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Birth Weight, Neonatal Care, and Infant Mortality: Evidence from Macrosomic Babies *

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Abstract

This study demonstrates that rule-of-thumb health treatment decision-making exists when assigning medical care to macrosomic newborns with an extremely high birth weight and estimates the short-run health return to neonatal care for infants at the high end of the birth weight distribution. Using a regression discontinuity design, we find that infants born with a birth weight above 5000 grams have a 2 percentage-point higher probability of admission to a neonatal intensive care unit and a 1 percentage-point higher probability of antibiotics receipt, compared to infants with a birth weight below 5000 grams. We also find that being born above the 5000-gram cutoff has a mortality-reducing effect: infants with a birth weight larger than 5000 grams face a 0.2 percentage points lower risk of mortality in the first month, compared to their counterparts with a birth weight below 5000 grams. We do not find any evidence of changes in health treatments and mortality at macrosomic cutoffs lower than 5000 grams, which is consistent with the idea that such treatment decisions are guided by the higher expected morbidity and mortality risk associated with infants weighing more than 5000 grams.

Keywords: Birth Weight, Health Care, Medical Inputs, Infants, Mortality.

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1 Introduction

This study examines the relationship between birth weight, neonatal care, and infant mortality among high-risk newborns at the upper end of the birth weight distribution. Prior work has mainly focused on newborns with a low birth weight (LBW). Medical research has shown that being born with a LBW increases the risk of developmental problems, which worsens as birth weight decreases (Abernethy et al., 2002, Hack et al., 1995). Economic studies have shown that health treatments received by very LBW children are effective in reducing the risk of infant mortality and at improving subsequent health and academic achievement (Almond et al., 2010, Bharadwaj et al., 2013, Breining et al., 2015, Cutler and Meara, 2000). Since these findings only apply to LBW infants, it is important to analyze the return to medical care for high-risk newborns with a high birth weight (HBW), who have been not been studied in the early life literature.

Recent data from the CDC Wonder System indicate that, over the past decade, the rate of *macrosomia*, or the percentage of newborns who were born with a HBW has hovered around 8%.[1] In contrast to LBW newborns, the health risks associated with macrosomia worsen as birth weight *increases*. Medical studies have shown that the morbidity and mortality risks associated with a macrosomic newborn all grow as birth weight increases (Boulet et al., 2003, Oral et al., 2001, Vidarsdottir et al., 2011, Zhang et al., 2008), especially for infants heavier than 5000 grams (Chatfield, 2001, Gottlieb and Galan, 2007). As the health complications increase in number or complexity, there is likely to be a corresponding increase in health care costs associated with treating them.[2]

Building on prior research that has found that a rule of thumb is used for assigning medical care to very LBW newborns (Almond et al., 2010, Bharadwaj et al., 2013, Breining et al., 2015, Cutler and Meara, 2000), we demonstrate that a similar rule of thumb is used in the assignment of medical care to high-risk newborns in the macrosomic segment of the birth weight distribution, and exploit the resulting plausibly exogenous variation in medical care receipt to estimate the health returns to providing neonatal care to macrosomic babies.

Our analysis uses data from the 2007-2013 Birth Cohort Linked Birth-Infant Death Files, which, starting in 2007, has collected newly available information on the health treatments

[1] *Macrosomia* implies fetal growth beyond a specific birth weight. The diagnostic threshold for macrosomia has been variously defined. See Section 2.

[2] As is the case for LBW infants, the health costs associated with a macrosomic birth are substantial. Lenoir-Wijnkoop et al. (2005) found that, in the U.S., the direct costs associated with neonatal complications for a macrosomic newborn are on average $3,799 (in $2009), which represents 24% of the total cost of a high-risk pregnancy and delivery involving a mother with gestational diabetes, and 49% of the total cost associated with a normal pregnancy and vaginal delivery.

received by newborns. In a regression discontinuity framework, we use a sample of newborns born within 227 grams (half a pound) from a macrosomic cutoff to analyze whether being born above the cutoff affects the probability of receiving health treatments in the delivery hospital and the risk of infant mortality. The underlying assumption in our analysis is that babies born within a small birth-weight window around the macrosomic cutoff are relatively homogeneous, except for the extra medical care that newborns weighing-in above the macrosomic cutoff the receive because of the rule-of-thumb treatment decisions.

Our results indicate that being born above a weight of 5000 grams (extremely HBW [EHBW]) increases the probability of receiving antibiotics for suspected sepsis and admission to a neonatal intensive care unit (NICU) by around 1 and 2 percentage points, respectively. We also find that the risk of 28-day mortality drops by around 0.2 percentage points as the 5000-gram cutoff is crossed from below. The results are robust to a wide variety of robustness and sensitivity checks. While the examination of health treatments represent our first-stage analysis, we interpret the reduction in mortality as the intention-to-treat effect of being an EHBW infant: even though it is plausible to link the reduced mortality for EHBW newborns to the increases in NICU-based treatments and antibiotics receipt, there may be other medical inputs that are not observable in our data that also change at the 5000-gram cutoff and contribute to the mortality reduction. We do not find similar discontinuities at macrosomic cutoffs below 5000 grams, which is consistent with the idea that the sensitivity of rule-of-thumb health treatment assignment may grow with the higher expected morbidity and mortality risks associated with heavier macrosomic babies.

The rest of the paper is organized as follows. Section 2 provides background information on fetal macrosomia, while Section 3 describes the data and presents descriptive evidence on health treatments and mortality for macrosomic newborns. Section 4 discusses the empirical strategy. Section 5 discusses our main results and the results from a battery of robustness and sensitivity checks at the 5000-gram cutoff, while section 6 analyzes other macrosomic cutoffs. Finally, section 7 concludes.

2 Fetal macrosomia

At present, a general consensus on the definition of fetal macrosomia does not exist. Authors have defined it as a birth weight of either at least 4000 grams, at least 4500 grams, or at least 5000 grams, regardless of gestational age. In the 2016 *Clinical Management Guidelines for Obstetrician-Gynecologists*, the American College of Obstetricians and Gynecologists (ACOG)

recognize a continuum of risk and divide macrosomia into three categories: (1) birth weight of 4000-4499 with increased risk of labor abnormalities and newborn complications; (2) birth weight of 4500-4999 grams with additional risk of maternal and newborn morbidity; and (3) birth weight of 5000 grams or greater with additional risk of stillbirth and neonatal mortality (ACOG, 2016).

The medical literature has identified several risk factors associated with a larger likelihood of having a macrosomic newborn, such as the baby's sex and the mother's race, but the most important determinants of macrosomia are the diabetes history of the mother and her pre-pregnancy weight or weight gain during pregnancy (ACOG, 2016, Boulet et al., 2003, Chatfield, 2001, Stotland et al., 2004).[3] Since a mother's diabetic status is a strong determinant of macrosomia, a common outcome for these infants is neonatal hypoglycemia, which may worsen in case of feeding difficulties (Cordero et al., 1998). However, the most severe complications associated with a macrosomic newborn are mainly due to prolonged labor and delivery difficulties, and are thus more likely to arise in case of a vaginal birth, either completed or attempted. Birth traumas, such as shoulder dystocia (Chauhan et al., 2005, Nesbitt et al., 1998) and respiratory problems, mainly due to an insufficient intake of oxygen (Gallacher et al., 2016, Wirbelauer and Speer, 2009), often require immediate interventions in order to conclude the delivery with an emergency c-section and/or to provide emergency care to the newborn. Hook et al. (1997) also show that the trial of labor, especially if failed and concluded with an emergency c-section, is associated with higher rates of suspected and confirmed sepsis.

Given all the complications associated with vaginal delivery, the ACOG has supported the use of elective c-section as a preventive treatment, even though very often this is not implemented because of the imprecise diagnosis of macrosomia and the inaccurate ultrasound estimation of birth weight during pregnancy (ACOG, 2016, Dudley, 2005). Furthermore, even in the case of a c-section, the newborn may face a risk of respiratory complications or sepsis (Hook et al., 1997, Linder et al., 2014, Shane et al., 2017), which may induce medical intervention and hospitalization.

When serious complications associated with fetal macrosomia arise, they cannot be treated in a general department but instead require admission to a specialist department, such as a NICU. While sepsis and respiratory distress represent major causes for admissions to NICUs

[3]In Table A.1 in the Appendix we present an analysis of determinants of macrosomia in our analysis sample of newborns within 227 grams from the 5000-gram cutoff, which shows that gestational diabetes, and weight gain during pregnancy significantly increase the risk of delivering an EHBW newborn. A mother's general diabetic status was not included in the analysis presented in Table A.1 because of its strong collinearity with gestational diabetes (the correlation coefficient between the two variables is 0.83). However, in the analysis below we consider both gestational diabetes and general diabetes status.

(Signore and Klebanoff, 2008, Tolosa and Calhoun, 2017), Modanlou et al. (1980) report that macrosomic newborns experience a higher rate of NICU admission than do appropriate-weight, term-size newborns. Even among all newborns weighing 4000 grams or more, the chance of a prolonged NICU stay has been found to be more than twice as high for babies born at or above 5000 grams (Gillean et al., 2005, Linder et al., 2014, Tolosa and Calhoun, 2017).

The most serious complications are more likely to arise for the largest fetuses, i.e., for newborns at the very high end of the birth weight distribution. For example, Ye et al. (2014) found that infants with a birth weight from 4000 to 4599 grams are not at increased risk of mortality or morbidity versus those weighing between 3500 and 3999 grams, whereas those with a birth weight between 4500 and 4999 grams or higher have a significantly higher risk of neonatal mortality, especially because of birth asphyxia and birth injury. This mirrors the distribution of morbidity and mortality risk identified by the ACOG (ACOG, 2016).

In the data, we observe whether a newborn was admitted to a NICU, received antibiotics, required assisted ventilation immediately after birth, or was given surfactant replacement therapy.[4] These neonatal treatments represent choices that hospital staff make after observing the actual birth weight of the child. Since the most dire health risks are associated with newborns born above 5000 grams, practitioners are likely to be most sensitive at the 5000-gram cutoff when considering additional health treatments for macrosomic babies, and, indeed, this is what we observe in the data. For this reason, we focus our analysis on the 5000-gram birth weight cutoff, and, in a later section, we investigate whether there are health treatment discontinuities at other macrosomic cutoffs.

3 Data

Data for this study were obtained from the 2007-2013 Birth Cohort Linked Birth-Infant Death Files.[5] These files are compiled by the U.S. National Center for Health Statistics, based on information provided by U.S. states under the Vital Statistics Cooperative Program. Our data set includes information from the birth certificate and, if the infant died before the first birthday, information from the death certificate. The birth certificate provides information on the child's and the mother's demographic characteristics, the child's health conditions at birth, information on maternal behavior during pregnancy, and the method of delivery. Critical for our analysis, starting in 2007, the birth certificate includes information on the health treatments

[4] Assisted ventilation and surfactant replacement therapy are treatments to address respiratory distress.

[5] This data set contains information on deaths of all infants born in a given calendar year, linked to their corresponding birth certificates, whether the death occurred in the same calendar year or the year after.

received by the newborn in the delivery hospital, and, for this reason, we focus on the latest available years of data, i.e., from 2007 to 2013.[6] The death certificate, if applicable, reports the age of death. We construct four measures of infant mortality, according to whether the child died within 24 hours, 7 days, 28 days, or 1 year after birth.

For the main analysis we use observations within 227 grams from the cutoff, corresponding to 8 ounces. Studies focusing on the 1500-gram cutoff used bandwidths that range from 85 grams to 200 grams (Almond et al., 2010, Bharadwaj et al., 2013, Breining et al., 2015). The bandwidth we use in the analysis is wider, given the smaller number of births around the larger cutoff value under investigation here.[7] We also restrict our analysis to singleton births, which represent about 99 percent of the sample of macrosomic newborns, and observations without missing information on birth weight, health treatments, and mortality indicators. The final analysis sample consists of 55,581 observations.

Table 1
Descriptive statistics for the sample around the 5000-gram threshold.

	All sample				Below 5000 g	Above 5000 g
	Mean	SD	Min	Max	Mean	Mean
Birth weight $\geq$ 5000 grams	0.2591	(0.4382)	0	1		
NICU	0.1073	(0.3095)	0	1	0.0951	0.1423
Antibiotics	0.0271	(0.1623)	0	1	0.0248	0.0337
Ventilation	0.0528	(0.2237)	0	1	0.0500	0.0610
Surfactant	0.0019	(0.0440)	0	1	0.0017	0.0026
24-hour Mortality	0.0006	(0.0236)	0	1	0.0005	0.0007
7-day Mortality	0.0010	(0.0314)	0	1	0.0009	0.0012
28-day Mortality	0.0013	(0.0355)	0	1	0.0012	0.0015
365-day Mortality	0.0024	(0.0485)	0	1	0.0020	0.0033
N	55581				41178	14403

Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the above variables.

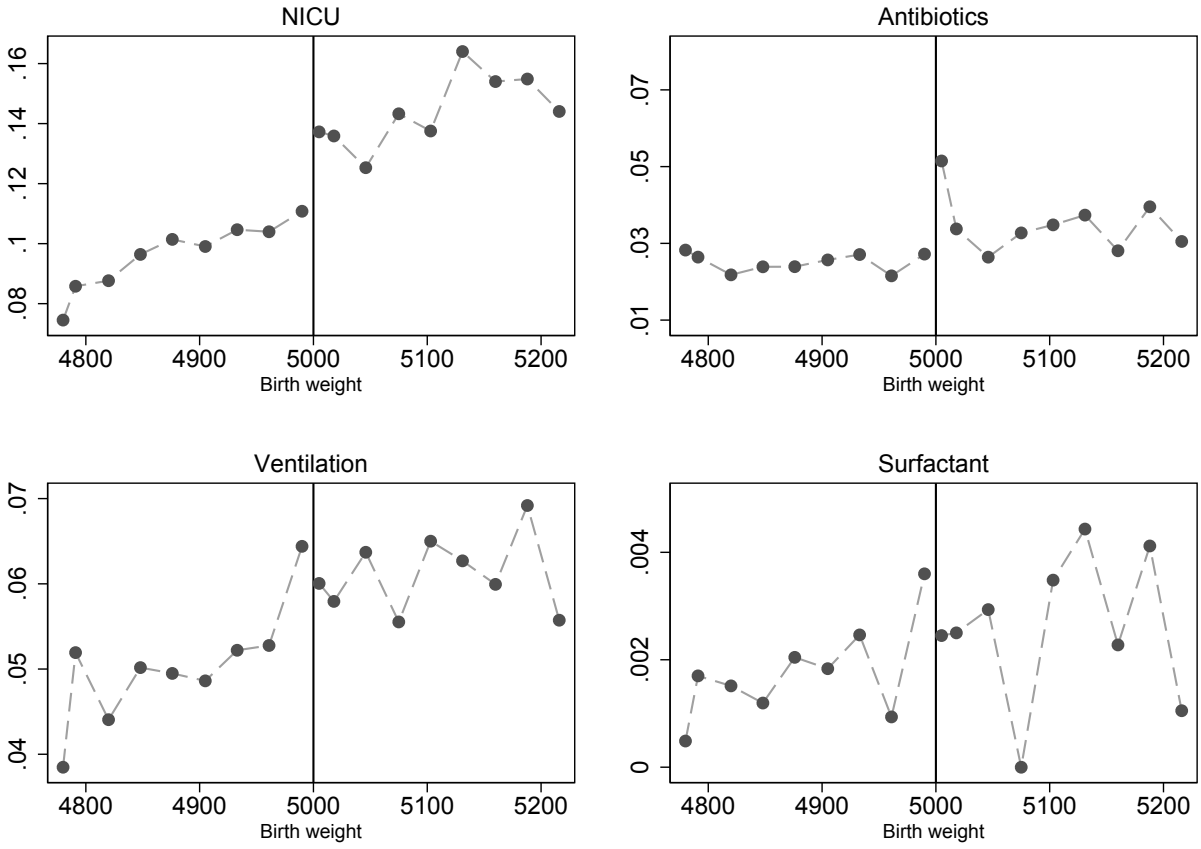
Table 1 reports the descriptive statistics for the main variables of the analysis, while Table A.2 in the Appendix reports the descriptive statistics for the covariates. Table 1 indicates that 26% of observations lie to the right of the 5000-gram cutoff. The most frequently used treatment for these newborns is admission to a NICU, which occurs for 10.7% of the infants. About 3% of infants in the sample received antibiotics for suspected sepsis, while 5% required

[6]We cannot observe if, after delivery, the child was discharged from the hospital and transferred to another clinic where he or she received additional health treatments.

[7]However, as we discuss below, our main results and conclusions hold when the bandwidth is decreased or increased in both parametric and non-parametric regressions.

assisted ventilation; the use of surfactant therapy occurred only in 0.2% of the cases. The frequency of all treatments increases for the newborns with a birth weight above 5000 grams. Mortality rates are quite low in this sample: they range from 0.06% for 24-hour mortality to 0.24% for 1-year mortality. To give an idea of the size of these values, consider that the rate of 24-hour and 1-year mortality in our sample was 141 and 594 deaths per 10 million macrosomic (≥4000-gram) births over the 2007-2013 period, respectively.

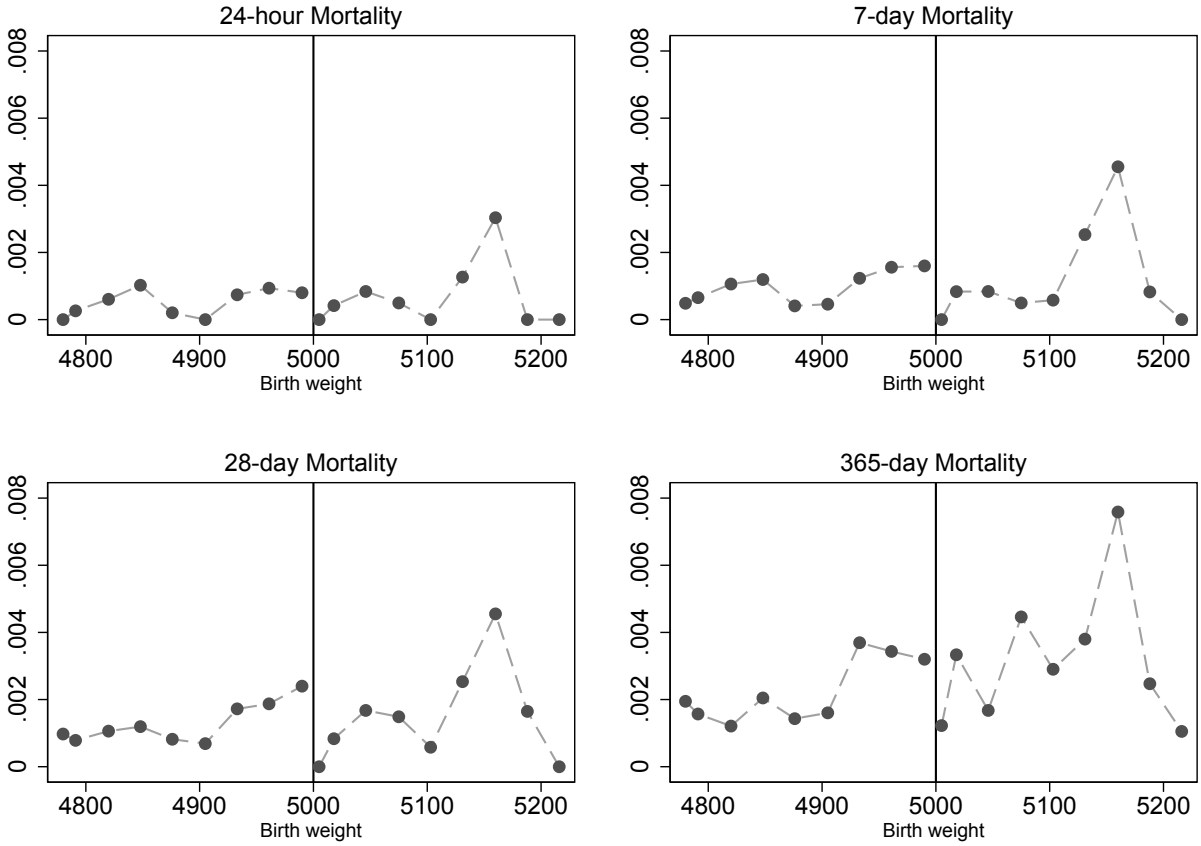
Figure 1
Neonatal treatments around the 5000-gram threshold



Notes: The dots represent averages of the treatment indicators inside 28-gram bins, with births grouped into 28-gram bins radiating from the 5000-gram threshold; the estimates are plotted at the median birth weight in each bin. Sample of U.S. singleton births in 2007-2013 with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1.

We now move to presenting visual evidence of differences in health treatment assignment and infant mortality risk around the 5000-gram threshold. Figure 1 shows that there is a sizable discontinuous jump in the probability of being admitted to a NICU at the 5000-gram threshold: the probability of being admitted to a NICU increases from almost 12% for newborns whose birth weight is just below 5000 grams to almost 14% for those with a birth weight just above 5000 grams. Receipt of antibiotics for suspected sepsis also shows a sizable jump across the cutoff, from about 3% below the cutoff to about 5% above the cutoff. The graphs do not

Figure 2
Mortality around the 5000-gram threshold



Notes: The dots represent averages of the mortality indicators inside 28-gram bins, with births grouped into 28-gram bins radiating from the 5000-gram threshold; the estimates are plotted at the median birth weight in each bin. Sample of U.S. singleton births in 2007-2013 with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1.

show meaningful discontinuities in treatments associated with respiratory distress (ventilation and surfactant) around the 5000-gram cutoff. In the case of the mortality outcomes, Figure 2 shows that there is a sizable discontinuous drop in the risk of death as birth weight crosses the 5000-gram cutoff from below. The drop in mortality risk is largest in the first 28 days.

4 Empirical strategy

In order to identify the effect of having a birth weight above a certain macrosomic threshold on both health treatments and infant mortality, we adopt a regression discontinuity (RD) design. We specify the following parametric regression:

$$y_i = \beta + \gamma I[bw_i \geq \bar{bw}] + f(bw_i - \bar{bw}) + \epsilon_i \tag{1}$$

where γ captures the effect of being above a macrosomic cutoff. In the baseline analysis we consider the highest diagnostic threshold for macrosomia identified in the medical literature, i.e. $\bar{bw} = 5000$, while in Section 6 we also examine other cutoffs. $f(bw_i - \bar{bw})$ is a polynomial in the distance from the cutoff; in the analysis, we control for separate linear or quadratic trends in the running variable on each side of the 5000-gram cutoff, thus allowing the slopes to differ on either side of the cutoff.[8] Equation 1 is estimated by weighted OLS, using the sample of newborns within a birth-weight window of 227 grams. All the parametric regressions use a triangular weight, which is decreasing in the distance from the cutoff, so observations near the cutoff receive higher weight than do observations farther from the cutoff. Following Lee and Card (2008), given that our running variable, birth weight, is discretized due to rounding, our standard errors are clustered at the gram level of birth weight in all specifications.

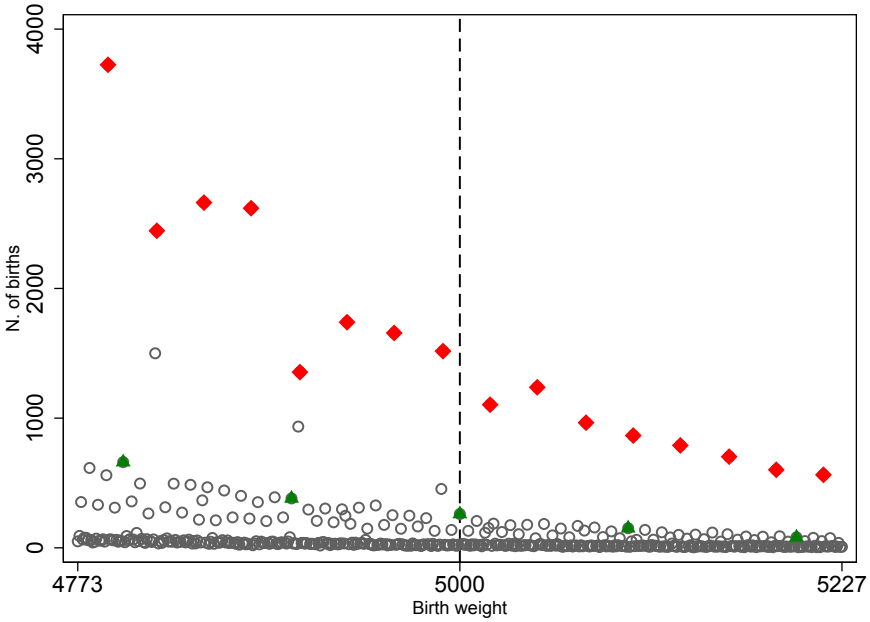
We consider a variety of outcome variables, which are represented by y_i in equation 1. For the analysis of health treatments, we focus on whether the newborn (i) was admitted to a NICU, which likely captures a deployment of one or more treatments, (ii) received antibiotics for suspected sepsis, (iii) required assisted ventilation, or (iv) was given surfactant replacement therapy. We also consider mortality at 24 hours, 7 days, 28 days, and 1 year. The analysis of the various health treatments represents our first-stage analysis, which helps to understand the channels that may drive any effect on infant mortality. However, we interpret the effects on mortality as the intention-to-treat effect of the additional medical care provided to EHBW infants because other treatments that we cannot observe, given either within the NICU or in another department, may change when crossing the 5000-gram threshold from below.

The identification of the effects of having a birth weight above 5000 grams on the outcomes of interest relies on four factors. First, as is satisfied in our setting with birth weight, there must be a continuous measure of health risk that is observed by health practitioners. Second, identification relies on the assumption that a diagnostic threshold generates a discontinuity in medical care receipt. The fulfillment of this assumption is demonstrated in Figure 1, which shows that NICU admission and antibiotics receipt rates behave in a discontinuous fashion around the 5000-gram cutoff.

Third, there should not be heaping of observations at the cutoff point. While manipulation of birth weight is very unlikely to occur–given the difficulty in estimating fetal weight–it might be the case that newborns are over-represented at certain birth weight values because of rounding by hospital staff. Figure 3 reports the frequency of births in the sample centered at

[8]Following Gelman and Imbens (2017), we report results from parametric regressions with linear and quadratic polynomials (but not higher-order polynomials) and complement this analysis with results from non-parametric regressions.

Figure 3
Frequency of births around the 5000-gram threshold



Notes: The circles represent the number of births per gram; the diamonds indicate the number of births at ounce multiples; the triangles indicate the values corresponding to 100-gram multiples. Sample of U.S. singleton births in 2007-2013 with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1.

the 5000-gram cutoff: the figure shows the number of births per gram (circles), the number of births at ounce multiples (diamonds), and the number of births at 100-gram multiples (triangles). We observe peaks at ounce and 100-gram multiples, but we do not observe systematically different heaps around the 5000-gram threshold of interest. We formally test for the existence of a discontinuity in the number of births at the cutoff value, by collapsing the data at the gram level and testing in a framework similar to equation (1) whether more or fewer births are reported just above the cutoff compared to just below the cutoff, following Almond et al. (2010) and Bharadwaj et al. (2013). The coefficient (std. error) associated with the 5000-gram cutoff dummy is -5.14 (54.38) when using a linear-trends specification, and -21.8 (78.22) when using a quadratic-trends specification. This test suggests that there is no manipulation of the running variable.[9] However, as pointed out by Barreca et al. (2016), heaps in the running variable (even far from the cutoff) can cause bias in the estimates. We examine the implications of heaping and for the decreasing trend in the number of births in a robustness check below.

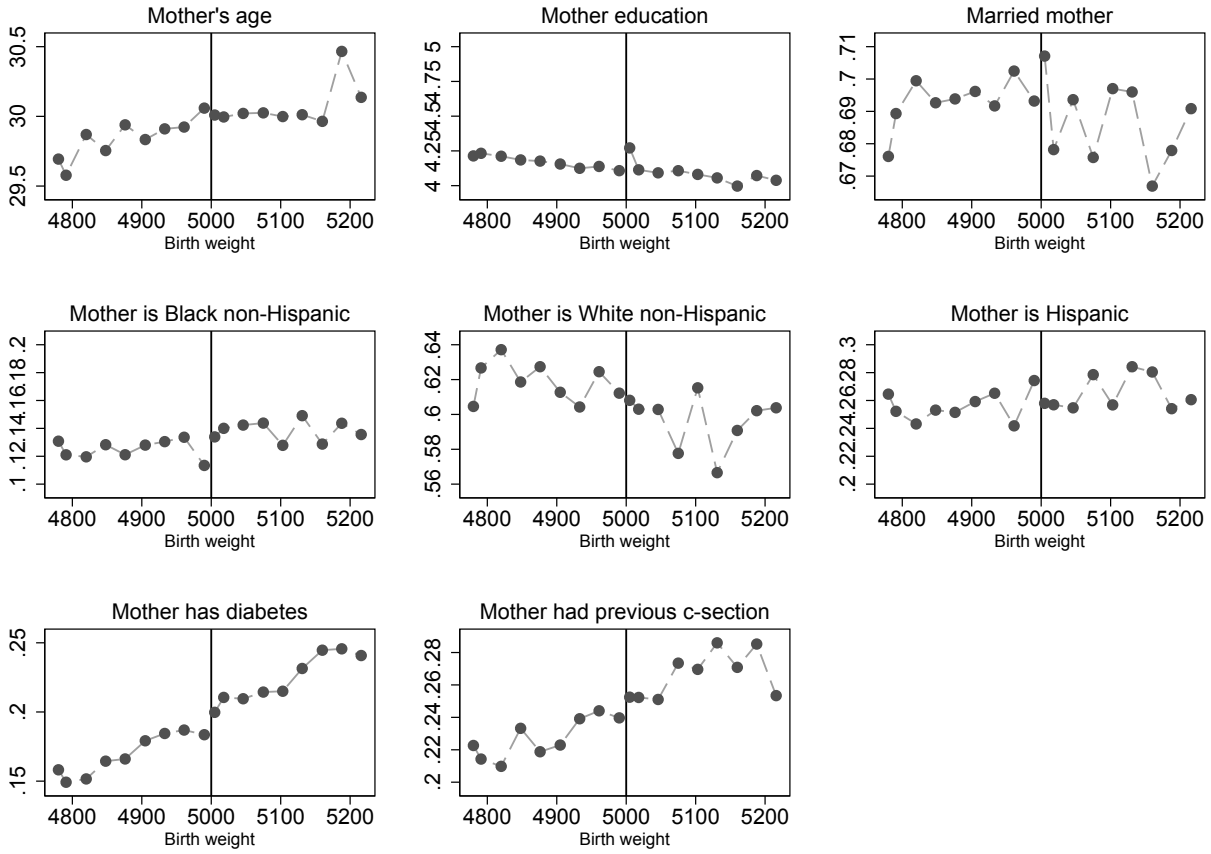
Finally, identification relies on the assumption that other observable pre-determined characteristics of the infant and the mother are continuous across the threshold (Imbens and Lemieux, 2008, Lee and Lemieux, 2010). Figures 4 and 5 report the distribution of demographic and

[9]Nevertheless, when presenting our results, we always report estimates from the entire sample and from the sample where observations at/in the vicinity of the cutoff have been dropped.

clinical factors around the 5000-gram threshold: the figures show that nearly all the characteristics present a continuous pattern across the threshold, although there appear to be some discontinuous changes. We further investigate this issue by estimating parametric regressions on the entire set of pre-determined variables. The results are presented in Appendix Table A.3 and confirm that some variables present significant changes at the cutoff, even though these are not always statistically significant across all the specifications. For this reason, in addition to our unconditional baseline analysis, in a robustness check below, we present an analysis in which we control for (i) the set of covariates showing even marginally significant changes at the cutoff value (birth order, number of prenatal visits, gestational diabetes, and sex) and (ii) all the covariates listed in Table A.3.

Figure 4

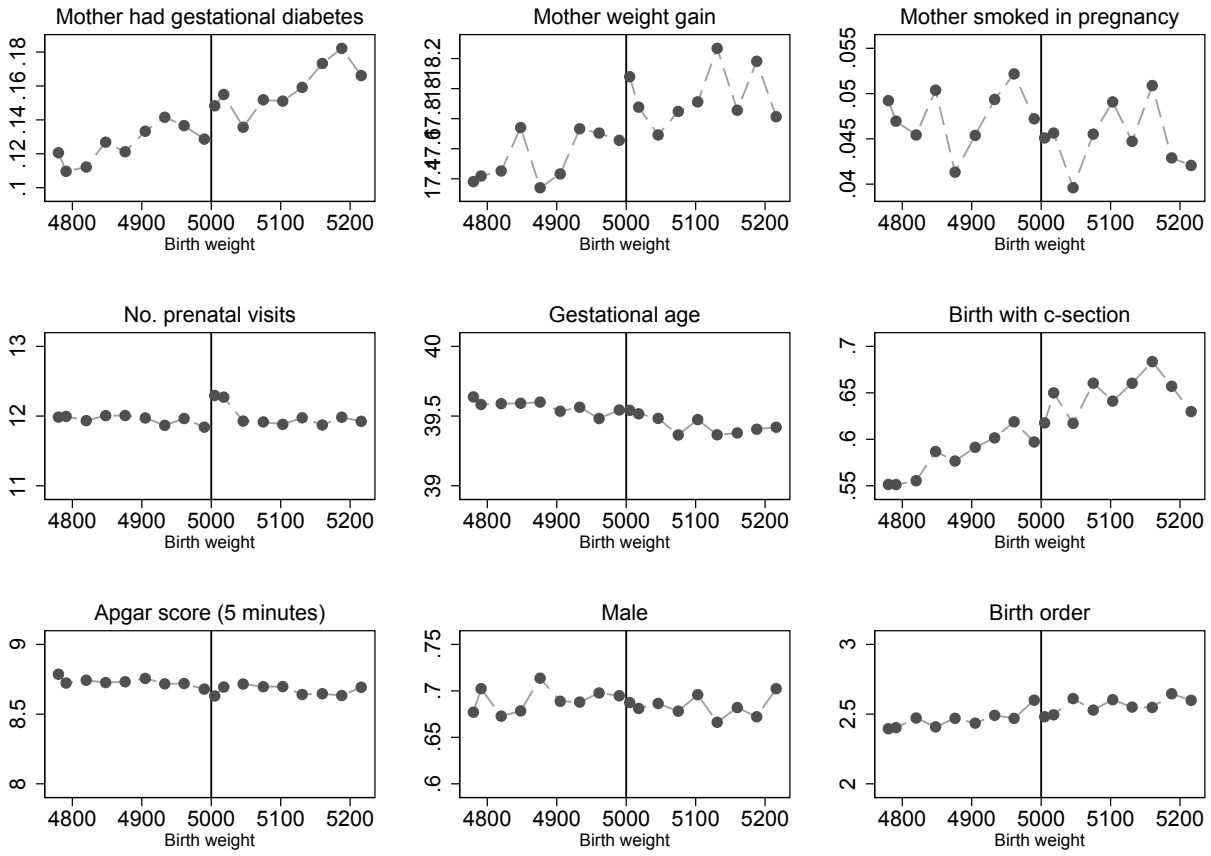
Distribution of covariates around the 5000-gram threshold: mother's characteristics.



Notes: The dots represent averages of the variables inside 28-gram bins, with births grouped into 28-gram bins radiating from the 5000-gram threshold; the estimates are plotted at the median birth weight in each bin. Sample of U.S. singleton births in 2007-2013 with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1.

As noted above, we start with a 227-gram bandwidth. By choosing a relatively large bandwidth, we have prioritized precision over bias because of the relatively small number of observations in the 5000-gram sample. However, we also test the sensitivity of the results to the

Figure 5
Distribution of covariates around the 5000-gram threshold: birth and pregnancy characteristics.



Notes: The dots represent averages of the variables inside 28-gram bins, with births grouped into 28-gram bins radiating from the 5000-gram threshold; the estimates are plotted at the median birth weight in each bin. Sample of U.S. singleton births in 2007-2013 with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1.

bandwidth size by using smaller bandwidths. This analysis results in less bias in the estimates, but also in less statistical power due to the smaller sample sizes.

5 Results

The results from the baseline analysis, where we consider observations in a bandwidth of 227 grams centered at the 5000-gram threshold, are presented in Table 2. Columns (1), (3) and (5) report regressions where we control for linear trends in the running variable; Columns (2), (4) and (6) report regressions where we control for quadratic trends. The table reports results from an analysis conducted on the whole sample (*No Donut*), on the sample where we drop observations with a birth weight equal to the cutoff (*Donut*), and on the sample where we drop observations with a birth weight between 4999 and 5001 grams (*Donut1*). All regressions use a triangular weight that prioritizes observations near the cutoff.

Panel A reports the estimated effect of being EHBW on the probability of being admitted to a NICU. Confirming the discontinuity that we observe in Figure 1, we find a large positive and statistically significant effect. The estimate in Column (1) indicates that the probability of being admitted to a NICU is about 1.8 percentage points higher for EHBW newborns, which corresponds to 19% of the average NICU admission rate below the 5000-gram cutoff (9.5%). Of note is that the coefficients are quite stable across the different specifications. Also consistent with the visual evidence in Figure 1, Column (1) of Panel B shows that we estimate an EHBW outcome to raise the likelihood of antibiotics receipt by about 1 percentage point or 40% of the mean below 5000 grams (2.5%). Finally, Panels C and D of the table confirm that there is not a similar effect on respiratory distress-related treatments, namely assisted ventilation and the use of surfactant therapy, as was suggested by the descriptive evidence presented in Figure 1.

The infant mortality results are reported in Panels E to F of Table 2. We find a very large negative effect of being above 5000 grams on infant mortality, especially for mortality measures from 7 days onward. The coefficient estimates in Column (1) suggest that being born with an EHBW lowers the risk of mortality by 0.12 percentage points, 0.16 percentage points, and 0.16 percentage points, depending on whether we refer to 7-day, 28-day, or 1-year mortality indicator, respectively. The effects are substantial: they correspond to about 130%, 130% and 80% relative to the mean 7-day, 28-day, and 1-year mortality rate among newborns with a birth weight below 5000 grams.

Table 2
Parametric estimations of the effect of being EHBW on health treatments and mortality

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. NICU						
Birth weight $\geq$ 5000 g	0.0177***	0.0223**	0.0151**	0.0175*	0.0154**	0.0182**
	(0.0067)	(0.0095)	(0.0064)	(0.0090)	(0.0063)	(0.0089)
Panel B. Antibiotics						
Birth weight $\geq$ 5000 g	0.0092*	0.0141**	0.0089*	0.0144**	0.0083	0.0131**
	(0.0048)	(0.0057)	(0.0052)	(0.0068)	(0.0050)	(0.0065)
Panel C. Ventilation						
Birth weight $\geq$ 5000 g	0.0007	-0.0036	-0.0006	-0.0063	-0.0008	-0.0068
	(0.0052)	(0.0071)	(0.0053)	(0.0072)	(0.0053)	(0.0072)
Panel D. Surfactant						
Birth weight $\geq$ 5000 g	-0.0006	-0.0005	-0.0004	-0.0000	-0.0002	0.0004
	(0.0010)	(0.0015)	(0.0010)	(0.0017)	(0.0010)	(0.0016)
Panel E. 24-hour Mortality						
Birth weight $\geq$ 5000 g	-0.0004	-0.0006	-0.0004	-0.0005	-0.0004	-0.0005
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Panel F. 7-day Mortality						
Birth weight $\geq$ 5000 g	-0.0012**	-0.0015**	-0.0012**	-0.0014**	-0.0012**	-0.0014**
	(0.0005)	(0.0006)	(0.0005)	(0.0007)	(0.0005)	(0.0007)
Panel G. 28-day Mortality						
Birth weight $\geq$ 5000 g	-0.0016***	-0.0023***	-0.0015***	-0.0022***	-0.0015***	-0.0022***
	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0007)
Panel H. 365-day Mortality						
Birth weight $\geq$ 5000 g	-0.0016*	-0.0019	-0.0017*	-0.0023	-0.0017*	-0.0023
	(0.0009)	(0.0014)	(0.0010)	(0.0015)	(0.0010)	(0.0015)
N	55581	55581	55320	55320	55268	55268
Specifications:						
Linear+Interactions	✓		✓		✓	
Quadratic+Interactions		✓		✓		✓
No Donut	✓	✓				
Donut			✓	✓		
Donut 1					✓	✓

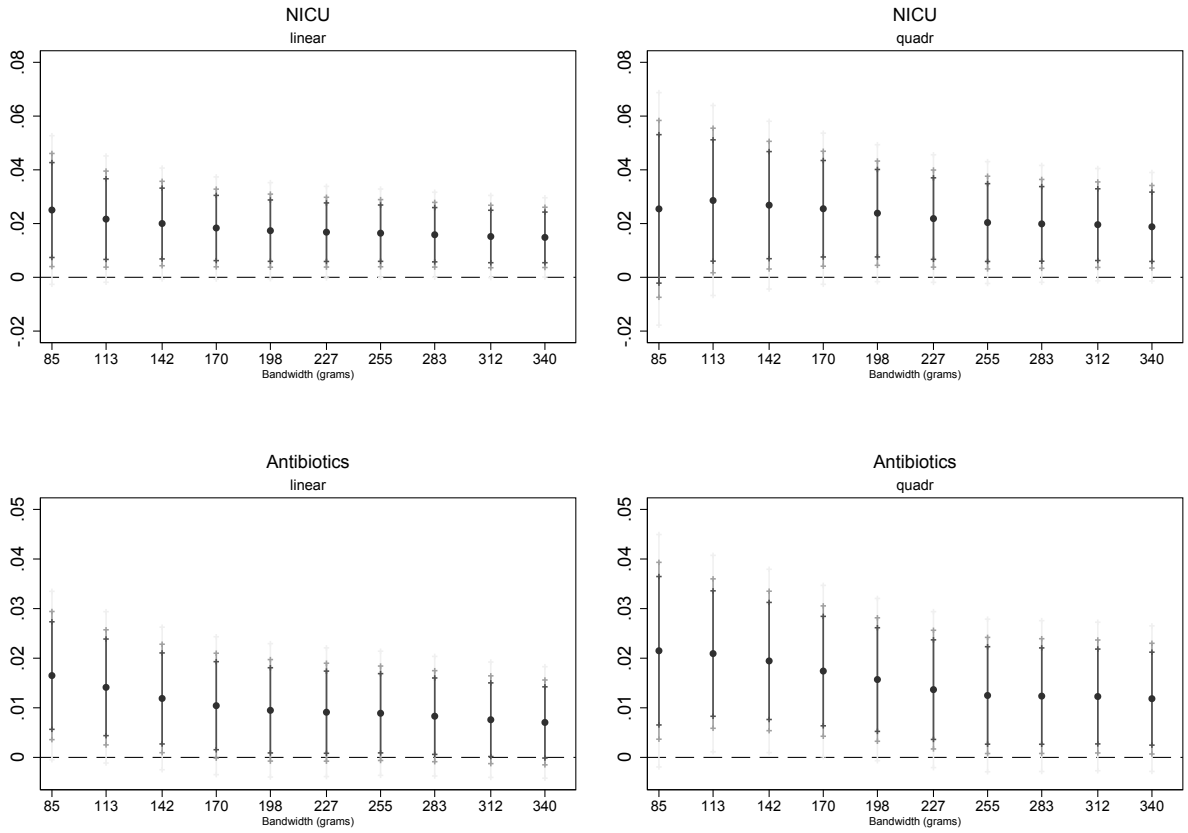
Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1. The specification *Donut* indicates that observations with birth weight equal to the cutoff have been dropped from the sample, while the specification *Donut 1* indicates that also observations with birth weight within +/-1 gram from the cutoff have been excluded. Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

5.1 Robustness and sensitivity checks

We test the robustness of our results along three main dimensions: (i) the size of the bandwidth, (ii) the presence of other confounding factors changing discontinuously at the 5000-gram threshold, and (iii) the potential bias introduced in the estimates by the heaping and decreasing trend in number of births in our macrosomic sample.

In the baseline analysis we adopt a bandwidth of 227 grams. In what follows, we repeat the baseline analysis by varying the bandwidth from 85 grams (i.e. 3 ounces) to 340 grams

Figure 6
Parametric estimations of the effect of being EHBW on NICU admission and antibiotics, with different bandwidth size. Whole sample.



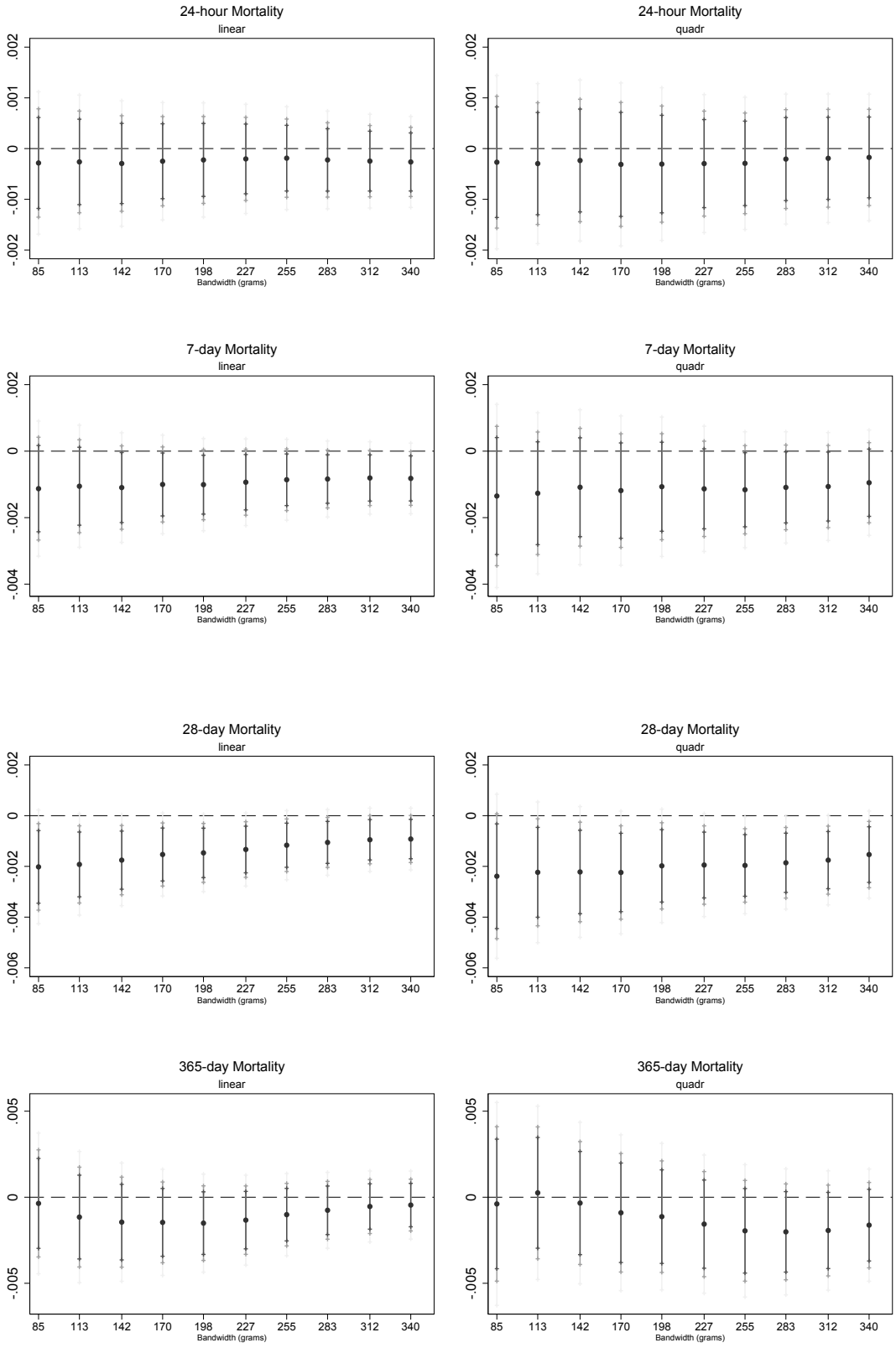
Notes: The graphs report the parametric estimates and 90%, 95% and 99% confidence intervals of the effects of being EHBW using, for each estimation, a bandwidth ranging between 85 and 340 grams. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births without observations with missing information in the variables listed in Table 1.

(corresponding to 12 ounces). Figure 6 reports the estimated coefficients (and 90%, 95% and 99% confidence intervals) for NICU admission and antibiotics receipt, when using linear (left panel) and quadratic trends (right panel): the figure shows that the effects of being EHBW on these treatments are very stable across the different specifications, but, as expected, they become less precisely estimated when the bandwidth is narrowed. Figure A.1 in the Appendix shows the estimated coefficients for ventilation and surfactant use, which are never statistically different from zero. Figure 7 shows the estimated effects of being EHBW on all mortality indicators in samples with different bandwidth sizes. Again mortality effects are quite stable across specifications, although they are less precisely estimated with smaller bandwidths .[10]

We further test the issue of bandwidth size, and also of the functional form adopted in

[10]Figures A.2 and A.3 in the Appendix present results for the *Donut* sample, and Figures A.4 and A.5 in the Appendix show results for the *Donut1* sample.

Figure 7
Parametric estimations of the effect of being EHBW on mortality, with different bandwidth size. Whole sample.



Notes: The graphs report the parametric estimates and 90%, 95% and 99% confidence intervals of the effects of being EHBW using, for each estimation, a bandwidth ranging between 85 and 340 grams. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births without observations with missing information in the variables listed in Table 1.

the baseline analysis, by estimating non-parametrically the effect of weighing more than 5000 grams at birth. The results are reported in Table 3 and confirm that the NICU admission and antibiotics receipt estimates hover around 2 percentage points, while the 28-day mortality estimates hover around 0.2 percentage points.

We now explore the implications of the significant changes in some covariates that we documented in Section 4 for our baseline results, by (i) controlling for this subset of covariates (birth order, number of prenatal visits, gestational diabetes, and sex) or (ii) controlling for the entire set of pre-determined covariates (i.e., all the variables listed in Table A.2). We also perform an analysis in which we control for year fixed effects, in order to account for time-varying determinants of birth weight, medical inputs, and mortality. In Table 4 we report the results from these additional robustness checks on the whole sample, while Table A.4 in the Appendix refers to the *Donut* sample, and Table A.5 in the Appendix report results for the *Donut1* sample. Reassuringly, our main conclusions are not affected by the inclusion of pre-determined covariates or when controlling for year fixed effects.

Finally, we test the sensitivity of the results to the inclusion of controls that take into account the distribution and density of observations in the macrosomic sample. Table 5 reports the results of the analysis where we control for (i) the gram-specific number of births, (ii) ounce-multiple fixed effects, (iii) 100-gram-multiple fixed effects, or (iv) both ounce- and 100-gram-multiple fixed effects, for the entire sample, while Tables A.6 and A.7 in the Appendix show the estimations in the *Donut* and *Donut1* samples, respectively. The results and conclusions do not differ from those of our baseline analysis.[11]

6 Analysis at other macrosomic cutoffs

In this section, we repeat the baseline estimation that we have performed for the 5000-gram cutoff, for the 4000- and 4500-gram birth weight thresholds, by using, as before, a bandwidth of 227 grams. The estimates for all cutoffs are reported in Figure 8 for NICU admission and antibiotics receipt, and in Figure 9 for mortality, and show that, unlike at the 5000-gram cutoff, there is no evidence of both extra medical care and a mortality reduction at either the 4000- or 4500-gram cutoffs.[12]

[11] We also estimated a more demanding specification where we include either linear or quadratic trends in the ounce-multiple fixed effects and the 100-gram-multiple fixed effects. The results are qualitatively similar and are available upon request from the authors.

[12] Figure A.6 in the Appendix reports the estimated coefficients for ventilation and surfactant use. Tables A.8 and A.9 in the Appendix report the detailed estimation results for all outcomes around the 4000- and 4500-gram thresholds, including the analysis of the *Donut* and *Donut1* samples.

Table 3
Non-parametric regressions for health treatments and mortality around the 5000-gram threshold.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. NICU						
RD Estimate	0.0260**	0.0287**	0.0205*	0.0239*	0.0216*	0.0252*
	(0.0116)	(0.0133)	(0.0119)	(0.0134)	(0.0120)	(0.0134)
Bandwidth	37	92	36	95	36	93
Panel B. Antibiotics						
RD Estimate	0.0211***	0.0236**	0.0365***	0.0340***	0.0269***	0.0303***
	(0.0080)	(0.0093)	(0.0121)	(0.0122)	(0.0099)	(0.0117)
Bandwidth	22	64	18	54	20	56
Panel C. Ventilation						
RD Estimate	-0.0035	-0.0051	-0.0072	-0.0071	-0.0081	-0.0079
	(0.0066)	(0.0100)	(0.0075)	(0.0094)	(0.0077)	(0.0094)
Bandwidth	51	82	41	98	39	97
Panel D. Surfactant						
RD Estimate	-0.0003	-0.0004	0.0000	0.0004	0.0004	0.0010
	(0.0012)	(0.0017)	(0.0013)	(0.0021)	(0.0014)	(0.0020)
Bandwidth	80	157	76	137	71	137
Panel E. 24-hour Mortality						
RD Estimate	-0.0006	-0.0001	-0.0005	-0.0001	-0.0005	-0.0003
	(0.0006)	(0.0011)	(0.0006)	(0.0012)	(0.0007)	(0.0011)
Bandwidth	60	34	57	33	57	37
Panel F. 7-day Mortality						
RD Estimate	-0.0014	-0.0019	-0.0014	-0.0021	-0.0014	-0.0022
	(0.0009)	(0.0014)	(0.0011)	(0.0015)	(0.0011)	(0.0015)
Bandwidth	50	46	38	44	37	45
Panel G. 28-day Mortality						
RD Estimate	-0.0024**	-0.0029*	-0.0022**	-0.0030*	-0.0022**	-0.0032*
	(0.0011)	(0.0016)	(0.0011)	(0.0017)	(0.0011)	(0.0017)
Bandwidth	39	47	43	45	43	45
Panel H. 365-day Mortality						
RD Estimate	-0.0007	-0.0007	-0.0013	-0.0039*	-0.0012	-0.0038
	(0.0018)	(0.0025)	(0.0018)	(0.0022)	(0.0018)	(0.0023)
Bandwidth	39	56	33	44	34	44
Order Loc. Poly. (p)	0	1	0	1	0	1
No Donut	✓	✓				
Donut			✓	✓		
Donut 1					✓	✓

Notes: The table reports Robust RD estimates, generated from local linear polynomial regressions, which were obtained using a triangular kernel function and the optimal bandwidth computed following the procedure proposed by Calonico et al. (2014). The specification *Donut* indicates that observations with birth weight equal to the cutoff have been dropped from the sample, while the specification *Donut 1* indicates that also observations with birth weight within +/-1 gram from the cutoff have been excluded. Sample of U.S. singleton births in 2007-2013 with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

Table 4

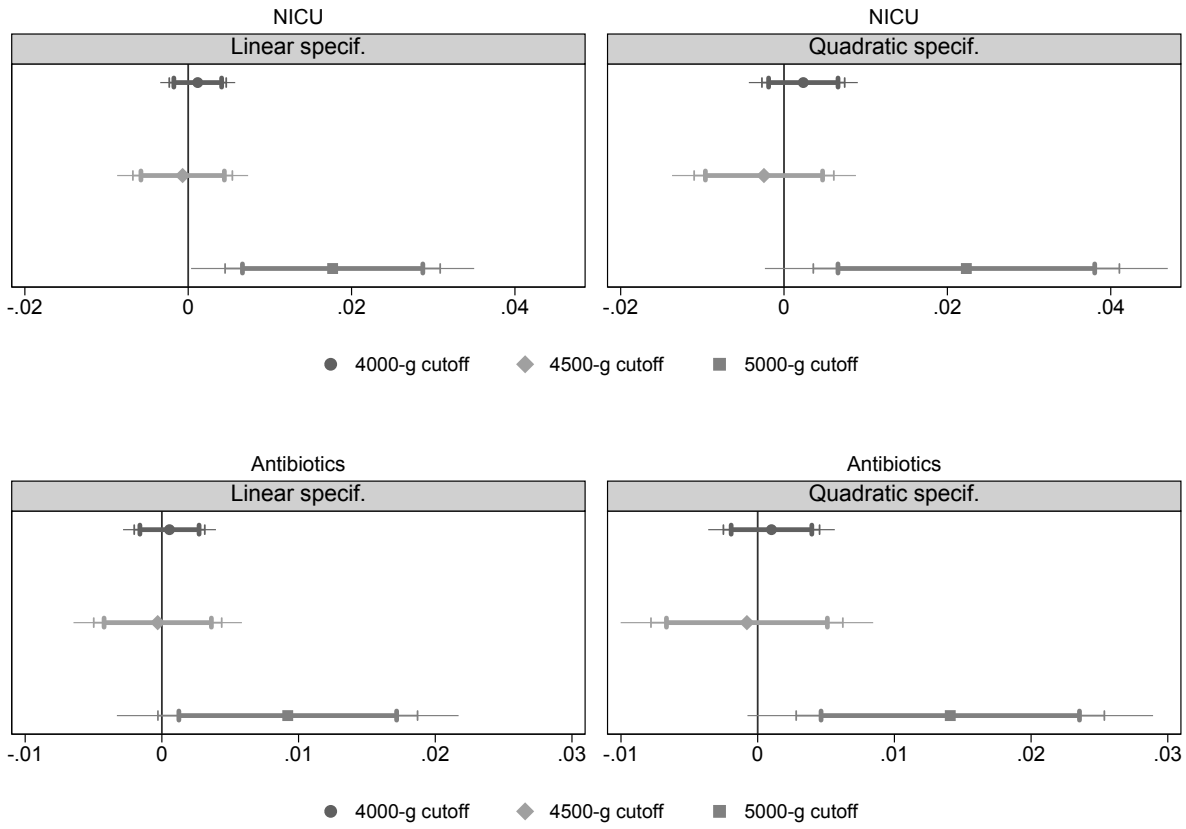
Parametric estimations conditional on covariates and year fixed effects. Whole sample.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. NICU						
Birth weight≥ 5000 grams	0.0174**	0.0213**	0.0184***	0.0280***	0.0176***	0.0221**
	(0.0070)	(0.0106)	(0.0069)	(0.0098)	(0.0067)	(0.0095)
Panel B. Antibiotics						
Birth weight≥ 5000 grams	0.0088*	0.0131**	0.0090*	0.0141**	0.0092*	0.0141**
	(0.0047)	(0.0056)	(0.0050)	(0.0066)	(0.0048)	(0.0057)
Panel C. Ventilation						
Birth weight≥ 5000 grams	0.0014	-0.0019	-0.0004	-0.0023	0.0006	-0.0037
	(0.0058)	(0.0080)	(0.0048)	(0.0064)	(0.0052)	(0.0072)
Panel D. Surfactant						
Birth weight≥ 5000 grams	-0.0009	-0.0012	-0.0011	-0.0012	-0.0006	-0.0006
	(0.0009)	(0.0014)	(0.0011)	(0.0017)	(0.0010)	(0.0015)
Panel E. 24-hour Mortality						
Birth weight≥ 5000 grams	-0.0004	-0.0006	-0.0009*	-0.0011**	-0.0004	-0.0006
	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.0004)	(0.0004)
Panel F. 7-day Mortality						
Birth weight≥ 5000 grams	-0.0012**	-0.0015**	-0.0013**	-0.0015*	-0.0012**	-0.0015**
	(0.0005)	(0.0007)	(0.0006)	(0.0009)	(0.0005)	(0.0006)
Panel G. 28-day Mortality						
Birth weight≥ 5000 grams	-0.0016***	-0.0023***	-0.0019***	-0.0025**	-0.0016***	-0.0023***
	(0.0005)	(0.0007)	(0.0007)	(0.0010)	(0.0005)	(0.0007)
Panel H. 365-day Mortality						
Birth weight≥ 5000 grams	-0.0020**	-0.0025*	-0.0019**	-0.0024	-0.0015*	-0.0019
	(0.0009)	(0.0014)	(0.0009)	(0.0015)	(0.0009)	(0.0014)
N	53467	53467	45070	45070	55581	55581
Linear+Interactions	✓		✓		✓	
Quadratic+Interactions		✓		✓		✓
Controls						
Birth order, No. Visits, Gest. diab., Male	✓	✓				
All covariates			✓	✓		
Year FE					✓	✓

Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1. Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

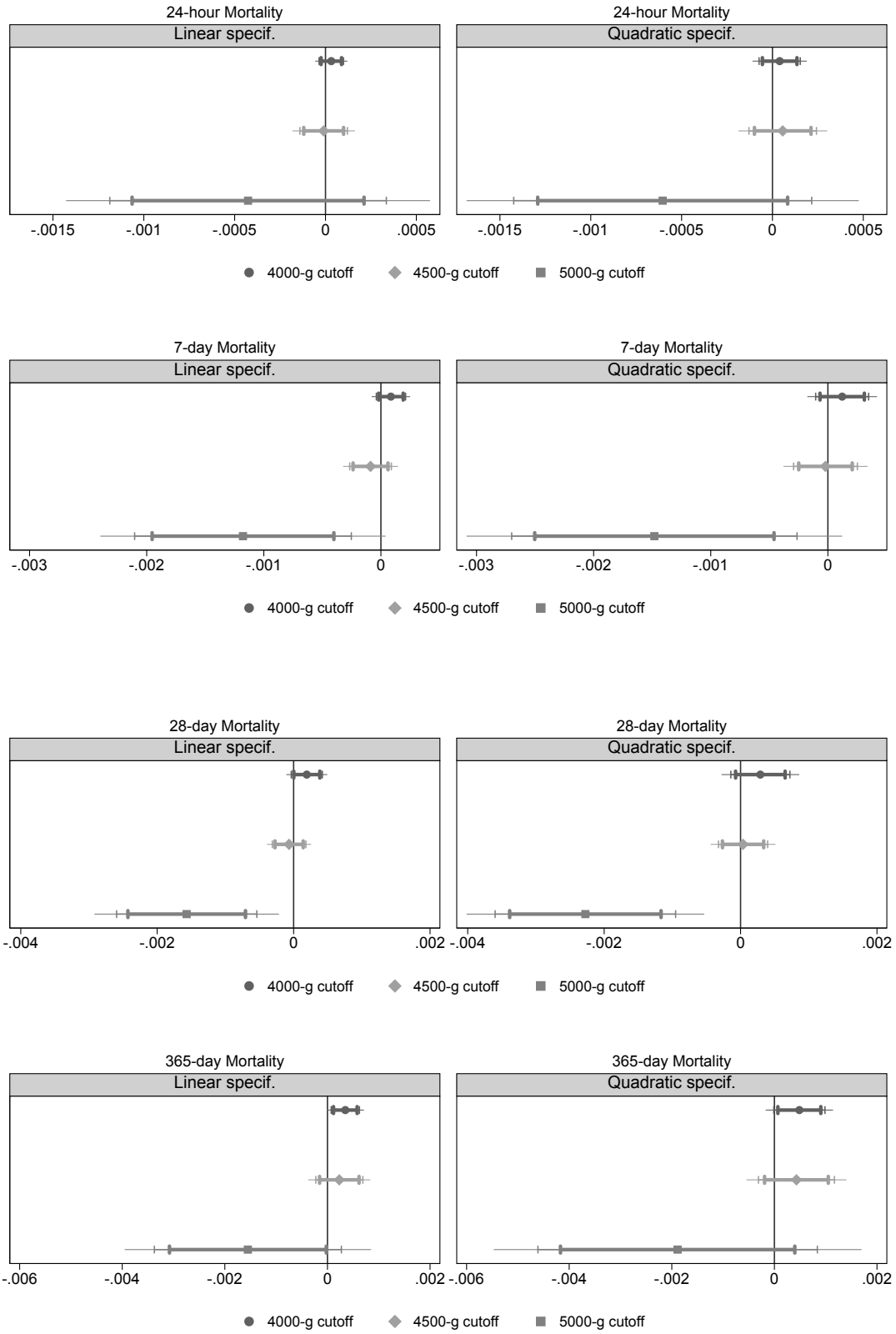
We also investigate whether there is evidence of other diagnostically relevant thresholds, by repeating the baseline analysis involving birth weight thresholds at 100-gram intervals in the 3900- to 5400-gram segment. Results for NICU admission and antibiotics are reported in Figure 10, while the results for mortality are reported in Figures 11 and 12. Figure A.7 in the Appendix reports the results for ventilation and surfactant use. Only at the 5000-gram cutoff do we find systematic evidence of extra medical care as well as a reduction in mortality risk as the cutoff is approached from below.

Figure 8
Parametric estimation of the effect of being HBW on NICU admission, at the macrosomic cutoffs of 4000, 4500 and 5000 grams. Whole sample.



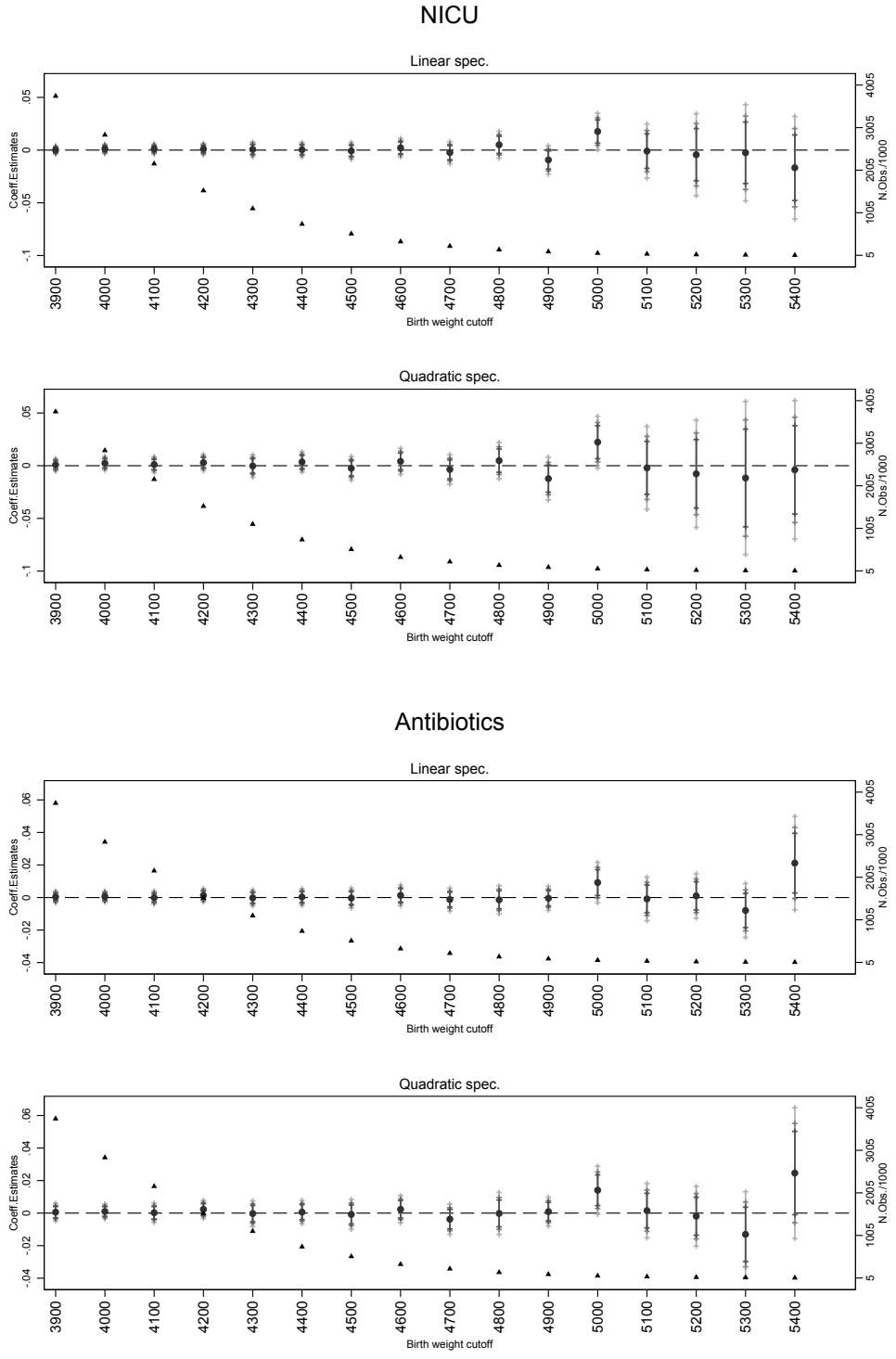
Notes: The graph reports the coefficients associated with a variable indicating whether a newborn has high birth weight, i.e. larger than 4000, 4500 and 5000 grams, and the corresponding 99%, 95% and 90% confidence intervals. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births in 2007-2013 with birth weight within 227 grams from the corresponding threshold, after dropping observations with missing information in the variables listed in Table 1.

Figure 9
Parametric estimation of the effect of being HBW on mortality, at the macrosomic cutoffs of 4000, 4500 and 5000 grams. Whole sample.



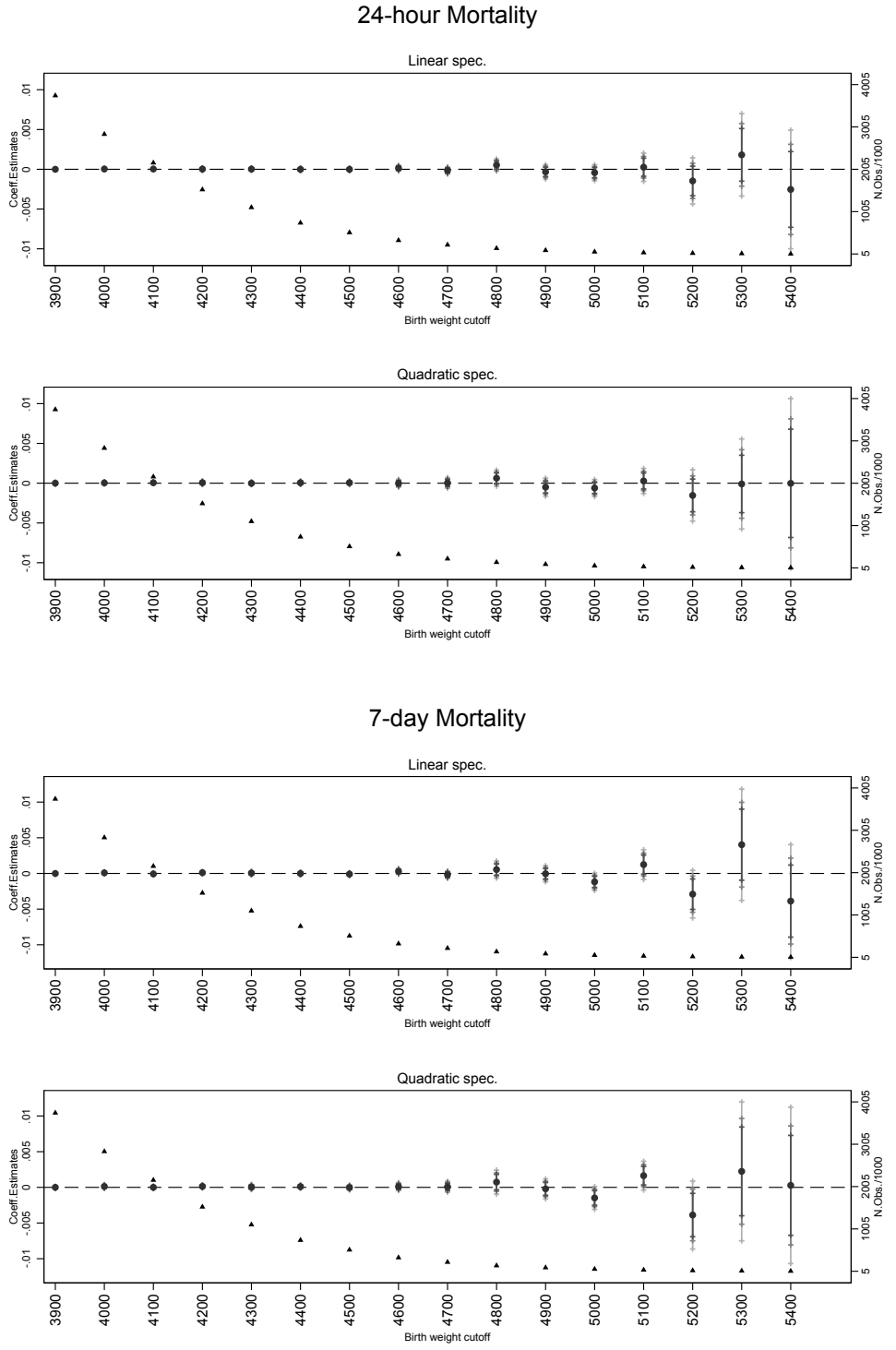
Notes: The graph reports the coefficients associated with a variable indicating whether a newborn has high birth weight, i.e. larger than 4000, 4500 and 5000 grams, and the corresponding 99%, 95% and 90% confidence intervals. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births in 2007-2013 with birth weight within 227 grams from the corresponding threshold, after dropping observations with missing information in the variables listed in Table 1.

Figure 10
Parametric estimation of the effect of being HBW on NICU admission and antibiotics, by using 100-gram apart thresholds in the 3900- to 5400-gram segment. Whole sample.



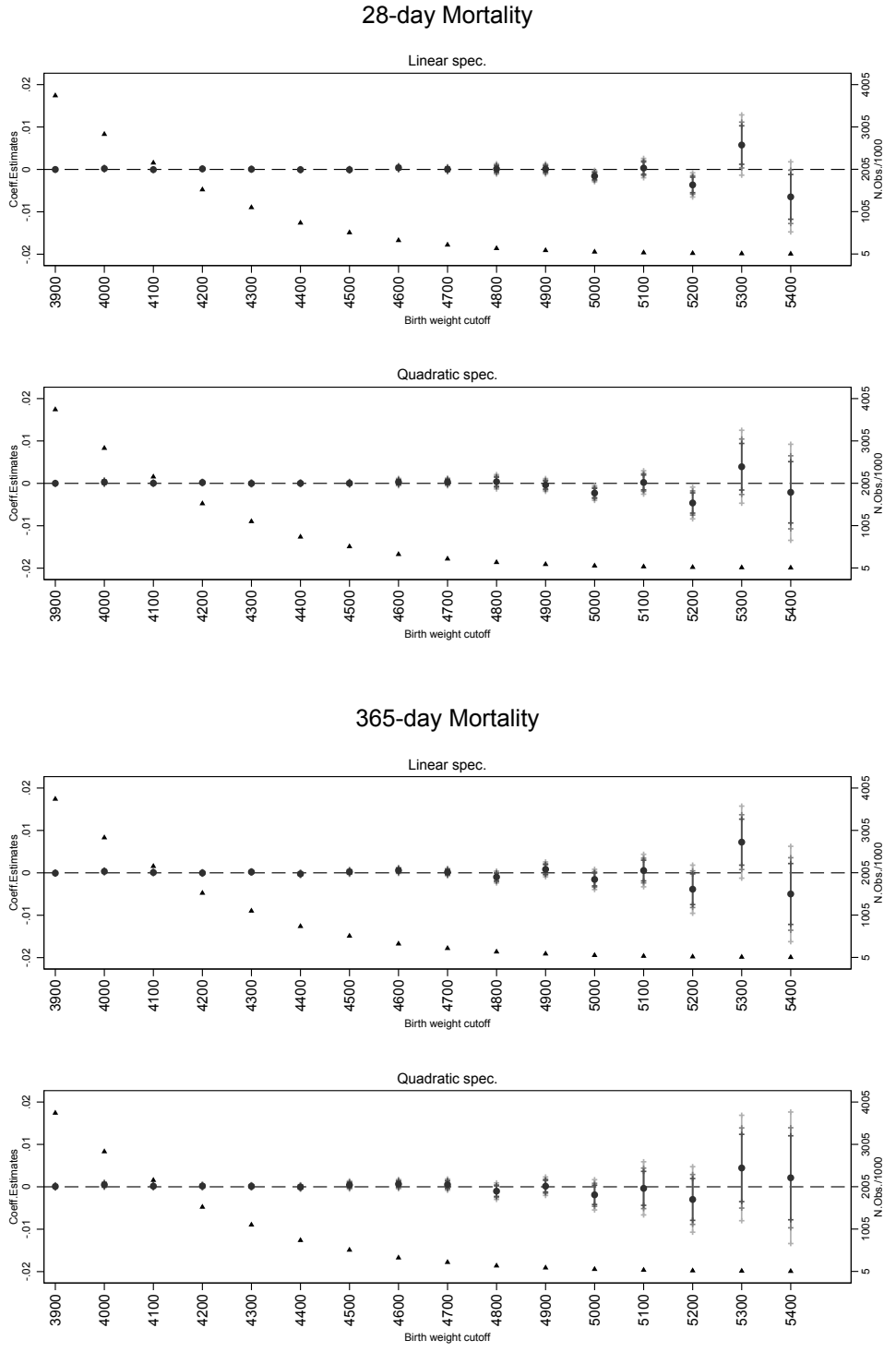
Notes: The graph reports the coefficients associated with a variable indicating whether a newborn has high birth weight, i.e. larger than the corresponding cutoff, and the corresponding 99%, 95% and 90% confidence intervals. All estimations control for linear (panel to the top) and quadratic (panel to the bottom) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births in 2007-2013 with birth weight within 227 grams from the corresponding threshold, after dropping observations with missing information in the variables listed in Table 1. The triangles indicate the number of observations for each regression sample, whose label is reported in the y-axis to the right.

Figure 11
Parametric estimation of the effect of being HBW on 24-hour and 7-day mortality, by using 100-gram apart thresholds in the 3900- to 5400-gram segment. Whole sample.



Notes: The graph reports the coefficients associated with a variable indicating whether a newborn has high birth weight, i.e. larger than the corresponding cutoff, and the corresponding 99%, 95% and 90% confidence intervals. All estimations control for linear (panel to the top) and quadratic (panel to the bottom) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births in 2007-2013 with birth weight within 227 grams from the corresponding threshold, after dropping observations with missing information in the variables listed in Table 1. The triangles indicate the number of observations for each regression sample, whose label is reported in the y-axis to the right.

Figure 12
Parametric estimation of the effect of being HBW on 28-day and 365-day mortality, by using 100-gram apart thresholds in the 3900- to 5400-gram segment. Whole sample.



Notes: The graph reports the coefficients associated with a variable indicating whether a newborn has high birth weight, i.e. larger than the corresponding cutoff, and the corresponding 99%, 95% and 90% confidence intervals. All estimations control for linear (panel to the top) and quadratic (panel to the bottom) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births in 2007-2013 with birth weight within 227 grams from the corresponding threshold, after dropping observations with missing information in the variables listed in Table 1. The triangles indicate the number of observations for each regression sample, whose label is reported in the y-axis to the right.

Table 5
Parametric estimations conditional on number of observations per gram, ounce-multiple and 100-gram-multiple fixed effects. Whole sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. NICU								
Birth weight≥ 5000 grams	0.0168***	0.0191**	0.0165***	0.0194**	0.0163**	0.0197**	0.0156***	0.0177**
	(0.0054)	(0.0080)	(0.0053)	(0.0077)	(0.0064)	(0.0089)	(0.0052)	(0.0074)
Panel B. Antibiotics								
Birth weight≥ 5000 grams	0.0086**	0.0119**	0.0083**	0.0120**	0.0087*	0.0133**	0.0081**	0.0118**
	(0.0041)	(0.0052)	(0.0038)	(0.0049)	(0.0049)	(0.0060)	(0.0039)	(0.0051)
Panel C. Ventilation								
Birth weight≥ 5000 grams	0.0013	-0.0016	0.0016	-0.0015	0.0007	-0.0035	0.0013	-0.0021
	(0.0045)	(0.0064)	(0.0046)	(0.0065)	(0.0052)	(0.0071)	(0.0045)	(0.0063)
Panel D. Surfactant								
Birth weight≥ 5000 grams	-0.0006	-0.0007	-0.0006	-0.0006	-0.0004	-0.0002	-0.0005	-0.0003
	(0.0010)	(0.0015)	(0.0010)	(0.0015)	(0.0010)	(0.0015)	(0.0010)	(0.0015)
Panel E. 24-hour Mortality								
Birth weight≥ 5000 grams	-0.0004	-0.0006	-0.0004	-0.0006	-0.0004	-0.0005	-0.0004	-0.0005
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Panel F. 7-day Mortality								
Birth weight≥ 5000 grams	-0.0012**	-0.0015**	-0.0012**	-0.0015**	-0.0012**	-0.0015**	-0.0012**	-0.0015**
	(0.0005)	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0007)
Panel G. 28-day Mortality								
Birth weight≥ 5000 grams	-0.0016***	-0.0023***	-0.0016***	-0.0023***	-0.0016***	-0.0023***	-0.0016***	-0.0023***
	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0007)
Panel H. 365-day Mortality								
Birth weight≥ 5000 grams	-0.0016*	-0.0019	-0.0016*	-0.0019	-0.0016*	-0.0020	-0.0016*	-0.0020
	(0.0009)	(0.0014)	(0.0009)	(0.0014)	(0.0009)	(0.0014)	(0.0009)	(0.0014)
N	55581	55581	55581	55581	55581	55581	55581	55581
Linear+Interactions	✓		✓		✓		✓	
Quadratic+Interactions		✓		✓		✓		✓
Controls								
No. Births per gram	✓	✓						
Ounce-multiple FE			✓	✓			✓	✓
100-g-multiple FE					✓	✓	✓	✓

Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations without missing information in the variables listed in Table 1. Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

7 Conclusions

In this study, we use a regression discontinuity design to estimate the short-run health returns to providing medical care to macrosomic newborns. We find that there are economically important and statistically significant effects of being born with an EHBW on one specific health treatment (antibiotics receipt for suspected neonatal sepsis) and what may entail a battery of health treatments (NICU admission). We also find that being born with an EHBW substantially reduces the risk of infant mortality.

A mortality-reducing effect of the additional medical care for EHBW newborns is consistent with what studies have found for high-risk LBW newborns (Almond et al., 2010, Bharadwaj et al., 2013).[13] The results from Bharadwaj et al. (2013) suggest that surfactant therapy

[13]Similar to what Almond et al. (2010) found at the very LBW threshold, our results suggest that most of

plays a role in the link between neonatal care and mortality risk among very LBW infants. In our analysis at the high-risk, high end of the birth weight distribution, we do not find discontinuities in respiratory treatments (assisted ventilation and surfactant therapy) around the 5000-gram cutoff. This suggests that, for macrosomic newborns, the decision to provide respiratory treatments may be linked to the actual occurrence of respiratory complications after birth and may be less sensitive to the higher expected morbidity and mortality risks associated with an EHBW outcome than the other health treatment decisions we observe in the data. More specifically, since neonatal sepsis is a major cause of neonatal mortality (Shane et al., 2017) and a primary NICU admitting diagnosis for macrosomic babies (Tolosa and Calhoun, 2017), the hospital staff may be more sensitive to the EHBW cutoff when deciding on NICU admission or the provision of antibiotics for suspected sepsis.

Our findings have important policy implications because maternal obesity, a major risk factor for macrosomia, is becoming more prevalent, which may result in a greater number of medical providers facing rule-of-thumb health treatment decisions at macrosomic cutoffs. However, our analysis leaves space for additional research. First, it should be noticed that we cannot isolate the specific medical inputs provided to macrosomic infants in NICUs that may translate into large short-run health gains in the macrosomic patient population, nor can we rule out that other medical inputs, not observable in our data, also improve the health of macrosomic infants. Pinning down the type and quantity of medical inputs provided to macrosomic newborns within and outside of NICUs would allow for a more comprehensive comparison of the costs and benefits associated with medical care for macrosomic babies. Second, since infant mortality is an extreme health event, future work on the impacts of neonatal care on other health or non-health outcomes is warranted.

the health gains associated with extra medical care receipt at the EHBW threshold are realized within the first 28 days; however, unlike Almond et al. (2010) we find that these gains may not linger through the first year of life. A possible reason for this difference might be that neonatal follow-up programs for babies that are discharged from NICUs are less commonly available for EHBW babies, as NICU follow-up clinics tend to focus on premature infants (Needelman and Jackson, 2018).

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A Additional tables and figures

Table A.1
Analysis of determinants of having a birth weight heavier than 5000 grams.

	OLS	LOGIT
Mother's age	0.0001	0.0005
	(0.0004)	(0.0024)
Mother's education	-0.0035**	-0.0184**
	(0.0016)	(0.0082)
Married mother	-0.0004	-0.0011
	(0.0055)	(0.0287)
Mother is White Non-Hisp	-0.0181**	-0.0919**
	(0.0086)	(0.0465)
Mother is Hispanic	-0.0202***	-0.1030**
	(0.0078)	(0.0403)
Mother had gestational diabetes	0.0352***	0.1735***
	(0.0087)	(0.0429)
Mother had previous c-section	0.0098*	0.0475*
	(0.0054)	(0.0277)
Mother weight gain in pregnancy	0.0014***	0.0071***
	(0.0003)	(0.0014)
Mother smoked in pregnancy	-0.0098	-0.0513
	(0.0118)	(0.0610)
No. Prenatal visits	0.0012*	0.0059*
	(0.0006)	(0.0034)
Gestational age	-0.0031*	-0.0160*
	(0.0016)	(0.0083)
C-section	0.0479***	0.2572***
	(0.0074)	(0.0286)
Birth order	0.0125***	0.0649***
	(0.0029)	(0.0110)
2007 cohort	0.0086	0.0461
	(0.0086)	(0.0466)
2008 cohort	0.0201**	0.1066**
	(0.0096)	(0.0499)
2009 cohort	0.0137	0.0733
	(0.0090)	(0.0496)
2010 cohort	0.0245***	0.1290***
	(0.0086)	(0.0472)
2011 cohort	0.0126	0.0675
	(0.0085)	(0.0437)
2012 cohort	0.0180*	0.0955**
	(0.0095)	(0.0464)
Constant	0.2903***	-0.8998**
	(0.0826)	(0.4226)
N	45326	45326

Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1 and in the above variables. Robust standard errors that are clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

Table A.2
Descriptive statistics for the mother, pregnancy and newborn characteristics in the sample around the 5000-gram threshold.

	Mean	SD	min	Max	N
Mother's age	29.8764	(5.6811)	12	50	55581
Mother education	4.1575	(1.7473)	1	8	54864
Married mother	0.6916	(0.4618)	0	1	55581
Mother is Black non-Hispanic	0.1283	(0.3344)	0	1	55141
Mother is White non-Hispanic	0.6149	(0.4866)	0	1	55141
Mother is Hispanic	0.2568	(0.4369)	0	1	55141
Mother has diabetes	0.1802	(0.3844)	0	1	55503
Mother had gestational diabetes	0.1317	(0.3382)	0	1	55503
Mother had previous c-section	0.2351	(0.4240)	0	1	55520
Mother weight gain	17.6290	(8.3440)	0	44.4528	52102
Mother smoked in pregnancy	0.0466	(0.2107)	0	1	50126
Prenatal visits	11.9725	(4.2087)	0	49	53700
Gestational age	39.5388	(1.7161)	32	47	55501
Birth with c-section	0.5952	(0.4908)	0	1	55549
Birth order	2.4804	(1.4569)	1	8	55311
Apgar score (5 minutes)	8.7178	(0.9218)	0	10	55146
Male	0.6886	(0.4631)	0	1	55581

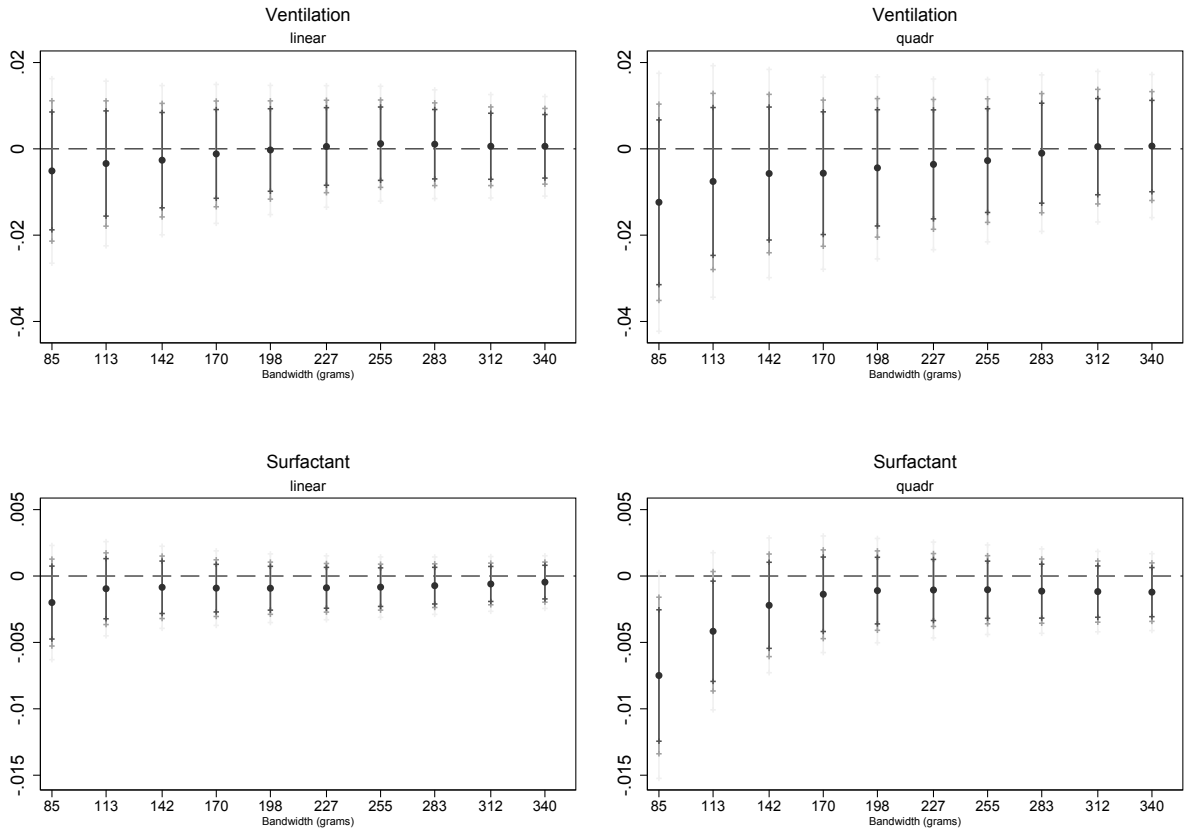
Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1.

Table A.3
Parametric estimations of the effect of being EHBW on the mother's, pregnancy and newborn characteristics.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Mother's age						
Birth weight ≥ 5000 g	-0.0410	0.0314	-0.0788	-0.0387	-0.0749	-0.0296
	(0.0909)	(0.1340)	(0.0859)	(0.1274)	(0.0866)	(0.1293)
Panel B. Mother's education						
Birth weight ≥ 5000 g	0.0653	0.0934	0.0534	0.0759	0.0505	0.0704
	(0.0458)	(0.0732)	(0.0455)	(0.0742)	(0.0457)	(0.0748)
Panel C. Married mother						
Birth weight ≥ 5000 g	-0.0054	-0.0048	-0.0046	-0.0030	-0.0042	-0.0021
	(0.0094)	(0.0139)	(0.0097)	(0.0150)	(0.0098)	(0.0153)
Panel D. Mother black non-Hispanic						
Birth weight ≥ 5000 g	0.0119	0.0160	0.0095	0.0103	0.0089	0.0089
	(0.0108)	(0.0149)	(0.0109)	(0.0151)	(0.0109)	(0.0152)
Panel E. Mother white non-Hispanic						
Birth weight ≥ 5000 g	-0.0015	0.0001	-0.0001	0.0049	-0.0005	0.0041
	(0.0205)	(0.0314)	(0.0212)	(0.0327)	(0.0214)	(0.0333)
Panel F. Mother Hispanic						
Birth weight ≥ 5000 g	-0.0104	-0.0161	-0.0094	-0.0152	-0.0083	-0.0131
	(0.0158)	(0.0247)	(0.0163)	(0.0258)	(0.0164)	(0.0260)
Panel G. Mother has diabetes						
Birth weight ≥ 5000 g	0.0054	0.0105	0.0065	0.0129	0.0075	0.0151
	(0.0078)	(0.0100)	(0.0083)	(0.0113)	(0.0083)	(0.0115)
Panel H. Mother had gest. diabetes						
Birth weight ≥ 5000 g	0.0015	0.0159*	0.0019	0.0181*	0.0021	0.0186*
	(0.0082)	(0.0090)	(0.0087)	(0.0102)	(0.0088)	(0.0104)
Panel I. Mother had previous c-section						
Birth weight ≥ 5000 g	0.0026	-0.0011	-0.0002	-0.0076	-0.0002	-0.0078
	(0.0088)	(0.0131)	(0.0086)	(0.0127)	(0.0087)	(0.0129)
Panel J. Mother's weight gain in pregn.						
Birth weight ≥ 5000 g	0.1477	0.2509	0.1613	0.3076	0.1537	0.2942
	(0.1430)	(0.1840)	(0.1503)	(0.1908)	(0.1506)	(0.1905)
Panel K. Mother smoked in pregn.						
Birth weight ≥ 5000 g	-0.0057	-0.0059	-0.0061	-0.0066	-0.0065	-0.0074
	(0.0043)	(0.0064)	(0.0047)	(0.0074)	(0.0047)	(0.0075)
Panel L. No. prenatal visits						
Birth weight ≥ 5000 g	0.2907***	0.4350***	0.3141***	0.5091***	0.3221***	0.5296***
	(0.1041)	(0.1621)	(0.1089)	(0.1739)	(0.1095)	(0.1761)
Panel M. Gestational age						
Birth weight ≥ 5000 g	0.0197	0.0656	0.0201	0.0734	0.0129	0.0592
	(0.0497)	(0.0742)	(0.0522)	(0.0787)	(0.0528)	(0.0790)
Panel N. C-section						
Birth weight ≥ 5000 g	0.0116	0.0201	0.0117	0.0208	0.0118	0.0211
	(0.0142)	(0.0179)	(0.0149)	(0.0191)	(0.0150)	(0.0193)
Panel O. Apgar score (5 mins)						
Birth weight ≥ 5000 g	-0.0093	-0.0164	0.0049	0.0082	0.0057	0.0099
	(0.0245)	(0.0326)	(0.0211)	(0.0269)	(0.0213)	(0.0273)
Panel P. Male						
Birth weight ≥ 5000 g	-0.0103	-0.0058	-0.0152**	-0.0160	-0.0158**	-0.0174
	(0.0081)	(0.0128)	(0.0075)	(0.0111)	(0.0076)	(0.0112)
Panel Q. Birth order						
Birth weight ≥ 5000 g	-0.0183	-0.0814	-0.0216	-0.0933*	-0.0179	-0.0864
	(0.0405)	(0.0498)	(0.0418)	(0.0519)	(0.0420)	(0.0524)
Linear+Interactions	✓		✓		✓	
Quadratic+Interactions		✓		✓		✓
No Donut	✓	✓				
Donut			✓	✓		
Donut 1					✓	✓

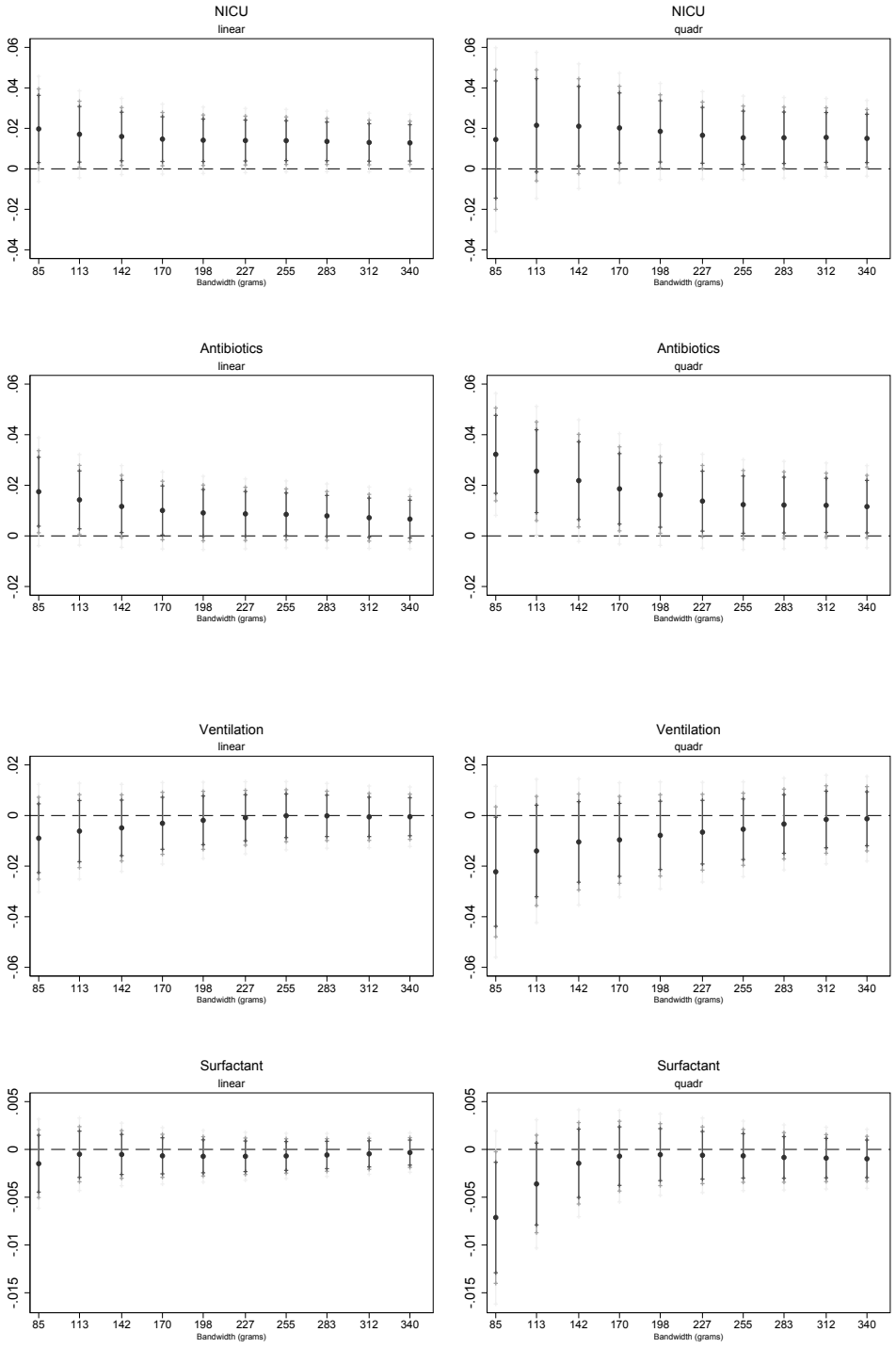
Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1 and in the variables above. The specification *Donut* indicates that observations with birth weight equal to the cutoff have been dropped from the sample, while the specification *Donut 1* indicates that also observations with birth weight within +/-1 gram from the cutoff have been excluded.

Figure A.1
Parametric estimations of the effect of being EHBW on ventilation and surfactant use, with different bandwidth size. Whole sample.



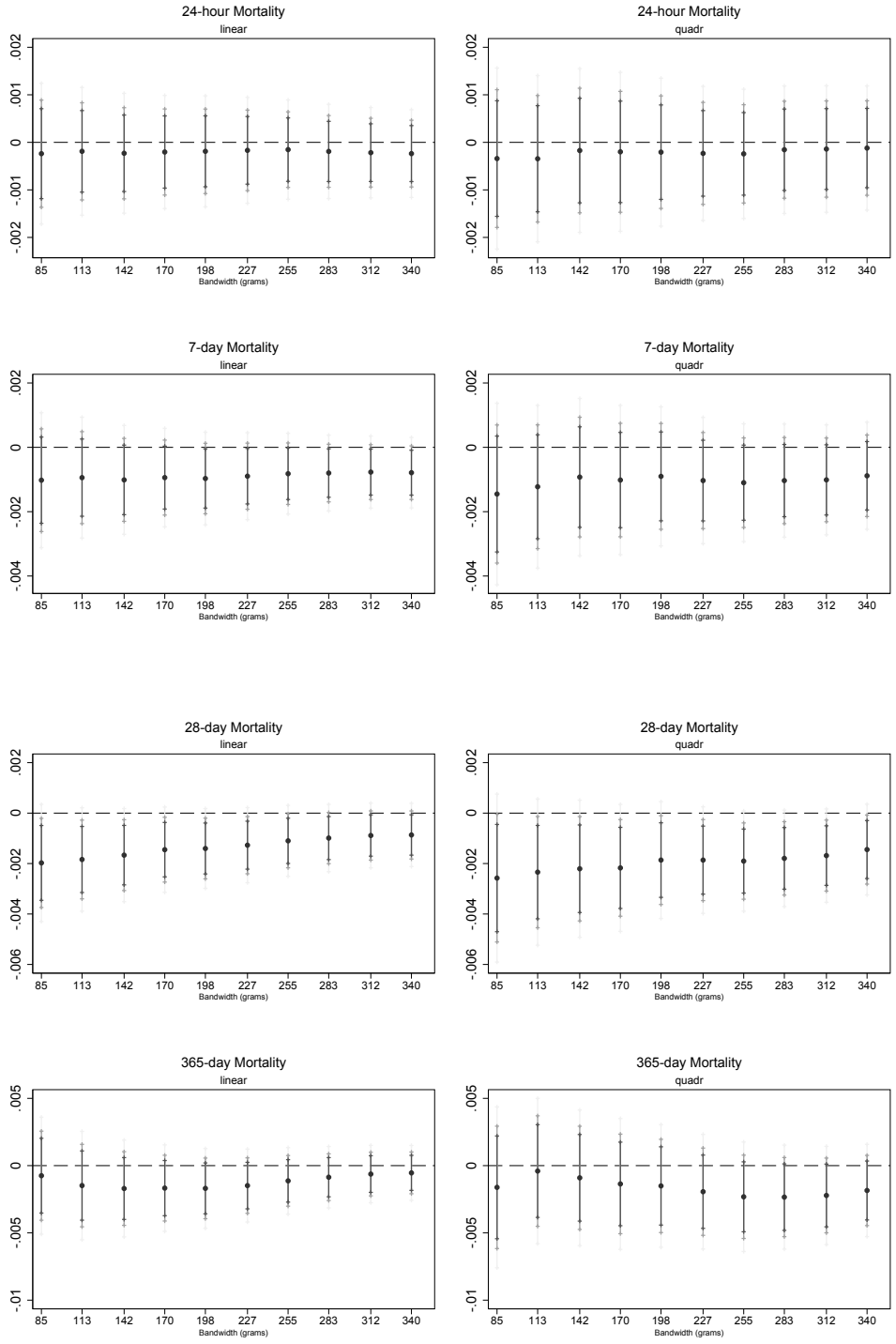
Notes: The graphs report the parametric estimates and 90%, 95% and 99% confidence intervals of the effects of being EHBW using, for each estimation, a bandwidth ranging between 85 and 340 grams. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births without observations with missing information in the variables listed in Table 1.

Figure A.2
Parametric estimations of the effect of being EHBW on neonatal treatments, with different bandwidth size. *Donut* sample.



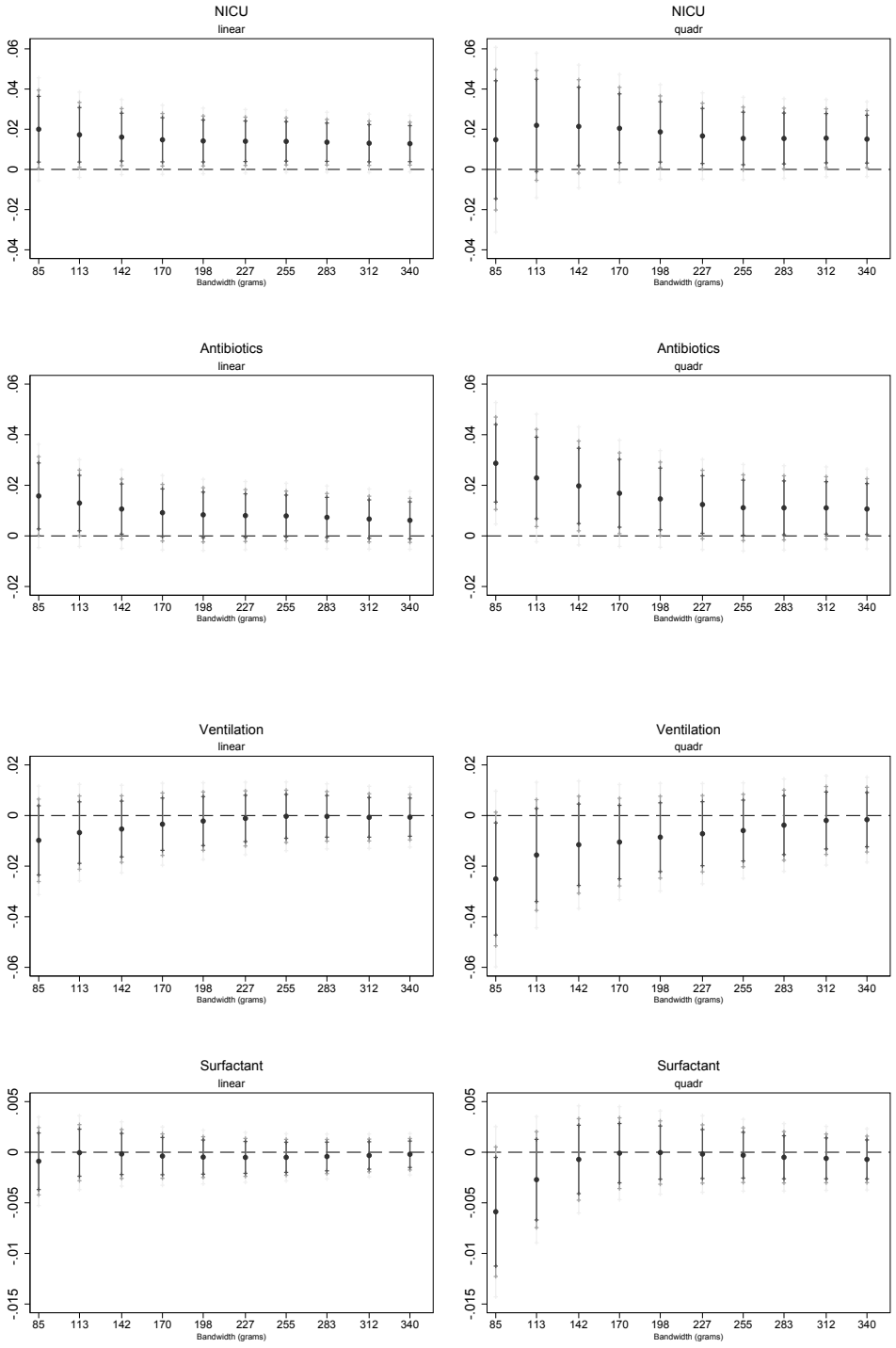
Notes: The graphs report the parametric estimates and 90%, 95% and 99% confidence intervals of the effects of being EHBW using, for each estimation, a bandwidth ranging between 85 and 340 grams. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births without observations with missing information in the variables listed in Table 1; for the *donut* sample also observations with a birth weight equal to the cutoff value have been dropped.

Figure A.3
Parametric estimations of the effect of being EHBW on mortality, with different bandwidth size. *Donut* sample.



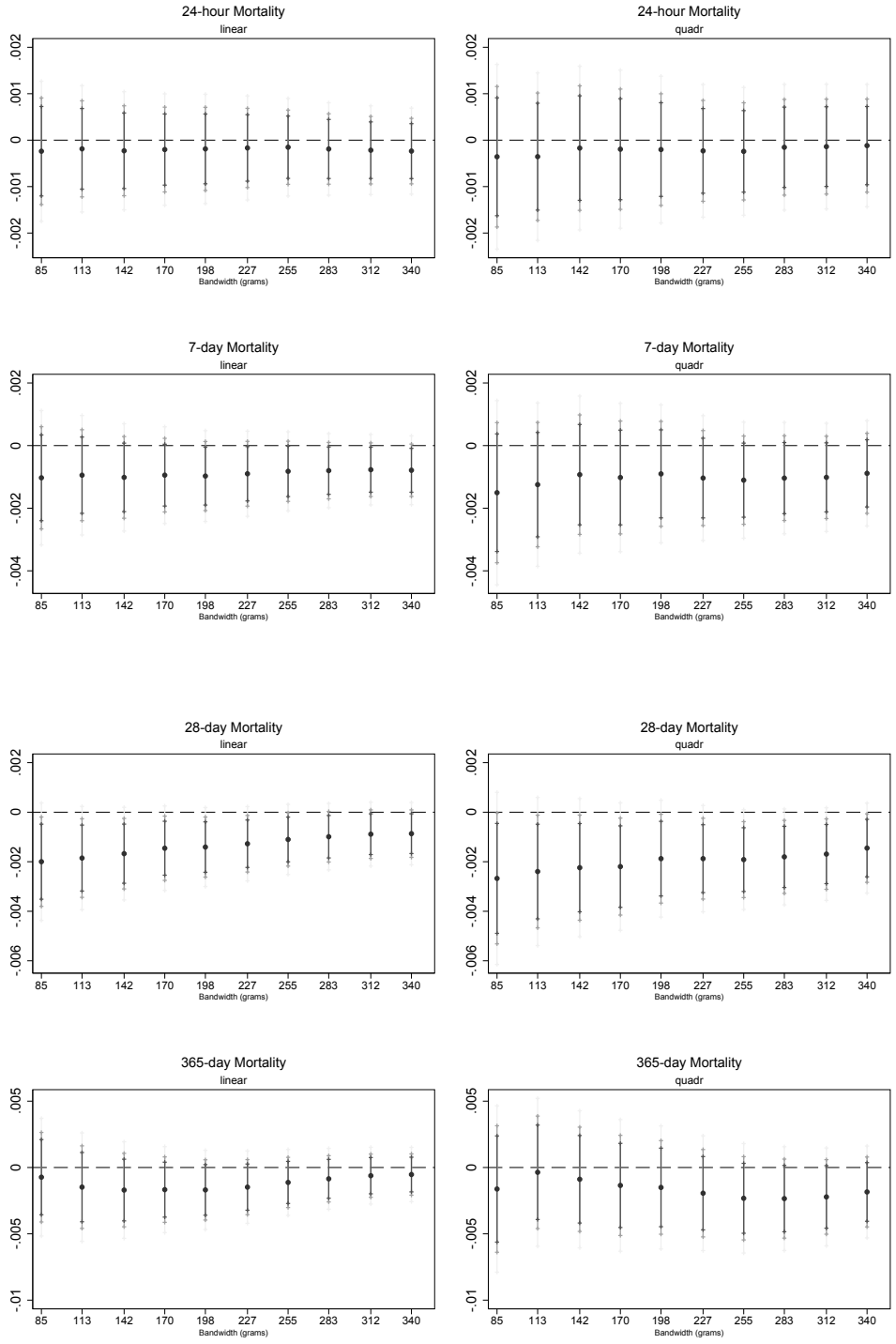
Notes: The graphs report the parametric estimates and 90%, 95% and 99% confidence intervals of the effects of being EHBW using, for each estimation, a bandwidth ranging between 85 and 340 grams. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births without observations with missing information in the variables listed in Table 1; for the *donut* sample also observations with a birth weight equal to the cutoff value have been dropped.

Figure A.4
Parametric estimations of the effect of being EHBW on neonatal treatments, with different bandwidth size. *Donut 1* sample.



Notes: The graphs report the parametric estimates and 90%, 95% and 99% confidence intervals of the effects of being EHBW using, for each estimation, a bandwidth ranging between 85 and 340 grams. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births without observations with missing information in the variables listed in Table 1; for the *donut 1* sample also observations with a birth weight within one gram from the cutoff value have been dropped.

Figure A.5
Parametric estimations of the effect of being EHBW on mortality, with different bandwidth size. *Donut 1* sample.



Notes: The graphs report the parametric estimates and 90%, 95% and 99% confidence intervals of the effects of being EHBW using, for each estimation, a bandwidth ranging between 85 and 340 grams. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births without observations with missing information in the variables listed in Table 1; for the *donut 1* sample also observations with a birth weight within one gram from the cutoff value have been dropped.

Table A.4

Parametric regressions conditional on covariates and year fixed effects. *Donut* sample.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. NICU						
Birth weight≥ 5000 grams	0.0142**	0.0153	0.0167**	0.0254**	0.0151**	0.0173*
	(0.0064)	(0.0097)	(0.0070)	(0.0102)	(0.0063)	(0.0090)
Panel B. Antibiotics						
Birth weight≥ 5000 grams	0.0084*	0.0131**	0.0090*	0.0150*	0.0090*	0.0144**
	(0.0050)	(0.0065)	(0.0054)	(0.0078)	(0.0051)	(0.0067)
Panel C. Ventilation						
Birth weight≥ 5000 grams	-0.0001	-0.0050	-0.0013	-0.0042	-0.0007	-0.0063
	(0.0058)	(0.0080)	(0.0050)	(0.0070)	(0.0053)	(0.0072)
Panel D. Surfactant						
Birth weight≥ 5000 grams	-0.0007	-0.0008	-0.0008	-0.0006	-0.0004	-0.0000
	(0.0010)	(0.0015)	(0.0011)	(0.0018)	(0.0010)	(0.0017)
Panel E. 24-hour Mortality						
Birth weight≥ 5000 grams	-0.0004	-0.0006	-0.0008	-0.0010**	-0.0004	-0.0005
	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0004)
Panel F. 7-day Mortality						
Birth weight≥ 5000 grams	-0.0012**	-0.0014*	-0.0012*	-0.0012	-0.0011**	-0.0014**
	(0.0005)	(0.0007)	(0.0006)	(0.0009)	(0.0005)	(0.0007)
Panel G. 28-day Mortality						
Birth weight≥ 5000 grams	-0.0015***	-0.0022***	-0.0017**	-0.0023**	-0.0015***	-0.0022***
	(0.0006)	(0.0008)	(0.0007)	(0.0010)	(0.0005)	(0.0007)
Panel H. 365-day Mortality						
Birth weight≥ 5000 grams	-0.0022**	-0.0030**	-0.0021**	-0.0029*	-0.0017*	-0.0023
	(0.0009)	(0.0014)	(0.0010)	(0.0015)	(0.0010)	(0.0015)
N	53215	53215	44845	44845	55320	55320
Linear+Interactions	✓		✓		✓	
Quadratic+Interactions		✓		✓		✓
Controls						
Birth order, No. Visits, Gest. diab., Male	✓	✓				
All covariates			✓	✓		
Year FE					✓	✓

Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1, and with a birth weight equal to the cutoff value (*Donut* specification). Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

Table A.5

Parametric regressions conditional on covariates and year fixed effects. *Donut 1* sample.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. NICU						
Birth weight≥ 5000 grams	0.0144**	0.0158*	0.0167**	0.0255**	0.0154**	0.0180**
	(0.0064)	(0.0095)	(0.0070)	(0.0101)	(0.0063)	(0.0089)
Panel B. Antibiotics						
Birth weight≥ 5000 grams	0.0077	0.0117*	0.0082	0.0135*	0.0083*	0.0132**
	(0.0048)	(0.0062)	(0.0052)	(0.0075)	(0.0050)	(0.0065)
Panel C. Ventilation						
Birth weight≥ 5000 grams	-0.0004	-0.0056	-0.0015	-0.0047	-0.0009	-0.0069
	(0.0059)	(0.0080)	(0.0051)	(0.0070)	(0.0053)	(0.0072)
Panel D. Surfactant						
Birth weight≥ 5000 grams	-0.0005	-0.0003	-0.0006	-0.0001	-0.0002	0.0004
	(0.0010)	(0.0015)	(0.0011)	(0.0017)	(0.0010)	(0.0016)
Panel E. 24-hour Mortality						
Birth weight≥ 5000 grams	-0.0004	-0.0006	-0.0008	-0.0010**	-0.0004	-0.0005
	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0004)
Panel F. 7-day Mortality						
Birth weight≥ 5000 grams	-0.0012**	-0.0014*	-0.0012*	-0.0012	-0.0011**	-0.0014**
	(0.0005)	(0.0007)	(0.0006)	(0.0009)	(0.0005)	(0.0007)
Panel G. 28-day Mortality						
Birth weight≥ 5000 grams	-0.0015***	-0.0022***	-0.0017**	-0.0023**	-0.0015***	-0.0022***
	(0.0006)	(0.0008)	(0.0007)	(0.0010)	(0.0005)	(0.0007)
Panel H. 365-day Mortality						
Birth weight≥ 5000 grams	-0.0022**	-0.0030**	-0.0020**	-0.0029*	-0.0017*	-0.0023
	(0.0009)	(0.0015)	(0.0010)	(0.0015)	(0.0010)	(0.0015)
N	53167	53167	44801	44801	55268	55268
Linear+Interactions	✓		✓		✓	
Quadratic+Interactions		✓		✓		✓
Controls						
Birth order, No. Visits, Gest. diab., Male	✓	✓				
All covariates			✓	✓		
Year FE					✓	✓

Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1, and with a birth weight within one gram from the cutoff value (*Donut 1* specification). Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

Table A.6

Parametric regressions conditional on number of observations per gram, ounce-multiple and 100-gram-multiple fixed effects. *Donut* sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. NICU								
Birth weight≥ 5000 grams	0.0145***	0.0147*	0.0144***	0.0154**	0.0151**	0.0176*	0.0144***	0.0155**
	(0.0052)	(0.0077)	(0.0053)	(0.0078)	(0.0064)	(0.0090)	(0.0053)	(0.0077)
Panel B. Antibiotics								
Birth weight≥ 5000 grams	0.0085*	0.0124**	0.0084**	0.0128**	0.0089*	0.0144**	0.0084**	0.0129**
	(0.0044)	(0.0060)	(0.0040)	(0.0055)	(0.0051)	(0.0068)	(0.0040)	(0.0056)
Panel C. Ventilation								
Birth weight≥ 5000 grams	-0.0002	-0.0045	-0.0000	-0.0047	-0.0006	-0.0063	-0.0001	-0.0048
	(0.0045)	(0.0063)	(0.0044)	(0.0062)	(0.0053)	(0.0072)	(0.0044)	(0.0062)
Panel D. Surfactant								
Birth weight≥ 5000 grams	-0.0004	-0.0002	-0.0004	-0.0001	-0.0004	-0.0000	-0.0004	-0.0001
	(0.0010)	(0.0016)	(0.0010)	(0.0016)	(0.0010)	(0.0017)	(0.0010)	(0.0016)
Panel E. 24-hour Mortality								
Birth weight≥ 5000 grams	-0.0004	-0.0005	-0.0004	-0.0005	-0.0004	-0.0005	-0.0004	-0.0005
	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Panel F. 7-day Mortality								
Birth weight≥ 5000 grams	-0.0012**	-0.0014**	-0.0011**	-0.0014**	-0.0011**	-0.0014**	-0.0011**	-0.0014**
	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0007)
Panel G. 28-day Mortality								
Birth weight≥ 5000 grams	-0.0015***	-0.0023***	-0.0015***	-0.0022***	-0.0015***	-0.0022***	-0.0015***	-0.0022***
	(0.0006)	(0.0007)	(0.0006)	(0.0007)	(0.0005)	(0.0007)	(0.0006)	(0.0007)
Panel H. 365-day Mortality								
Birth weight≥ 5000 grams	-0.0017*	-0.0023	-0.0017*	-0.0023	-0.0017*	-0.0023	-0.0017*	-0.0023
	(0.0010)	(0.0015)	(0.0010)	(0.0015)	(0.0010)	(0.0015)	(0.0010)	(0.0015)
N	55320	55320	55320	55320	55320	55320	55320	55320
Linear+Interactions	✓		✓		✓		✓	
Quadratic+Interactions		✓		✓		✓		✓
Controls								
No. Births per gram	✓	✓						
Ounce-multiple FE			✓	✓			✓	✓
100-g-multiple FE					✓	✓	✓	✓

Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1. In all regressions, observations with birth weight equal to the cutoff have been dropped from the sample. Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

Table A.7
Parametric regressions conditional on number of observations per gram, ounce-multiple and 100-gram-multiple fixed effects. *Donut 1* sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A. NICU								
Birth weight≥ 5000 grams	0.0148***	0.0154**	0.0147***	0.0161**	0.0154**	0.0183**	0.0147***	0.0162**
	(0.0051)	(0.0077)	(0.0053)	(0.0077)	(0.0063)	(0.0089)	(0.0053)	(0.0077)
Panel B. Antibiotics								
Birth weight≥ 5000 grams	0.0079*	0.0112*	0.0078*	0.0116**	0.0083*	0.0132**	0.0078**	0.0117**
	(0.0043)	(0.0058)	(0.0039)	(0.0054)	(0.0050)	(0.0065)	(0.0039)	(0.0054)
Panel C. Ventilation								
Birth weight≥ 5000 grams	-0.0004	-0.0050	-0.0003	-0.0052	-0.0008	-0.0068	-0.0003	-0.0053
	(0.0045)	(0.0063)	(0.0044)	(0.0063)	(0.0053)	(0.0072)	(0.0045)	(0.0063)
Panel D. Surfactant								
Birth weight≥ 5000 grams	-0.0002	0.0003	-0.0002	0.0004	-0.0002	0.0004	-0.0002	0.0003
	(0.0010)	(0.0016)	(0.0010)	(0.0016)	(0.0010)	(0.0016)	(0.0010)	(0.0016)
Panel E. 24-hour Mortality								
Birth weight≥ 5000 grams	-0.0004	-0.0005	-0.0004	-0.0005	-0.0004	-0.0005	-0.0004	-0.0005
	(0.0004)	(0.0005)	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0005)
Panel F. 7-day Mortality								
Birth weight≥ 5000 grams	-0.0012**	-0.0014**	-0.0012**	-0.0014**	-0.0012**	-0.0014**	-0.0012**	-0.0014**
	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0005)	(0.0007)
Panel G. 28-day Mortality								
Birth weight≥ 5000 grams	-0.0015***	-0.0023***	-0.0015***	-0.0023***	-0.0015***	-0.0022***	-0.0015***	-0.0023***
	(0.0006)	(0.0007)	(0.0006)	(0.0007)	(0.0005)	(0.0007)	(0.0006)	(0.0007)
Panel H. 365-day Mortality								
Birth weight≥ 5000 grams	-0.0017*	-0.0023	-0.0017*	-0.0023	-0.0017*	-0.0023	-0.0017*	-0.0023
	(0.0010)	(0.0015)	(0.0010)	(0.0015)	(0.0010)	(0.0015)	(0.0010)	(0.0015)
N	55268	55268	55268	55268	55268	55268	55268	55268
Linear+Interactions	✓		✓		✓		✓	
Quadratic+Interactions		✓		✓		✓		✓
Controls								
No. Births per gram	✓	✓						
Ounce-multiple FE			✓	✓			✓	✓
100-g-multiple FE					✓	✓	✓	✓

Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 4773 and 5227 grams, after dropping observations with missing information in the variables listed in Table 1. In all regressions, observations with birth weight within one gram from the cutoff have been dropped from the sample. Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

Table A.8
Parametric regressions for health treatments and mortality around the 4000-gram threshold.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. NICU						
Birth weight $\geq$ 5000 g	0.0012	0.0024	0.0003	0.0004	0.0003	0.0004
	(0.0018)	(0.0026)	(0.0016)	(0.0022)	(0.0016)	(0.0022)
Panel B. Antibiotics						
Birth weight $\geq$ 5000 g	0.0006	0.0010	0.0003	0.0005	0.0003	0.0004
	(0.0013)	(0.0018)	(0.0013)	(0.0019)	(0.0013)	(0.0019)
Panel C. Ventilation						
Birth weight $\geq$ 5000 g	-0.0002	-0.0011	-0.0004	-0.0015	-0.0004	-0.0016
	(0.0011)	(0.0014)	(0.0012)	(0.0015)	(0.0011)	(0.0015)
Panel D. Surfactant						
Birth weight $\geq$ 5000 g	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Panel E. 24-hour Mortality						
Birth weight $\geq$ 5000 g	0.0000	0.0000	0.0000	-0.0000	0.0000	-0.0000
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Panel F. 7-day Mortality						
Birth weight $\geq$ 5000 g	0.0001	0.0001	0.0000	-0.0000	0.0000	0.0000
	(0.0001)	(0.0001)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Panel G. 28-day Mortality						
Birth weight $\geq$ 5000 g	0.0002*	0.0003	0.0001*	0.0000	0.0001*	0.0000
	(0.0001)	(0.0002)	(0.0000)	(0.0001)	(0.0000)	(0.0001)
Panel H. 365-day Mortality						
Birth weight $\geq$ 5000 g	0.0003**	0.0005*	0.0002**	0.0002*	0.0002**	0.0002
	(0.0001)	(0.0003)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
N	2834152	2834152	2821031	2821031	2818461	2818461
Specifications:						
Linear+Interactions	✓		✓		✓	
Quadratic+Interactions		✓		✓		✓
No Donut	✓	✓				
Donut			✓	✓		
Donut 1					✓	✓

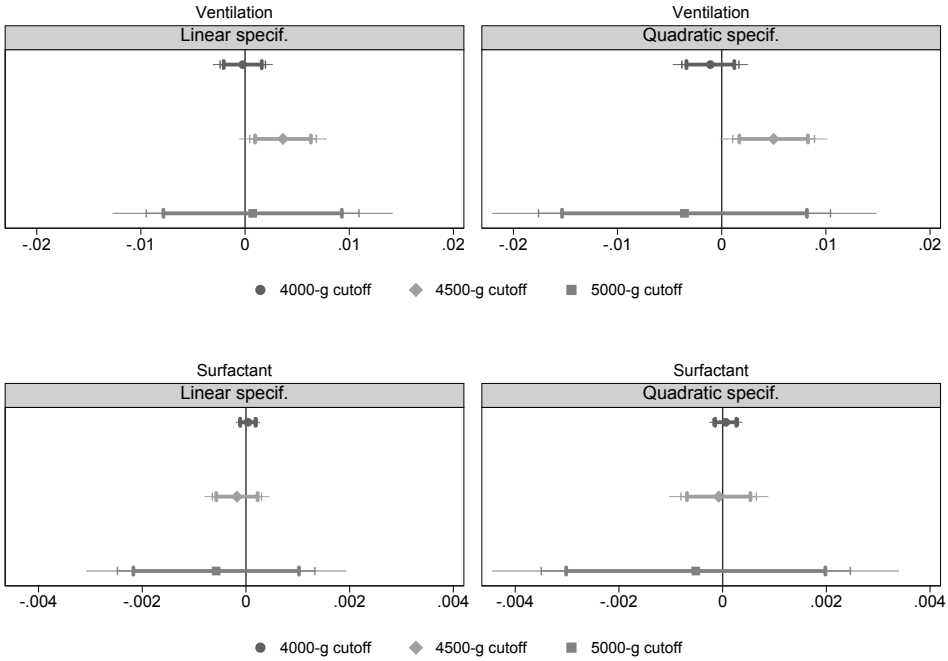
Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 3773 and 4227 grams, after dropping observations with missing information in the variables listed in Table 1. The specification *Donut* indicates that observations with birth weight equal to the cutoff (4000 grams) have been dropped from the sample, while the specification *Donut 1* indicates that also observations with birth weight within one gram from the cutoff have been excluded. Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

Table A.9
Parametric regressions for health treatments and mortality around the 4500-gram threshold.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. NICU						
Birth weight $\geq$ 5000 g	-0.0007	-0.0025	-0.0011	-0.0032	-0.0008	-0.0027
	(0.0031)	(0.0044)	(0.0031)	(0.0044)	(0.0032)	(0.0045)
Panel B. Antibiotics						
Birth weight $\geq$ 5000 g	-0.0003	-0.0008	-0.0007	-0.0014	-0.0007	-0.0015
	(0.0024)	(0.0036)	(0.0024)	(0.0036)	(0.0024)	(0.0037)
Panel C. Ventilation						
Birth weight $\geq$ 5000 g	0.0036**	0.0050**	0.0034**	0.0046**	0.0034**	0.0046**
	(0.0016)	(0.0020)	(0.0017)	(0.0022)	(0.0017)	(0.0023)
Panel D. Surfactant						
Birth weight $\geq$ 5000 g	-0.0002	-0.0001	-0.0002	-0.0001	-0.0003	-0.0003
	(0.0002)	(0.0004)	(0.0002)	(0.0004)	(0.0002)	(0.0003)
Panel E. 24-hour Mortality						
Birth weight $\geq$ 5000 g	-0.0000	0.0001	-0.0000	0.0000	-0.0000	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Panel F. 7-day Mortality						
Birth weight $\geq$ 5000 g	-0.0001	-0.0000	-0.0001*	-0.0001	-0.0001*	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Panel G. 28-day Mortality						
Birth weight $\geq$ 5000 g	-0.0001	0.0000	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Panel H. 365-day Mortality						
Birth weight $\geq$ 5000 g	0.0002	0.0004	0.0002	0.0004	0.0002	0.0004
	(0.0002)	(0.0004)	(0.0002)	(0.0004)	(0.0002)	(0.0004)
N	510584	510584	508326	508326	507886	507886
Specifications:						
Linear+Interactions	✓		✓		✓	
Quadratic+Interactions		✓		✓		✓
No Donut	✓	✓				
Donut			✓	✓		
Donut 1					✓	✓

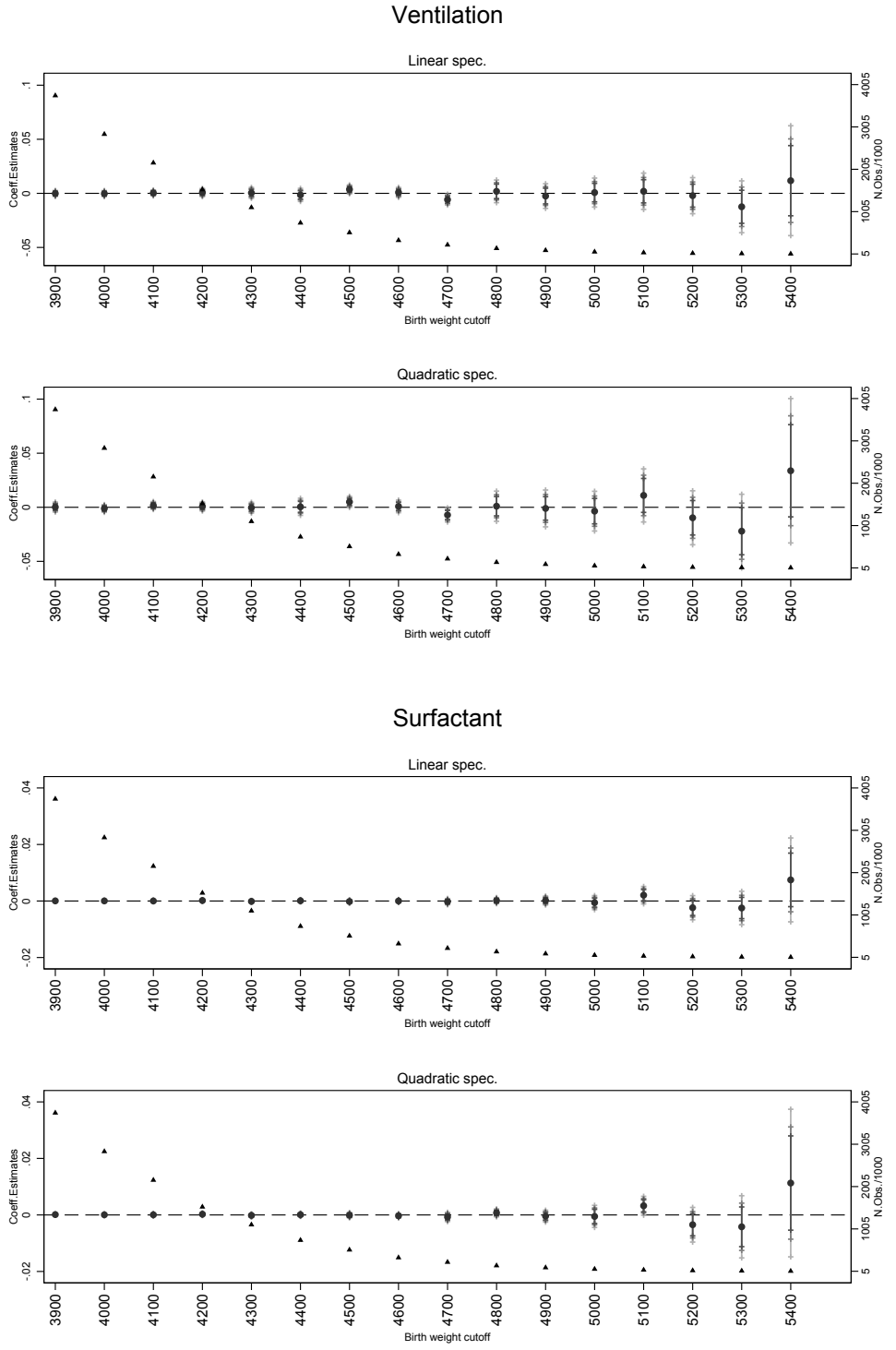
Notes: Authors' calculations using linked birth/death certificates data, 2007-2013. The regressions include either linear or quadratic trends in the distance to the cutoff value of birth weight, on each side of the 5000-gram cutoff. All the regressions are weighted using triangular weights. Sample of U.S. singleton births with birth weight between 4273 and 4727 grams, after dropping observations with missing information in the variables listed in Table 1. The specification *Donut* indicates that observations with birth weight equal to the cutoff (4500 grams) have been dropped from the sample, while the specification *Donut 1* indicates that also observations with birth weight within one gram from the cutoff have been excluded. Robust standard errors clustered at the gram level of birth weight are in parentheses. Asterisks denote statistical significance at the * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ levels.

Figure A.6
Parametric estimations of the effects of being HBW on ventilation and surfactant use, at the macrosomic cutoffs of 4000, 4500 and 5000 grams.



Notes: The graph reports the coefficient associated with a variable indicating whether a newborn has high birth weight, i.e. larger than 4000, 4500 and 5000 grams, and the corresponding 99%, 95% and 90% confidence intervals. All estimations control for linear (panel to the Left) and quadratic (panel to the Right) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births with birth weight within 227 grams from the corresponding threshold, after dropping observations with missing information in the variables listed in Table 1.

Figure A.7
Parametric estimation of the effect of being HBW on ventilation and surfactant, by using 100-gram apart thresholds in the 3900- to 5400-gram segment. Whole sample.



Notes: The graph reports the coefficients associated with a variable indicating whether a newborn has high birth weight, i.e. larger than the corresponding cutoff, and the corresponding 99%, 95% and 90% confidence intervals. All estimations control for linear (panel to the top) and quadratic (panel to the bottom) trends, clustering the standard errors at the gram level of birth weight. Sample of U.S. singleton births in 2007-2013 with birth weight within 227 grams from the corresponding threshold, after dropping observations with missing information in the variables listed in Table 1. The triangles indicate the number of observations for each regression sample, whose label is reported in the y-axis to the right.