(5)	(6)
Baseline (no trimming)						
DDD	-81.58** [-135.19,-27.97]	3.38** [0.95,5.82]	-3.03** [-5.13,-0.93]	1.77 [-0.52,4.07]	-0.23 [-1.45,0.99]	0.03 [-0.08,0.14]
Dep var mean	3213.00	6.86	4.51	5.53	1.11	9.05
Dep var SD	506.73	25.28	20.74	22.85	10.46	0.80
Municipalities	87	87	87	87	87	87
Births	25,407	25,407	25,407	25,407	25,407	25,407
Trim observations with birthweight below 3rd percentile of birthweight distribution (2,200g)						
DDD	-94.56** [-149.87,-39.25]	4.05*** [2.03,6.08]	-3.13** [-5.30,-0.97]	2.43* [0.34,4.52]	-0.25 [-1.51,1.02]	0.04 [-0.07,0.15]
Dep var mean	3257	3.978	4.645	3.263	1.141	9.08
Dep var SD	442.14	19.54	21.05	17.77	10.62	0.74
Municipalities	87	87	87	87	87	87
Births	24,783	24,783	24,783	24,783	24,783	24,783
Trim observations with birthweight below average birthweight of babies who died during birth (1,773g)						
DDD	-89.17** [-146.45,-31.90]	3.70** [1.15,6.24]	-3.07** [-5.20,-0.95]	2.06 [-0.33,4.45]	-0.23 [-1.47,1.01]	0.03 [-0.07,0.14]
Dep var mean	3234	5.735	4.56	4.434	1.12	9.07
Dep var SD	468.49	23.25	20.86	20.58	10.53	0.76
Municipalities	87	87	87	87	87	87
Births	25,163	25,163	25,163	25,163	25,163	25,163

Notes: This table presents estimated triple-differences coefficients for the baseline model using the bounds estimator of Lee (2009). Coefficients for regressions with binary outcome variables (low birth weight, high birth weight, short gestational length, long gestational length) have been multiplied by 100. In the second panel, we drop babies that satisfy the following three conditions: (i) are born to young mothers, (ii) are born in cohorts excluding the treatment cohort, (iii) are born with birthweight below z , where z corresponds to the 3rd percentile of the birthweight distribution for young mothers in the treatment cohort. In the third panel, we drop babies that satisfy the following three conditions: (i) are born to young mothers, (ii) are born in cohorts excluding the treatment cohort, (iii) are born with birthweight below z , where z corresponds to the average birthweight of babies that died during birth and are born to young mothers in the treatment cohort. Controls and fixed effects are the same as in the baseline model. Standard errors clustered at the municipality level. Means and standard deviation of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.16: Characteristics of young and old mothers

	15-24 y/o	25-49 y/o	Difference
	(1)	(2)	(3)
Married	0.56	0.75	-0.19***
Completed HS	0.11	0.22	-0.11***
In labor force	0.41	0.60	-0.19***
Birth = residential municipality	0.65	0.64	0.01*
Parity	0.58	1.56	-0.98***
Observations	27,572	25,407	

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.17: Impact of hurricane on formal employment rates

	Male & Female 15-69	Male 15-69	Female 15-69	Female 15-24	Female 25-49
	(1)	(2)	(3)	(4)	(5)
DD (2002)	-1.34 [-3.57,0.88]	-1.26 [-3.78,1.26]	-1.42 [-4.64,1.80]	-0.42 [-2.51,1.66]	-2.15 [-6.57,2.28]
DD (2004)	-0.06 [-0.89,0.77]	0.25 [-0.86,1.36]	-0.38 [-1.19,0.44]	0.09 [-1.03,1.21]	-0.75 [-1.87,0.38]
DD (2005)	0.37 [-1.00,1.74]	0.86 [-1.03,2.75]	-0.16 [-1.39,1.06]	-0.01 [-1.73,1.71]	-0.35 [-1.89,1.18]
Dep var mean	20.74	25.19	16.22	15.70	20.56
Dep var SD	11.06	14.69	8.73	10.60	10.57
Municipalities	87	87	87	87	87
Observations	348	348	348	348	348

Notes: This table examines the effect of the hurricane on formal employment rates. The dependent variable is the number of formally employed workers in that cell divided by the population estimate in that cell multiplied by 100. Each observation is at the municipality-year level. All regressions include municipality and year fixed effects. Standard errors clustered at the municipality level. Means and standard deviation of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table B.18: Impact of hurricane on health appointments and hospital admissions per 1,000 women

	Public health service appointments			Admissions for pregnancy-related complications		
	Prenatal	Ultrasound	Gynecological	All mothers	15-24 y/o	25-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)
DDD (2001)	-1.92 [-8.88,5.03]	2.26 [-0.63,5.15]	7.47 [-2.28,17.23]	0.24 [-0.14,0.63]	1.43 [-0.74,3.61]	0.71 [-0.42,1.84]
DDD (2002)	-2.90 [-10.08,4.28]	1.71 [-1.05,4.47]	10.71 [-4.16,25.59]	-0.17 [-0.58,0.23]	-0.94 [-3.19,1.30]	-0.49 [-1.63,0.65]
DDD (2004)	2.09 [-5.45,9.62]	3.82* [0.88,6.76]	2.32 [-7.06,11.69]	0.01 [-0.36,0.38]	0.04 [-2.06,2.13]	0.05 [-0.99,1.09]
DDD (2005)	-0.76 [-7.19,5.66]	2.96* [0.13,5.80]	6.07 [-10.21,22.34]	-0.03 [-0.37,0.31]	-0.19 [-2.10,1.72]	-0.11 [-1.05,0.83]
Dep var mean	28.66	4.65	18.16	1.79	9.86	4.96
Dep var SD	22.68	7.17	33.93	1.05	5.83	2.94
Municipalities	87	87	87	87	87	87
Observations	5,220	5,220	5,220	5,220	5,220	5,220

Notes: This table examines the effect of the hurricane on the number of public health service appointments per 1,000 women aged 15-49 (columns 1-3) and on the number of hospital admissions for pregnancy-related complications per 1,000 women aged 15-49 (column 4), per 1,000 women aged 15-24 (column 5), and per 1,000 women aged 25-49 (column 6). Each observation is at the municipality-year-month level. All regressions include municipality, year, and month fixed effects. Standard errors clustered at the municipality level. Means and standard deviation of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

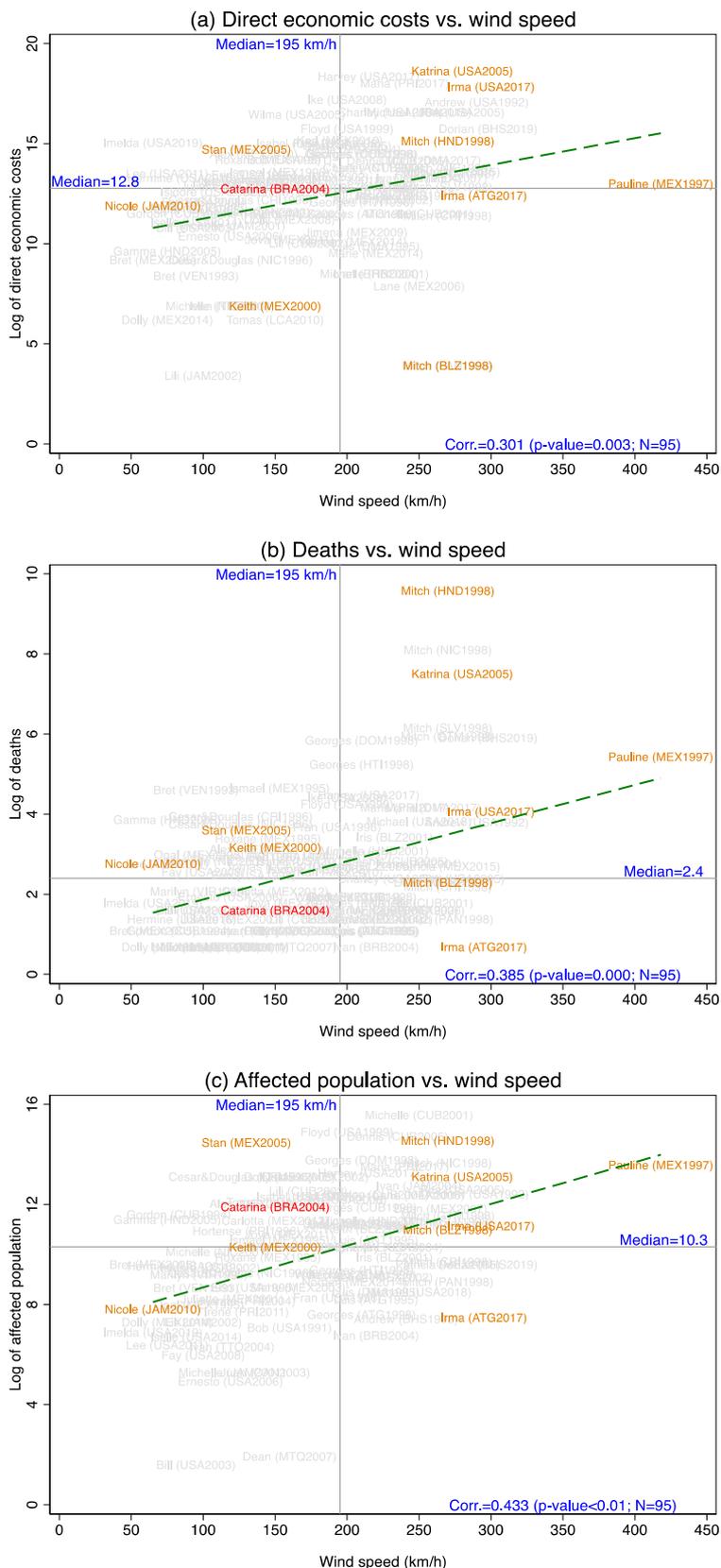
Table B.19: Impact of hurricane on birth outcomes by young, prime-age, and old mothers

	Birth weight (grams)			Low birth weight (<2,500g)			High birth weight (>4,000g)		
	15-19 y/o	20-39 y/o	40-49 y/o	15-19 y/o	20-39 y/o	40-49 y/o	15-19 y/o	20-39 y/o	40-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD	-111.58*	-20.13	-168.15	5.27*	0.05	-0.75	-2.48	-1.41	-6.09
	[-202.02,-21.15]	[-70.01,29.75]	[-473.72,137.42]	[1.15,9.39]	[-2.08,2.18]	[-13.95,12.44]	[-5.25,0.29]	[-3.50,0.69]	[-21.41,9.22]
Dep var mean	3169.00	3271.00	3226.00	8.26	5.85	8.72	3.53	6.40	7.32
Dep var SD	515.66	509.56	571.31	27.52	23.48	28.24	18.46	24.47	26.07
	Short gestational length (<37 weeks)			Long gestational length (>41 weeks)			Apgar score (0-10)		
	15-19 y/o	20-39 y/o	40-49 y/o	15-19 y/o	20-39 y/o	40-49 y/o	15-19 y/o	20-39 y/o	40-49 y/o
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DDD	4.49	-0.94	-0.34	-0.33	-0.31	-1.53	-0.01	-0.03	0.12
	[-0.60,9.58]	[-2.77,0.90]	[-13.91,13.23]	[-2.01,1.35]	[-1.26,0.64]	[-5.24,2.17]	[-0.17,0.16]	[-0.13,0.07]	[-0.21,0.46]
Dep var mean	6.27	4.98	6.54	1.25	1.01	0.93	9.02	9.10	9.04
Dep var SD	24.24	21.76	24.75	11.13	10.02	9.63	0.84	0.77	0.95
Municipalities	87	87	77	87	87	77	87	87	77
Births	10,090	41,583	1,301	10,090	41,583	1,301	10,090	41,583	1,301

Notes: This table presents the estimated triple difference coefficients for the baseline model. Coefficients for regressions with binary outcome variables (low birth weight, high birth weight, short gestational length, long gestational length) have been multiplied by 100. Birth weight is measured in grams. Low birth weight is defined as being born weighing less than 2,500 grams. High birth weight is defined as being born weighing over 4,000 grams. Babies with short gestational length are those with less than 37 completed weeks of gestation. Babies with long gestational length are those with over 41 completed weeks of gestation. All regressions include the following controls: gender of the baby, race of the baby (white or other), age bins for the mother (in 5 year intervals), marital status of the mother (married or not), indicators for mother's educational attainment (completed high school or not), 3 indicators for parity at current birth (2nd birth, 3rd birth, or 4th and above), and an indicator for whether the mother's municipality of residence is the same as the municipality where the baby is born. All regressions include municipality, month, and year fixed effects. Standard errors clustered at the municipality level. Means and standard deviations of dependent variables are measured in 2003 before the hurricane. 95% confidence intervals in square brackets. * p < 0.05, ** p < 0.01, *** p < 0.001.

C Additional Figures

Figure C.1: Relationship between damages and wind speed of hurricane



Source: EM-DAT (1991-2019).

Figure C.2: Distribution of birth weight for various control groups when implementing Lee (2009) bounding procedure

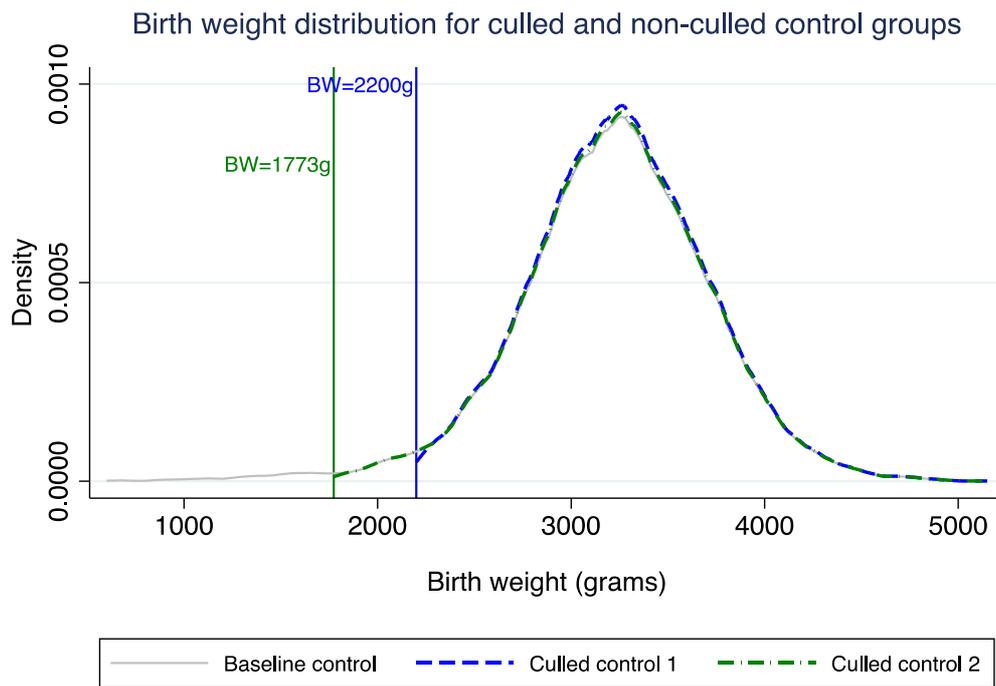


Figure C.3: Robustness check for different cut-off distances for mothers 15-24 y/o

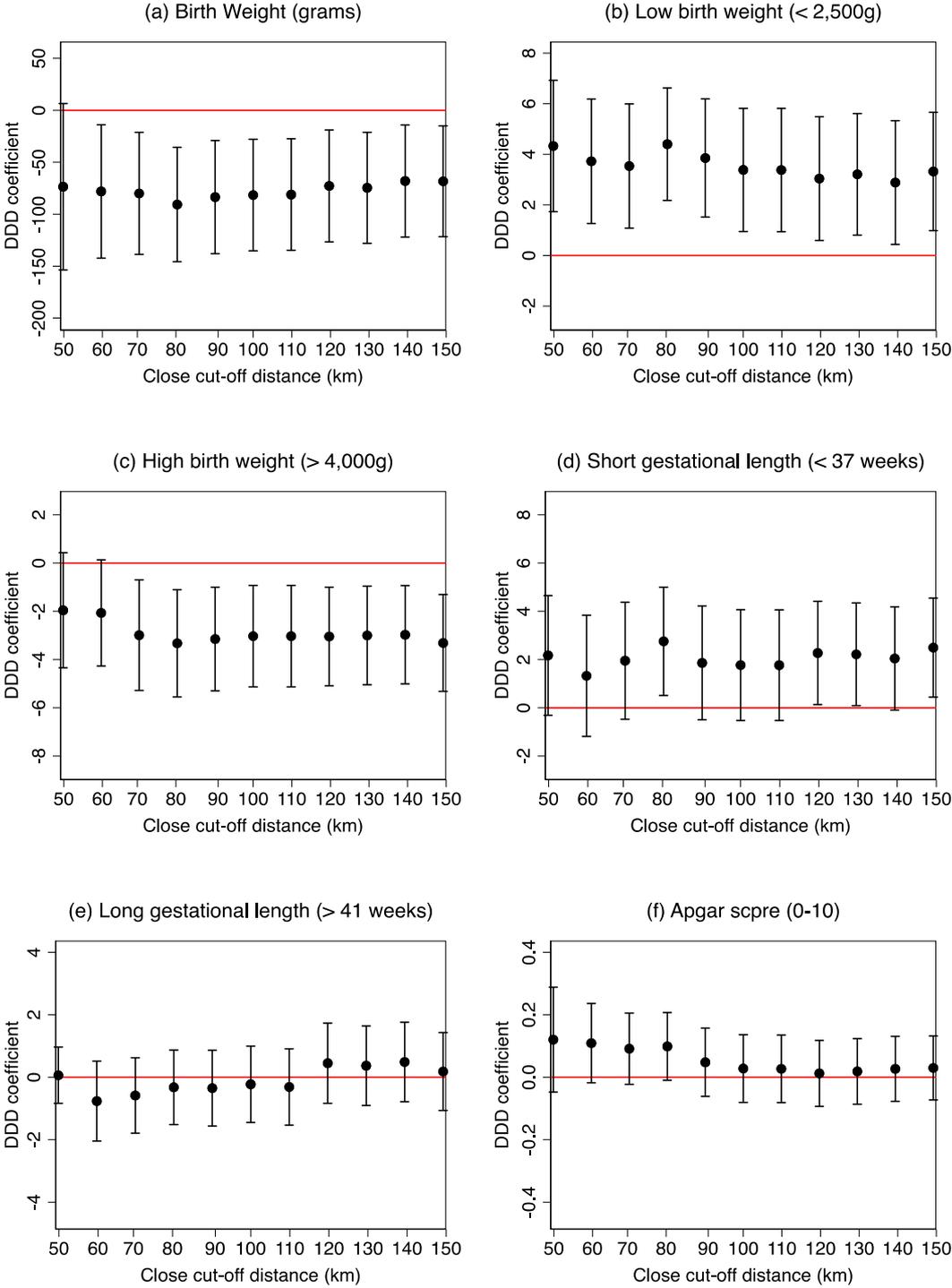


Figure C.4: Robustness check for different cut-off distances for mothers 25-49 y/o

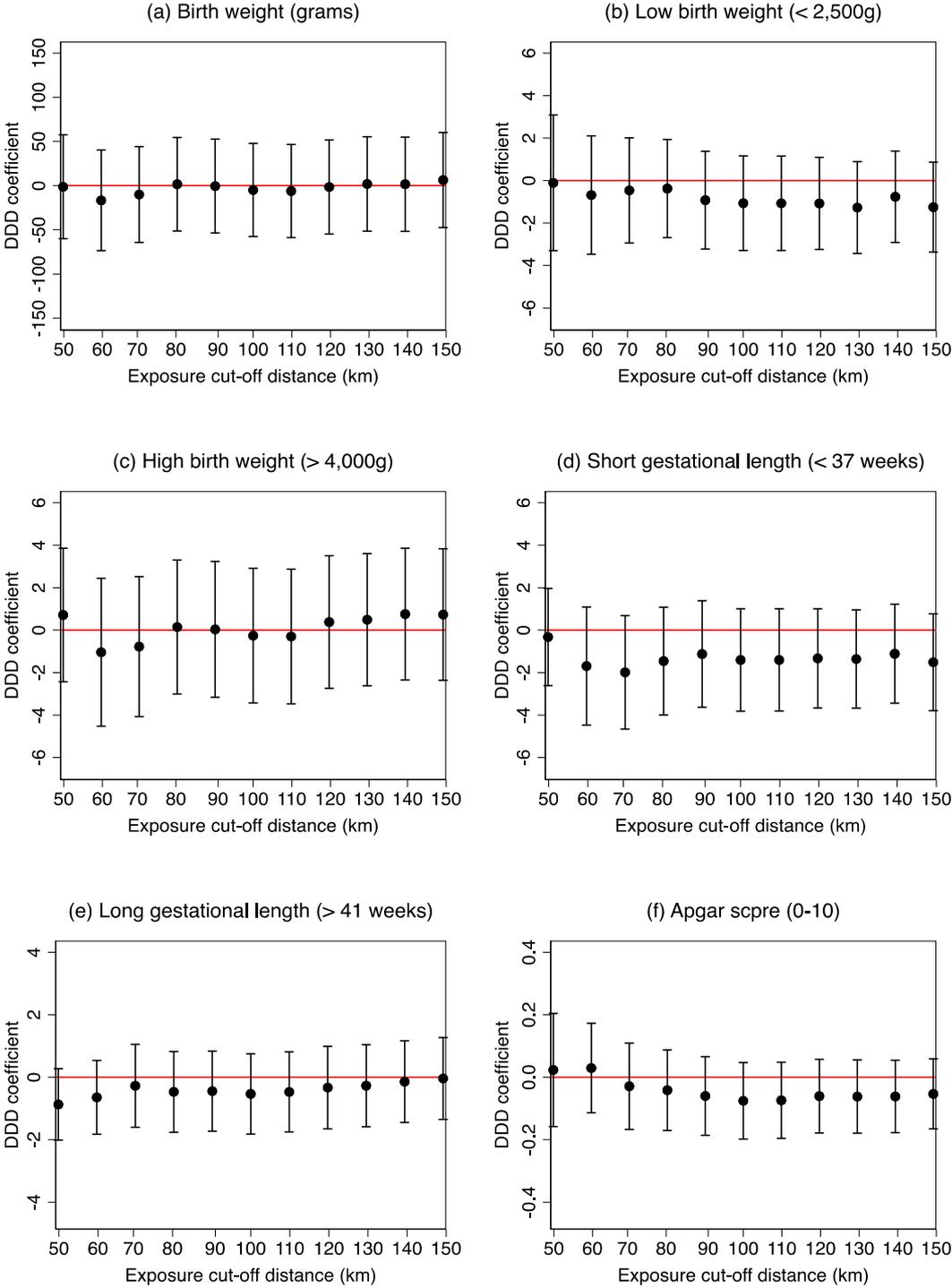


Figure C.5: Robustness check for different cut-off distances for mothers 15-24 y/o

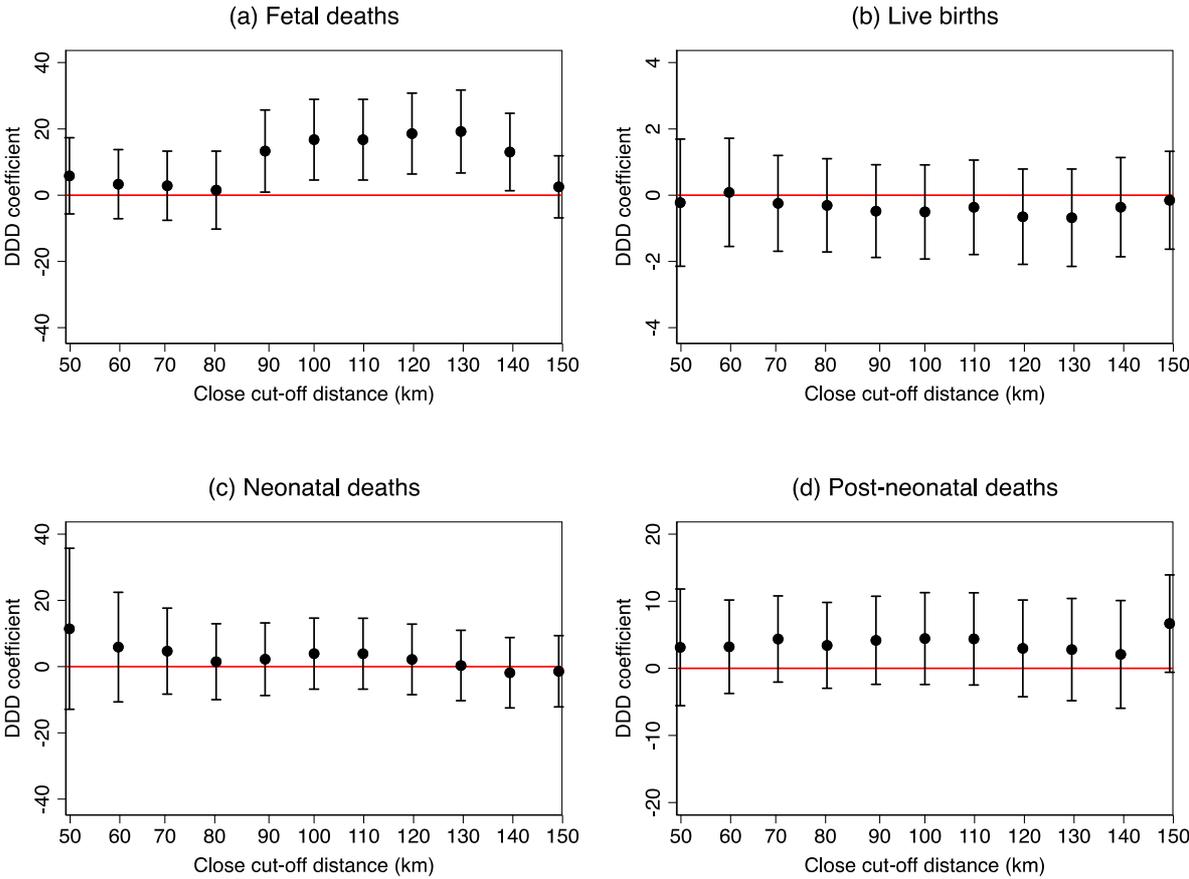
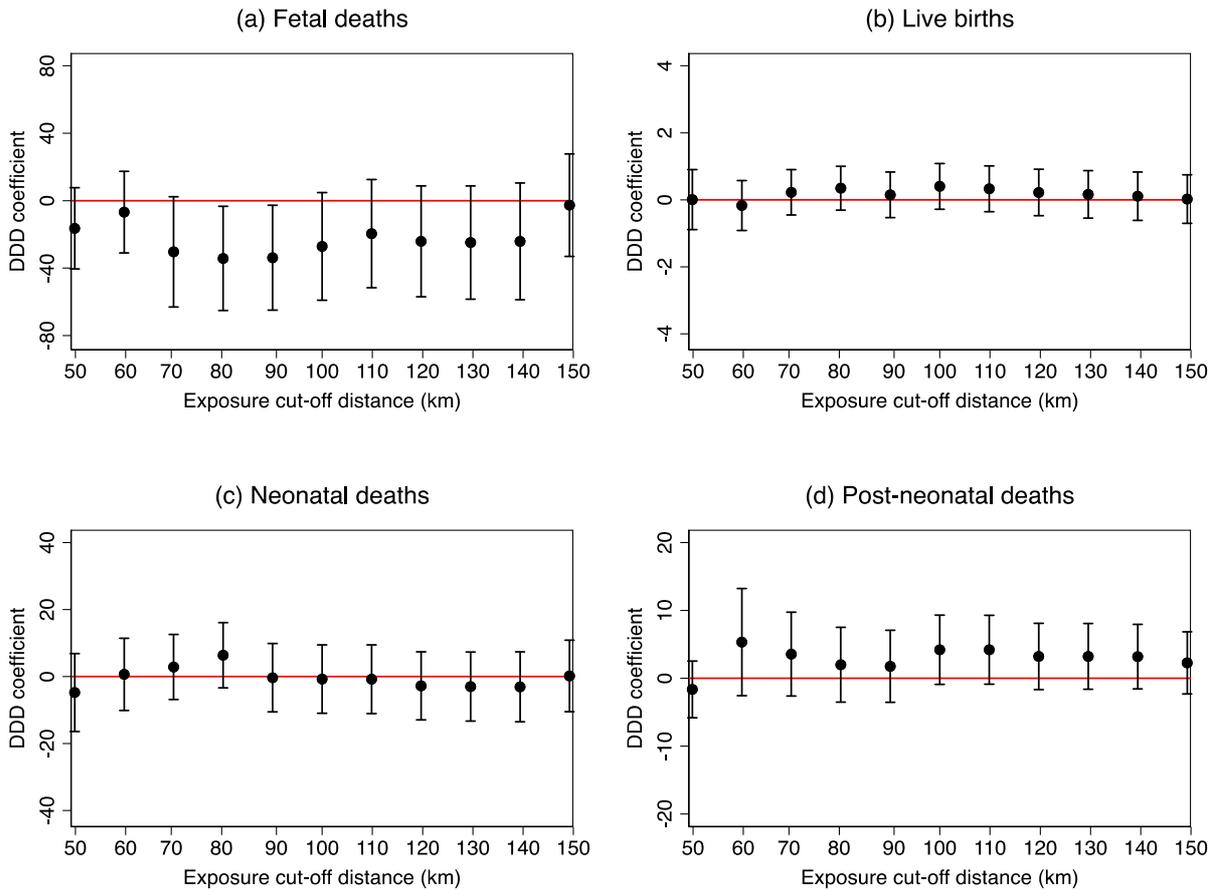


Figure C.6: Robustness check for different cut-off distances for mothers 25-49 y/o



D Comparison of DDD and DD methods

In this appendix, we compare estimates of the impact of the hurricane based on differences-in-differences-differences (DDD) and differences-in-differences (DD) specifications. When making this comparison, we simplify our specification by removing the set of fixed effects and controls in equation (1) of the main paper. With this simplification in mind, a natural DD specification in our context is given by the following equation:

$$y_{itmdp} = a_0 + a_1 Post_{t_{dm}} + a_2 Close_p + a_{DD} Close_p \times Post_{dm} + u_{itmdp}, \quad (D1)$$

where $Post_{t_{dm}}$ equals 1 if baby i is born on or after March 28 2004 and zero otherwise, $Close_p$ equals 1 if municipality p is within 100 km of the hurricane center, and a_{DD} is the DD coefficient of interest. The corresponding simplified DDD specification is given by the following equation:

$$\begin{aligned} y_{itmdp} = & b_0 + b_1 Mar28_{dm} + b_2 Yr2004_t + b_3 Close_p + b_4 (Close_p \times Mar28_{dm}) \\ & + b_5 (Close_p \times Yr2004_t) + b_6 (Mar28_{dm} \times Yr2004_t) \\ & + b_{DDD} (Mar28_{dm} \times Yr2004_t \times Close_p) + \epsilon_{itmdp}. \end{aligned} \quad (D2)$$

Equations (D1) and (D2) show that the DD and DDD models are equivalent if $b_1 = b_2 = b_4 = b_5 = 0$. If this is the case, then there are no advantages to using the more complex DDD model.

We estimate equations (D1) and (D2) separately for three groups of mothers (all mothers, young mothers, and older mothers) and plot the estimated a_{DD} and b_{DDD} coefficients for each group in Figure D.1. For each group, we report the F-statistic and corresponding p-value from testing the constraint required for the DD and DDD models to be equivalent. For most birth outcomes, the DD and DDD specifications yield different estimates, particularly for the group of young mothers. For example, using the DD specification suggests that Hurricane Catarina had no significant effect on the birth weight of babies born to young mothers (1.54 g) whereas the simplified DDD specification suggests that on average birth weight of this group fell by 76.3 g. Furthermore, the constraint test rejects the hypothesis that these models are equivalent for young mothers for three out of our six birth outcome variables.

In Figure D.2, we extend this analysis by adding the set of fixed effects and controls included in the baseline equation (year, month, municipality fixed effects and sociodemographic characteristics) to equations (4) and (5).¹ The differences between the DD and DDD estimates are also evident, highlighting the

¹ In this case, the $Close_p$ drops out as it is collinear with the vector of municipality fixed effects.

importance of allowing for season of birth effects, region-specific season of birth effects, and year-specific season of birth effects.

Figure D.1: DDD vs. DD, excluding municipality, month, year fixed effects and sociodemographic controls

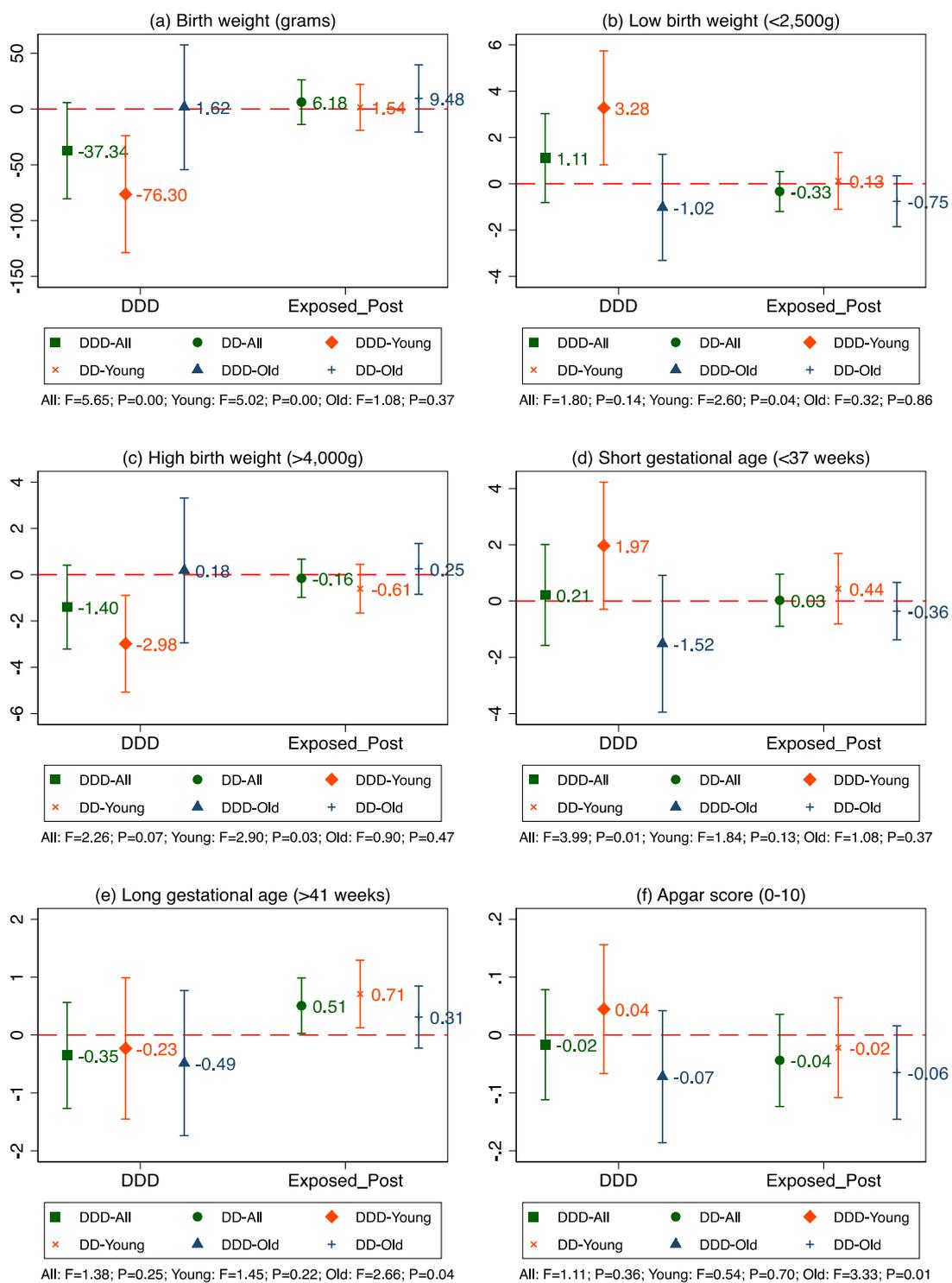


Figure D.2: DDD vs. DD including municipality, month, year fixed effects and sociodemographic controls

