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DO ELECTIONS MAKE YOU SICK?

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ABSTRACT

Anecdotal reports and small-scale studies suggest that elections are stressful, and might lead to a deterioration in voters' mental well-being. Nonetheless, researchers have yet to establish whether elections actually make people sick, and if so, why. By applying a regression discontinuity design to administrative health care claims from Taiwan, we determine that elections increased health care use and expense only during legally specified campaign periods by as much as 19%. Overall, the treatment cost of illness caused by elections exceeded publicly reported levels of campaign expenditure, and accounted for 2% of total national health care costs during the campaign period.

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An appendix is available at http://www.nber.org/data-appendix/w26697

1. Introduction

One defining characteristic of a democratic society is free and fair elections where candidates with different political views compete to hold public office. Because each candidate must convince voters that their views and proposed policies are superior to their opponents', election campaigns necessarily create societal conflict. This a natural consequence of the fact that supporters of the candidate, who grow in number as the campaign progresses, advocate for the candidate's views in their interactions with both uncommitted voters and supporters of the opposing candidates. They also band together with as many as tens of thousands of other supporters at rallies intended to promote the candidate and project political strength (Paget 2019; Al Jazeera 2019; Shaheen 2018; Szwarcberg 2012; de la Torre and Conaghan 2009).

Although elections heighten dominant opposing views among segments of the electorate, the transfer of political power through elections typically reduces conflict and violence relative to authoritarian societies. This is one reason why citizens of democratic societies live longer, healthier lives than their counterparts in autocracies (Bollyky et al. 2019). Nonetheless, there is always concern that the societal conflicts arising during an election will escalate to the point of more serious social strife. In order to keep the electoral process fair and orderly, most countries have rules governing political advertising, the organization of rallies, and the operation of voting centers (ACE Electoral Knowledge Network, 2019). These and other regulations, such as minimum mandated campaign periods, facilitate the democratic process by ensuring that all candidates have equal access to the electorate and sufficient time to educate voters of their policy positions so that they can make informed choices (Arceneaux 2005).

Recently, numerous articles and analyses in the global media as well as some formal research studies have documented the effects of elections and election campaigns on psychological well-being (Williams and Medlock 2017; Hagan et al. 2018; Krupenin et al. 2019; Seigel 2018; Kritz 2018; Faridz, Hollingsworth and John 2019; Ganesan 2018; Smith, Hibbing and Hibbing 2019). News outlets and other organizations have provided anecdotal evidence that the political conflict caused by elections is associated with elevated levels of stress and psychological distress. For example, results from the Stress in America Survey conducted around the time of the 2016 U.S. presidential election revealed that over half of all Americans found the election to be a "very" or "somewhat" significant source of stress in their lives (American Psychological Association, 2017). Likewise, an article in the overseas edition of the People's Daily (a prominent Chinese Communist Party newspaper) claimed that the incidence of "sleeplessness, headaches, faintness, loss of appetite, anger and violent tendencies" increased during the 2016 Taiwanese presidential

election (Tatlow 2016). Other articles have documented the emergence of election stress disorders in India and Taiwan and the high incidence of morbidity and mortality among campaign workers in Indonesia from overexertion (Ming-Hsiang and Xie 2019; Ganesan 2018; Faridz, Hollingsworth and John 2019).

Similar phenomenon have been found in the U.S. For example, Hoyt et al. (2018) provides evidence to support adverse effects of the 2016 presidential election. Specifically, the authors document negative emotions and elevated cortisol levels (a hormone released by the body in response to stress) among young adults in the two days leading up to the election night, especially among those supporting the losing candidate (i.e. women and racial/ethnic minorities). Similarly, Hagan et al (2018) provides survey-based evidence of clinically significant stress among 25 percent of 769 college students attending a large public university. DeJonckheere, Fisher and Chang (2018) describes feelings of stress and anxiety, particularly among young women, during and after the 2016 presidential election.

These findings are consistent with earlier studies of the 2008 U.S. presidential election, which detected elevated levels of cortisol and depressed testosterone secretion among supporters of the losing party immediately after the election (Stanton et al. 2009; Stanton et al. 2010). Likewise, male voters exhibited elevated cortisol levels during the 2009 national election in Israel (Waismel-Manro, Ifergane and Cohen 2011). Numerous studies demonstrate that changes in both testosterone and cortisol affect aggression, low mood, anxiety and anxious depression (Terburg, Morgan and Van Honk 2009; Van Honk et al. 2003; Brown et al 1996; Bohus, De Kloet and Veldhuis 1982). It is therefore not surprising that 26.4% of individuals in a representative survey of U.S. adults became depressed after their preferred candidate lost an election; 4.1% even reported suicidal thoughts (Smith, Hibbing and Hibbing 2019). The possibility that election stress could trigger an acute deterioration in mental health is not confined to the U.S. Psychiatrists in Taiwan reported a 30 percent increase in anxiety attacks and related disorders in some hospitals during an election period (The Telegraph 2012).

Nearly all studies on the link between elections and health focus on how elections increase stress, anxiety and other measures of psychological well-being. Yet, there is the potential for stressful social events like elections to affect physical as well as mental health. For example, Smith, Hibbing and Hibbing (2019) reports that 12% of survey respondents agreed that politics adversely affected their physical health. Furthermore, in a review of the literature Schwartz et al. (2012) concludes that stressful social events and natural disasters, such as earthquakes, blizzards, sporting events, and holidays can trigger life-threatening or fatal cardiovascular illness. We expand this literature by investigating whether elections and political campaigns

negatively affect physical health. We also bring a more rigorous approach to the study of elections and health by applying causal methods to high-quality data on health care use and expenditure. Prior studies report correlations that could be subject to selection bias if individuals with higher levels of participation in election events have better or worse health.

Our research design makes use of unique administrative health care claims data from Taiwan, drawn from over 900 thousand insurants. Health claims have two distinct advantages over measures of self-reported health. First, they provide both a way to verify that the condition in question required formal medical treatment and a measure of treatment intensity. Second, they contain the cost of medical treatment, which is often of interest to policy makers. We also collected information on vote counts for two local mayoral elections and two presidential elections from administrative election profiles. In order to determine whether elections cause changes in health, we use a regression discontinuity design. Because election campaigns target eligible voters, those of legal voting age should be most affected by election-related events. We therefore analyze the sharp jump in health care use during the election period that occurs for those of the legal voting age relative to those too young to vote. Importantly, the voting age of 20 in Taiwan does not correspond to other important age-based milestones, such as the legal age for drinking or smoking, or the year at which individuals go to college or enter military service.[1] Furthermore, Taiwan's national health care system limits the potential for differences in access to care to result in selection bias. The large size of our sample also allows us to identify the specific medical conditions affected by election campaigns.

Our results suggest that campaigns during national presidential elections increased health care use and expenditure by 17 – 19%, and campaigns for local mayors increased use and expenditure by 7 – 8% among young adults. Elevated health care use occurred only during the campaign period and did not persist after the election. Nonetheless, the excess costs from campaigns were sizable, accounting for 2% of nationwide health care costs during presidential campaigns. We find that campaigns increased the incidence of acute respiratory infections, gastrointensinal conditions, and injuries. This is consistent with the negative effects of participating in rallies and other organized campaign events. Although our identification strategy targets the physical health effects of elections, we provide suggestive evidence that the elections in question did not increase the use of mental health services.

Our study relates to the broader literature on the effects of election campaigns.

[1] The legal age for drinking and smoking is 18. Adolescents usual enter college or university at age 18 and complete their mandatory military service after they graduate (usually age 21). Adolescents who do not go to college typically enter military service at age 18.

Numerous studies investigate the how campaigns influence election outcomes, voter turnout, trust in government, and other factors (Jacobson 2015; Lau, Sigelman and Rovner 2007). However, no prior research considers the health care cost of election campaigns. If campaign spending has a negligible effect on election outcomes, as some studies suggest, then significant negative health care costs of election campaigns could provide an economic justification for laws that limit campaign spending (Levitt 1994; 1995; Palda and Palda 1998).

2. Politics and Elections in Taiwan

On October 25, 1945 Chiang Kai-shek moved the Government of the Republic of China to Taiwan, and for the next forty years Taiwan was ruled by a single political party called *Koumintang* (KMT). In 1986 a second political party was established, the *Democratic Progressive Party* (DPP), and in 1996 direct presidential elections were introduced under the two-party system (Lay, Yap and Chen 2008). Elections for the president, members of the unicameral legislature, and mayors of municipalities, counties and townships are held every four years, but not all at the same time. After 1996, national elections for the president and legislature were held in 2000, 2004, 2008, 2012, and 2016, while district elections for municipalities, counties and townships were held in 2001, 2005, 2009, 2013, and 2017. Because of the president's ability to appoint and remove many other officials from the government, including the premier, the president is considered the single most powerful elected official in Taiwan.

Our analysis is based on the national presidential elections in 2008 and 2012 and the local township mayoral elections in 2005 and 2009. Citizens aged 20 and older were eligible to vote in these elections, and the DPP and KMT parties nominated the majority of competing candidates. Core supporters of these parties come from different social strata in Taiwan. KMT supporters are largely white-collar workers and government employees, whereas DPP supporters tend to be blue-collar workers, younger and pro-independence voters. The KMT party prevailed in both presidential elections, but by a different margin. In the March 22, 2008 presidential election the KMT candidate received 58% of the vote, winning by a 2.2 million vote margin over the DPP candidate, who received 42% of the vote. In the January 14, 2012 election this margin narrowed, with the KMT candidate receiving 50% of the vote and DPP candidate 45% (a third party candidate received the remainder of the vote). The KMT party was also dominant in the 2005 and 2009 township mayoral elections: 173 of the 319 mayors elected on December 3, 2005 (54%) were from the KMT party, while 35 mayors (11%) belonged to the DPP. Among the winners elected on December 5, 2009, 57% and 16% were from the KMT party and the DPP, respectively.

The main reasons why we analyze data from both presidential and township mayoral elections are that: (1) we wish to determine whether the scale of the election matters to voter health and; (2) we seek to compare health care spending before, during, and after election campaign periods. The mandated campaign period for presidential elections is four weeks, whereas township mayor campaigns may occur only one week prior to the election date. Analyzing these two campaign periods will provide insight into whether increases in health care use result from election campaigns or from election outcomes.

3. Data

In order to identify the causal effect of elections and political campaigns on health care utilization we use data from several different sources. These include unique administrative health care records, hand-collected data on election outcomes and campaign spending, and control data from several government agencies in Taiwan.

3.1 Health claim profiles from the National Health Insurance Program

We obtained information on health care use and expenditure from the administrative health claims profiles of Taiwan's National Health Insurance Program (NHI; Chiang 1997; Wu et al. 2010). The NHI is a government-sponsored health insurance system that provides 98% of Taiwanese residents with comprehensive coverage for inpatient and outpatient medical services and prescription drugs. We base our analysis on a 5% random sub-sample of NHI enrollees maintained by National Health Institute in Taiwan (NHIT). These data are nationally representative and afford a sample of approximately one million individuals in each year. We created analytical files by sub-setting the NHIT data to health claims surrounding the national presidential and district-level election years of 2005, 2008, 2009 and 2012.

Because our empirical strategy exploits the jump in health care use that occurs when individuals become eligible to vote at age 20, we limited the sample to ages 15-25 using information on year and month of birth in the claim profiles. We also limited the sample to health care claims that occurred close to the election period. The most expansive period we used to analyze the national presidential election includes one week before the start of presidential campaigns, the four-week campaign period, and two weeks following the election.[2] We also constructed a more limited sample that includes only the four-week campaign period of 798,760 person-week observations. Likewise, our most expansive sample surrounding the township mayoral elections

[2] We analyze only two weeks before and one week after the 2012 presidential election because the election date in this case was between the Western New Year and Chinese New Year holidays. The inclusion of weeks that include these two holidays could produce misleading results.

includes one week prior to the campaign period, the one-week campaign period and two weeks following the campaign. A more restricted sample covering just the one-week campaign period includes 133,369 person-week observations.

Outcome variables in our model include binary indicators for any health care use as well as separate indicators for the use of outpatient services and prescription drugs. We also constructed measures of combined and service-specific health care expenditure, normalized to 2005 new Taiwan dollars (NT$), that encompass all third party and out-of-pocket payments. As part of our investigation of mechanisms that underlie our findings, we used the ICD-9 codes on each medical claim to construct use and expenditure measures for specific conditions, including mental disorders, injuries and poisoning, infections and parasitic diseases, and disorders of the circulatory, respiratory and digestive systems.

The NHI health claim profiles contain information that we used to control for several individual characteristics. Specifically, we created a binary indicator for gender, indicators for the four employment categories corresponding to different versions of NHI insurance (labor insurance for general hired and self-employed workers, government employee insurance, farmer insurance and other insurance programs predominantly for the unemployed and the military)[3], and 358 indicators for township of residence (i.e. township fixed effects).[4] We also controlled for the monthly earned income of the insurant using binary indicators for different income levels defined by the NHIT.[5]

3.2 Election and campaign data

Administrative data on voting in the 2008 and 2012 national presidential election and the 2005 and 2009 local township mayoral election are from the Central Election Commission of Taiwan. These data include the number of eligible voters and the number of votes cast for each candidate in every township as well as the political party of the candidate. We created three variables to measure voter turnout, the level of competition between candidates and campaign expenditure. The first variable is the voter turnout rate, which we defined as the number of votes cast in a township to the number of eligible voters in that township. The next two variables are based on studies by Simonovits (2012), and Fauvelle-Aymar and Francois (2006). The closeness index is one minus the difference between the number of votes cast for the

[3] These four main insurance programs differ in insurance premiums and contribution rates. See, for example, Chang and Meyerhoefer (2019). We defined the occupation of the NHI insurants based on their specific type of NHI social insurance.

[4] In the NHI, dependents are assigned the same insurance category as the primary wage earner.

[5] NHI earned income is equal to approximately 90% of the wage income reported elsewhere (Lien (2011).

top two candidates divided by the total number of votes cast for these candidates in each township.[6] Higher values of this index, which we normalized to the unit interval, indicate a narrower margin of victory by the elected candidate. Our other measure of election competitiveness is one minus the Herfindahl-Hirschman index (HHI)[7], where the HHI is based on the average share of votes to each candidate in every township.

In order to measure political campaign expenditure we used administrative data from the Control Yuan in Taiwan (the government's official auditor). Following an election, political candidates must report their total campaign expenditures to the Control Yuan. From these data we created a variable measuring the total campaign expenditure by all candidates in a township. Unfortunately, we could not create an analogous variable for presidential campaigns because presidential candidates report campaign expenditures at the national level, making it impossible to determine the amount of spending in different geographic areas. We merged all of the election variables to the individual health care claim profiles using township geocodes.

3.2. Local area characteristics

In order to control for the supply of health care providers in each area we used data from the Taiwanese Ministry of Health and Welfare. From these data we constructed the following three township-level variables and merged them to our main dataset using township geocodes: the number of hospitals and clinics, the number of hospital beds, and the total number of medical personnel.

Another important characteristic of local environment during election periods is the level of atmospheric pollution, which numerous studies find to reduce health (World Health Organization 2016). Using data from the Taiwanese Environmental Protection Administration, we created three variables to measure the weekly average level of particulate matter for CO, NO, and PM during the week of the election in each township. Finally, we added township population to our main dataset. We report the definition and sample statistics of the selected variables in Table 1.

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[6] Formally, the closeness index is constructed as $1-\frac{vote(1)-vote(2)}{vote(1)+vote(2)}$, where *vote*(1) and *vote*(2) indicate the votes cast to the winning candidate and runner up, respectively.

[7] $HHI_j = \sum_{k=1}^{K} s_k^2$, where *j* indicates township, *K* is the total number of candidates in each township, and s_k is ratio of the vote for the k[th] candidate in township *j*.

4. Econometric analysis

We identify the effect of political campaigns and voting on health care use and expenditure using a regression discontinuity design (RD). This approach allows us to exploit the jump in an election's influence on the individual when he or she becomes eligible to vote at age 20. Because our data contain the month of birth we applied the sharp version of the RD design, specified as:

$$(1) \quad y_{ijt} = \alpha \times Vote_{ijt} + f(age) + Vote_{ijt} \times f(age) + \beta' X_{ijt} + t_{year} + t_{week} + v_j + \varepsilon_{ijt},$$

where y_{ijt} is the health care utilization measure for the i^{th} individual in township j at time t (measured by year and month). The dummy variable *Vote* equals one if the enrollee is aged >= 20 (determined using birth month), and equals zero otherwise. The variable *age* is the running variable used in the sharp RD design, which measures the month of birth of the individual. In our primary specification we included individuals aged 15 - 25, so the value *age* ranges between +60 and -60 months. In sensitivity analyses we used a narrower age range and obtained similar results. *f(age)* is the polynomial function that captures the nonlinear effects of individual age on health care use and expense.[8] X is a vector of variables that contains the individual- and township-specific control variables listed in Table 1. The variables t_{year} and t_{week} are fixed effects for election year and the week before and after the election date, and v_j is the township fixed effect. The parameter α captures the effect of the voter eligibility rule on health care use and expense.

Although we can estimate equation (1) using Ordinary Least Square (OLS), this approach fails to account for the mass point at zero health care expenditure and for the right-skewness of positive expenditure values. Following a sizable literature on health care expenditure modeling, we used a two-part model (TPM) to estimate the health care use and expense equations in two different parts (Jones 2000). The first part of the TPM accounts for a mass point at zero in the expenditure distribution resulting from the failure by some to purchase health care, and the second part of the model accounts for right-skewness in the distribution of expenditure among health care users.

We used a probit model to capture the probability that an individual uses a health care service in the first part of the TPM. This is specified as:

$$(2) \quad \Pr(D_{ijt}=1) = \alpha \times Vote_{ijt} + f(age) + Vote_{ijt} \times f(age) + \beta' X_{ijt} + t_{year} + t_{week} + v_j$$

where D_{ijt} is a dummy variable that is equal to 1 if the individual uses health care, and

[8] We conducted the specification test suggested in Lee and Lemieux (2010) to determine the best functional specification for *f(age)*. The test indicated that a third order polynomial adequately captures the trend in age, and we use this specification in our main model. However, sensitivity analyses indicate that our results are not sensitive to the functional specification of *f(age)*.

is equal to 0 otherwise.

The second part of the TPM is the log of health care expenditure for the sample of individuals with use and is specified as:

$$(3)\quad \log(y_{ijt} \mid D_{ijt}=1) = \alpha \times Vote_{ijt} + f(age) + Vote_{ijt} \times f(age) + \beta' X_{ijt} + t_{year} + t_{week} + v_j + \varepsilon_{ijt}$$

We clustered the standard errors of the parameters in the TPM at level of the running variable (birth month).

By combining equations (2) and (3), one can construct the unconditional mean of health care expenditure as follows:

$$(4)\qquad E(y_{ijt}) = \Pr(D_{ijt}=1) \times \exp(y_{ijt} \mid D_{ijt}=1) \times \delta$$

where $\delta = E(\exp(\varepsilon_{ijt}))$ is the smearing factor used to transform the estimates from the log scale back to the dollar scale. We used Duan's nonparametric estimator for the smearing factor (Duan et al. 1983) and calculated the standard errors of the unconditional marginal effects for the key variable vote using the block bootstrap method defined over birth month. Because of the inclusion of fixed effects in our specification, we prefer the log OLS version of the TPM, but we tested the sensitivity of our main result using alternative versions of the TPM that employed a generalized linear model (GLM) in the second part of the model.[9]

5. Results

In Table 2 we report the average level of health care use and daily health care expenditure of individuals above and below the legal voting age of 20 for each of the analysis samples.[10] The probability of using any health care during the election campaign periods was similar across different samples, ranging from 13.5% before the township mayoral election to 14.8% during the presidential campaigns. Likewise, daily total health care expenditure was similar across samples, ranging from 28.5 - 35.3 NT$/day. Both the likelihood of prescription drug use and expenditure on drugs were less than the analogous outpatient service measures. Health care use and expenditure were greater for the voting age population than those not yet eligible to vote. In order to see how the level of these outcomes varies by birth month (the running variable) around the voting threshold, we provide plots over the range of birth month in Figure 1 (all health care services) and in Appendix Figures A1-A2

[9] Specifically, we found that a Poisson GLM with a log link produced a TPM marginal effect estimate similar to the log OLS version of the model, and that a Gamma GLM with log link generated an estimate that was 63% as large as the log OLS estimate. Estimates are available from the authors upon request.

[10] The data include the four-week campaign period preceding the presidential election, and the one-week campaign preceding the township mayoral election.

(outpatient services and prescription drugs). The third order polynomial lines of central tendency indicate a discontinuity at the legal voting age of 20, with some difference in trends before and after the cutoff.

5.1 Estimates by week and campaign period

We report marginal effect estimates from the first part of the TPM on the probability of health care use and estimates from the full TPM for health care expenditure by week before and after the election date in Table 3. The campaigns of presidential candidates are legally restricted to the four weeks preceding the election, while mayor candidates in local elections may only campaign during the week preceding the election. The pattern of estimates for the combined sample of presidential and mayoral elections (left columns) and for the sample of just presidential elections (middle columns) are the same, and reflect the mandated presidential campaign period. In particular, eligibility to vote only has a statistically significant impact on health care use and expenditure in the fourth weeks preceding the election date. The magnitude of the marginal effect estimates is nontrivial indicating an increase in the probability of health care use of 9.1% - 19.8% and a 9.2% - 18.0% increase in health care expenditure during the presidential campaign period. It is notable that we fail to find any impact of voter eligibility in the two weeks following the presidential election date. When the sample is sub-set to only the local mayoral election we likewise find that voter eligibility increases health care use and expenditure during the legally mandated one-week campaign period, but not before the campaign or in the two weeks following the election. Because of these findings, we restrict to the sample to the presidential and mayoral campaign periods in all subsequent analyses.

We report marginal effect estimates for models of total health care use and expenditure, outpatient care, and prescription drugs in Table 4 (We report full regression results for the all health care models in Appendix Table A1). Eligibility to vote increased the probability of any health care use by 2.0 percentage points (14.1% relative to the mean) and total health care expenditures by NT$ 3.97 per day (15.3%) in the combined sample of national and local election campaign periods. The magnitudes of these effects are essentially the same when we use outpatient services as the outcome, but are slightly larger in the model for prescription drugs. In particular, eligibility to vote increased the use of prescription drugs and drug expenditure by 16.8%.

When we sub-set the combined sample to urban and rural areas, we find that election campaigns had a larger impact on health care use in the latter. For example, total health care expenditure for eligible voters increased by NT$ 4.78 per day

(18.4%) during the campaign periods in rural areas, but only by NT$ 3.20 per day (12.9%) in urban areas. The discrepancy between outpatient service use and expenditure in rural and urban areas is similar to total health care use, but prescription drug expenditure is only 0.9 percentage points higher in rural areas.

The bottom two sections of Table 4 contain separate estimates for the national presidential and local mayoral election campaigns. As expected, the magnitudes of the effects are much larger for the presidential election campaigns, which determine the composition of the national government. During presidential elections, there was a 2.5 percentage point (17.4%) increase in health care use, whereas health care use increased by only a 0.9 percentage point (6.9%) during a local elections. Likewise, health care expenditure for eligible voters increased by 19.0% during presidential campaigns, but only by 7.7% during local mayoral campaigns.

5.2 Heterogeneity across election and individual characteristics

Next, we consider whether the average marginal effects reported above vary across different election and voter characteristics. Estimates in Table 5 are derived from the combined sample of national and local election campaign periods (with the exception of the last two rows), and show marginal effects for total health use and expense stratified by whether a given election characteristic was in the first (lowest) quartile of the respective distribution or the fourth (highest) quartile. Both health care use and expenditure increased more in close elections where the margin of the vote between the top two candidates was narrower. Health care expenditure was 14.9% higher for eligible voters when the election was in the top quartile of the closeness index, but was only 8.9% higher when the election was in the lowest quartile. We find the same pattern when we consider the competitiveness of the election, as measured by our competition index and the voter turnout rate. The marginal effect for the probability of health care use is 1.5 percentage points (10.9%) when the election was in the top quartile of the turnout rate distribution, but smaller and imprecisely estimated when voter turnout was low. Finally, for local mayoral elections only, we report differences in health care use and expenditure by campaign expenditure. Health care use was 17.0% higher and expenditure 16.5% higher among eligible voters during campaigns in the highest quartile of the campaign expenditure distribution, but only 0.5% and 3.2% higher, respectively, during the lowest spending election campaigns.

Table 6 contains similar marginal effect estimates, stratified by voter characteristics. Both the likelihood of health care use and health care expenditure were higher for men during the election campaigns than for women. In fact, the marginal effect for expenditure is more than twice as large for men. Stratifying the

estimates by income quartile reveals that health care utilization was only elevated during election campaigns for eligible voters in the middle two income quartiles. This range of the income distribution roughly applies to blue-collar workers.

5.2 Estimates by medical condition

An important question is how exactly election campaigns increased medical care utilization. The prior literature indicates that psychological stress might be an important driver, but the dearth of studies on elections and health suggests there could be numerous undetected mechanisms. In order to uncover possible pathways, we estimated models by the specific medical conditions most likely affected by campaign activities (Table 7). We find that election campaigns had a significant impact on acute respiratory infections, gastrointestinal disorders, and injuries. The largest effects are on disorders of the esophagus, stomach and duodenum, where medical care use increased by 20.6%.

Notably, estimates from the models for mental disorders are small and not statistically significant. Identification in our models comes from the jump in medical care utilization that occurs when individuals gain voting eligibility, making it difficult to estimate the impact of elections on mental health conditions. This is because those who are close to voting age may experience similar levels of stress during the election as those just old enough to vote. In order to gain a better understanding of the mental health consequences of elections we estimate an ordinary TPM of mental health expenditure separately for those too young to vote and eligible voters using data from the five weeks before and one week after the presidential elections. In Appendix Table A2 we report marginal effect estimates for the variables indicating week before or after the election. For the voting eligible population there are offsetting effects in the third and fourth weeks prior to the election and no statistically significant effects in any other week. In the non-eligible population, there are statistically significant increases in mental health care expenditure one and two weeks before the election, but the magnitudes are very small. In particular, expenditure in these weeks was only 1.4% higher than in the fifth week prior to the election. Although these estimates reflect associations, they suggest a lack any significant upward trend in mental health expenditure among young adults before and after the election.

5.2 Specification tests and robustness checks

We conduct several specification and falsification tests in order to demonstrate the robustness of our results. First, we check the sensitivity of the results from the models of total health care use and expense to the magnitude of the age bandwidth used in the RD model. Overall, the estimates in Appendix Table A3 are qualitatively

similar for narrower bandwidths. The magnitude of the marginal effect for health care expenditure decreases as the bandwidth narrows, but there is no similar trend in the marginal effects for health care use. Next, we re-estimate the model with different specifications for the polynomial of the running variable, age. The estimates of the marginal effects in Table A4 are virtually unchanged when we use a second or first order polynomial as opposed to a third order polynomial.

It is common in RD models to demonstrate that demographic control variables are smooth around the cutoff point in order to ensure that the model is not capturing the shift in a demographic trend that occurs at the same point of the running variable as the event in question. In our case the only individual-level demographic control variables are insurance type and income level. We affirm the smoothness of these variables around the cutoff by using each as the outcome in the RD model. The coefficient estimate corresponding to voter eligibility is small and statistically insignificant in both models.[11]

We also subjected the RD model to several falsification tests. Table A5 reports the marginal effect estimates using different cutoff points for age other than the legal voting age of 20. Irrespective of whether the age cutoff is increased or decreased, the resulting estimates are not statistically distinguishable from zero. In Table A6 we report the results of a model intended to demonstrate that the election campaigns do not have spill-over effects on the non-eligible voting population using a different approach than in Table A5. In this case we sub-set the sample to the 2008 presidential election period and estimate models using the four weeks prior to the campaign period and the four week campaign. The marginal effect estimate of a binary variable for the election campaign period is only large and precisely estimated for the voting eligible population and not those less than age 20. Our final falsification test, reported in Table A7, involves the estimation of our RD model on the set of townships that did not have local mayoral elections at the same time as the townships in our analysis sample that did have elections. In support of our identification strategy, we do not find a statistically significant effect of voter eligibility on health care use or expenditure in the townships without elections.

6. Discussion and Conclusion

Using a regression discontinuity design that leverages the exogenous change in age-based voter eligibility, we found that election campaigns resulted in sizable increases in health care utilization during the campaign period of as much as 19%. Health care expenditure was most strongly associated with the treatment of acute respiratory

[11] Estimates are available upon request.

infections, gastrointestinal illness, and injuries. We did not find any increase in mental health expenditure, but this could be due to similar levels of stress and anxiety among those eligible and not yet eligible to vote. Nonetheless, in a supplementary analysis we failed to observe any significant increasing trend in mental health care expenditure around the election period among the voting-eligible population.

It is important to note that our inability to find any effects on mental health care, does not mean that the elevated levels of stress documented in previous studies did not occur in Taiwan, or have serious consequences. It is possible that stress experienced by potential voters caused fatigue and weakened immunity, making eligible voters more susceptible to viral infections and gastrointestinal conditions (Segerstrom and Miller 2004). However, we did not find evidence that the stress induced by elections caused physical health effects as serious as the fatal cardiovascular events reported by Schwartz et al. (2012) for occurrences such as earthquakes or high-level sporting events. Another important discrepancy between our findings and the earlier literature concerns the timing of health effects. While we found that physical health was negatively impacted only during legally mandated campaign periods, several studies document elevated levels of stress, anxiety, and unfavorable changes in biomarkers both before and after the election (DeJonckheere, Fisher and Chang 2018; Stanton et al. 2009; Stanton et al. 2010). One possible reason for the discrepancy is that ours is the first study to use administrative health care claims. It is possible that the changes in biomarkers or self-reported health measured in previous studies did not lead to any subsequent increase in health care utilization after the election.

The prior literature fails to documents any effects of election campaigns on physical health, but many earlier studies use data from the U.S. where campaign periods are much longer, and individual campaign events are less intense, than in Taiwan; prior studies of elections in Israel also reflect longer campaign periods (Hebrew Wikiquote 2019). Taiwan has achieved notoriety as the "Island of Elections" due to the high-level of participation in campaign rallies that are particularly impassioned (Chao and Myers 2000). Also, the fact that election campaigns affect the health of men more than women is presumably because men are more likely to participate in the rallies. The effects we find are perhaps most similar to reports by Faridz, Hollingsworth and John (2019) that 300 campaign workers in Indonesian died from fatigue-related stress during recent presidential and legislative elections.[12]

Our analysis provides information that is useful for health care workers and public health officials. We found that increases in health care use are concentrated

[12] This is the only case that we know of for which there must have been a nontrivial level of associated health care use.

during campaign periods making higher demand for health care services during election periods predictable. We also show that the need for health care services is greatest during more competitive elections with high voter turnout. Likewise, areas with more competitive local elections where campaign spending is highest demand more health care services than areas with less competitive local elections and lower campaign spending. In both local and national elections, eligible voters in rural areas, where the public health infrastructure is most limited, use more health care services than urban voters. Last, our results indicate that the adverse health effects of campaigns are concentrated among lower to middle income blue-collar men, who were core supporters of the opposition political party during the 2008 and 2012 presidential elections.[13] Public health officials seeking to reduce the adverse health consequences of election campaigns may therefore wish to target low-income men living in rural areas for intervention.

While the health care costs of election campaigns are high in percentage terms, the length of exposure to campaign activities is relatively short. In order to determine whether interventions to reduce health care expenditure could be cost-effective, it is useful to know the level of aggregate costs for all eligible voters. We approximated these costs for the working population aged 20-64 using data from the 2008 presidential election under the assumption that the costs identified in our models also apply to older individuals. First, we multiplied the predicted medical expenditure for those aged 15-20 by the marginal effect estimated in our model for total health care use. After multiplying the result by the number of eligible voters aged 20-64, we find that excess medical care costs from the 2008 presidential election were $1,272,711,330 or $118 per person, in 2005 NT$ over the 28 day campaign period. This represents approximately 2% of all health expenditure in Taiwan during the campaign period, and 119% of the total reported campaign expenditure by presidential candidates participating in the election. While it is widely believed that campaign expenditures are under-reported in Taiwan, the medical care costs associated with campaign events are clearly sizable (Wang and Fan 2010).

Our estimate of the negative health cost of election campaigns provides policy makers new information to consider when setting limits on campaign length and activities. Of course, the reason for high costs would need to be determined in order formulate specific policy proposals. One possibility is that the concentration of election campaigns within a short period increases the intensity of campaign events in a way that is harmful to health. Longer campaigns, such as those in the U.S., could moderate campaign activities and reduce health care costs. However, no studies have

[13] The winning candidate in both elections was from the KMT party.

investigated the tradeoffs from varying the length of election campaigns. Unfortunately, we cannot estimate the benefits of longer campaigns in Taiwan because all of the presidential (or mayoral) campaigns in our sample were the same length.[14] Nonetheless, we see this as a useful area of future research.

Alternatively, policy makers could internalize the medical care costs of election campaigns through a tax on campaign expenditures. The tax would need to target the privately funded events responsible for spreading illness and causing injuries. Although our estimates by medical condition suggest that campaign rallies and public meetings are most likely responsible for elevated levels of sickness, health care cost estimates for specific campaign events are necessary to construct targeted tax instruments.

Finally, our findings are consistent with prior research suggesting that limits on campaign spending could increase social welfare. In particular, Levitt (1994) concludes that campaign spending by both challengers and incumbents is socially wasteful because it has little effect on election outcomes. We uncover another downside of high campaign spending in the form of greater health care costs. However, information on both the costs and benefits is necessary to formulate policy on spending limits. While we are not aware of any studies that quantify benefits, Kam (2006) provides evidence that campaigns promote open-minded thinking.

Our research has some limitations. Although we can identify the specific health conditions caused or exacerbated by election campaigns, we have no way of linking the affected conditions directly to different campaign events. There is anecdotal evidence that the spirited campaign rallies in Taiwan may account for elevated health care costs. Furthermore, half of eligible voters either attended a campaign event or watched a debate on television, based on responses to a random survey of 2,000 individuals during the 2008 presidential election (Yu 2010). However, we are unable to link existing surveys of voter behavior to our health care claims data at the individual level. In addition, although we have determined that higher campaign spending in local elections leads to greater health care use we have no way measuring differences in health care use across geographic areas associated with higher spending by presidential candidates. This is because presidential campaigns are only required to report spending at the national level. Last, our estimates pertain to eligible voters aged 20-25, and it is not clear whether the health effects for older voters are greater than or less than the effects we identify in younger voters.

[14] Furthermore, comparing the one-week campaign periods in local elections to the four week national election campaigns is not helpful due to the much higher level of voter interest and participation in the latter.

Despite these limitations, we believe that our study provides valuable insight into the consequences of election campaigns for health and health care expenditure using unique administrative data. Contrary to small-scale studies and media reports, the negative health effects we identify are for physical health conditions. Furthermore, we provide information public health officials can use to target initiatives designed to mitigate the significant negative externalities of election campaigns for health.

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Table 1. Sample statistics for outcomes and explanatory variables by vote eligibility.

		Combined		Eligible		Not eligible	
		(Age 15-25)		(Age 20-25)		(Age 15-19)	
N*T		932,129		456,808		475,321	
Variable	Definition	Mean	S.D.	Mean	S.D.	Mean	S.D.
Outcome variables							
Any use	If any health care use (=1).	0.14	0.35	0.15	0.35	0.14	0.34
Total exp.	Health care expenditure on all services (NT$/day).	25.92	441.25	29.48	467.78	22.50	414.12
Outpatient use	If outpatient service use (=1).	0.14	0.35	0.15	0.35	0.14	0.34
Outpatient exp.	Expenditure on outpatient services (NT$/day).	17.66	175.49	19.42	171.52	15.96	179.21
Drug use	If prescription drug use (=1).	0.09	0.28	0.09	0.29	0.09	0.28
Drug exp.	Expenditure on prescription drugs (NT$/day).	3.11	152.53	3.44	145.43	2.79	159.05
Explanatory variables							
Vote	If eligible to vote (=1).	0.49	0.50	1	0	0	0
Male	If a male insured (=1).	0.48	0.50	0.45	0.50	0.51	0.50
Gov. insurance	If government employee insurance (=1).	0.00	0.07	0.01	0.09	0.00	0.02
Farmer insurance	If farmer insurance (=1).	0.00	0.07	0.01	0.10	0.00	0.02
Worker insurance	If private worker insurance (=1).	0.27	0.44	0.45	0.50	0.09	0.28
Income level 1	If insured is low income (=1).	0.63	0.48	0.39	0.49	0.87	0.34
Income level 2	If insured is low-middle income (=1).	0.21	0.41	0.32	0.47	0.11	0.31
Income level 3	If insured is middle income (=1).	0.09	0.28	0.15	0.36	0.02	0.15
Income level 4	If insured is high-middle income (=1).	0.04	0.18	0.07	0.25	0.00	0.06
Income level 5	If insured is high income (=1).	0.03	0.18	0.06	0.25	0.00	0.03
Hospitals	Number of hospitals in a township.	0.25	0.23	0.25	0.22	0.25	0.23
Clinics	Number of clinics in a township.	9.83	5.09	9.99	5.12	9.68	5.06
Beds	Number of hospital beds in a township.	77.75	76.43	78.31	76.25	77.21	76.61
Personnel	Number of medical personnel in a township.	121.3	112.1	123.7	112.9	118.9	111.3
Population	Population in a township (100,000 person).	1.77	1.31	1.81	1.30	1.72	1.32
CO	Weekly CO concentration index (1,000 ppm).	0.00	0.01	0.00	0.01	0.00	0.01
NO2	Weekly NO2 concentration index (1,000 ppb).	0.04	0.01	0.04	0.01	0.04	0.01
PM	Weekly PM2.5 concentration index (1,000 ug/m^3).	0.07	0.02	0.07	0.02	0.07	0.02
Urban	If living in an urban area (=1).	0.80	0.16	0.80	0.16	0.81	0.16
Closeness	Closeness of the election. The higher the more intense.	0.48	0.07	0.48	0.07	0.48	0.07
Competition	1-HHI index. The higher the more competitive.	0.75	0.05	0.75	0.05	0.74	0.05
Turnout rate	Number of voters to all eligible voters in a township.	0.86	0.35	0.86	0.35	0.86	0.35

Notes: All monetary variables are in 2005 NT$.

Table 1. Sample statistics for outcomes and explanatory variables by vote eligibility, continued.

		Combined (Age 15-25)		Eligible (Age 20-25)		Not eligible (Age 15-19)	
N*T		932,129		456,808		475,321	
Variable	Definition	Mean	S.D.	Mean	S.D.	Mean	S.D.
Expense[#]	Campaign expense per voter in a township (NT$ 100).	0.86	0.63	0.87	0.63	0.86	0.64
Year 2005	If 2005 local township mayoral election (=1).	0.10	0.30	0.10	0.30	0.09	0.29
Year 2008	If 2008 national president election (=1).	0.57	0.49	0.57	0.49	0.57	0.49
Year 2009	If 2009 local township mayoral election (=1).	0.05	0.21	0.04	0.20	0.05	0.22
Year 2012	If 2012 national president election (=1).	0.28	0.45	0.28	0.45	0.29	0.45

Notes: All monetary variables are in 2005 NT$. #: Only defined for local mayoral elections

Table 2. Sample statistics for medical care use and expense by voter eligibility and subsample.

	Health care use (0/1)								
	All health care			Outpatient services			Prescription drugs		
Sample	Age ≥ 20	Age < 20		Age ≥ 20	Age < 20		Age ≥ 20	Age < 20	
Combined	0.146	0.137	***	0.146	0.137	***	0.091	0.087	***
Urban	0.147	0.138	***	0.146	0.138	***	0.091	0.089	***
Rural	0.146	0.135	***	0.145	0.135	***	0.091	0.086	***
Presidential election	0.148	0.139	***	0.148	0.139	***	0.093	0.090	***
Mayoral election	0.135	0.121	***	0.134	0.121	***	0.079	0.070	***
	Average daily health care expenditure (2005 NT$/day)								
Combined	29.48	22.50	***	19.42	15.96	***	3.44	2.79	**
Urban	28.93	21.69	***	19.36	15.88	***	3.45	2.60	**
Rural	30.14	23.32	***	19.50	16.04	***	3.42	2.99	
Presidential election	28.50	21.76	***	19.37	15.67	***	3.40	2.49	***
Mayoral election	35.28	26.94	***	19.74	17.74		3.66	4.66	

Notes: Sample statistics were calculated using 932,129 person-week specific observations from the NHI health claim profile. A two-sample t-test is used to test the difference in means. *** and ** indicate statistical significance at the 1% and 5% level.

Table 3. Marginal effect estimates for health care utilization models by week before or after the election date.

	Combined sample						National presidential election						Local township mayoral election					
	Use (0/1)			Expense (NT$/day)			Use (0/1)			Expense (NT$/day)			Use (0/1)			Expense (NT$/day)		
Week to election date	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%
Fifth week before	0.009	0.007	5.6%	0.802	1.612	3.1%	0.009	0.007	5.6%	0.802	1.612	3.1%						
Fourth week before	0.029 ***	0.006	19.8%	4.133 **	1.525	15.7%	0.027 ***	0.007	17.9%	3.189	1.258	11.2%						
Third week before	0.014 **	0.007	9.7%	4.389 **	1.745	18.0%	0.021 **	0.008	13.4%	4.061 **	1.742	16.2%						
Second week before	0.019 ***	0.005	12.7%	3.560 ***	1.235	15.2%	0.022 ***	0.006	15.0%	4.172 ***	1.218	18.4%	0.008	0.008	5.7%	1.524	2.076	6.1%
First week before	0.012 **	0.005	9.1%	2.531 **	1.152	9.2%	0.022 ***	0.006	16.6%	4.993 **	1.788	19.4%	0.008 *	0.005	6.5%	2.527 *	1.239	8.1%
First week after	0.005	0.005	3.1%	0.528	1.562	1.9%	0.009	0.006	5.4%	1.396	1.324	4.9%	-0.004	0.008	-2.6%	-1.537	2.769	-5.5%
Second week after	0.009	0.006	7.0%	1.983	1.746	8.0%	0.007	0.008	5.8%	1.623	1.481	6.7%	0.011	0.008	7.9%	1.965	1.942	7.8%

Notes: Standard errors are cluster-corrected at the birth month level. The *unconditional* marginal effects for health care expenditure are reported in 2005 NT$. Marginal effects in percentage terms are calculated using the sample mean of the dependent variable. All models include year and township fixed-effects and the set of control variables reported in Table 1. ***,**,* indicate statistical significance at the 1%, 5% and 10% level.

Table 4. Marginal effect estimates for health care utilization models.

	All health care						Outpatient services						Prescription drugs					
	Combined sample (all elections)																	
	Use (0/1)			Expense (NT$/day)			Use (0/1)			Expense (NT$/day)			Use (0/1)			Expense (NT$/day)		
	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%
Vote	0.020 ***	0.006	14.1%	3.967 ***	1.109	15.3%	0.020 ***	0.006	14.2%	2.704 ***	0.754	15.3%	0.015 ***	0.004	16.8%	0.523 ***	0.141	16.8%
N*T	932,129			131,919			932,129			131,431			932,129			83,081		
	Urban sample (all elections)																	
Vote	0.016 **	0.006	11.5%	3.196 **	1.282	12.9%	0.017 ***	0.006	11.7%	2.377 ***	0.874	13.7%	0.012 ***	0.004	13.3%	0.499 ***	0.170	16.7%
N*T	487,446			70,009			487,446			69,778			487,446			42,996		
	Rural sample (all elections)																	
Vote	0.024 ***	0.006	16.6%	4.780 ***	1.397	18.4%	0.023 ***	0.006	16.6%	2.989 ***	0.900	17.6%	0.016 ***	0.005	18.2%	0.544 ***	0.195	17.6%
N*T	444,683			62,950			444,683			62,697			444,683			38,862		
	Local township mayoral election																	
Vote	0.009 *	0.005	6.9%	2.407 *	1.437	7.7%	0.008 *	0.004	6.2%	1.353 *	0.678	7.2%	0.007 *	0.004	9.2%	0.302	0.508	7.3%
N*T	133,369			17,098			133,369			17,000			133,369			9,945		
	National presidential election																	
Vote	0.025 ***	0.006	17.4%	4.761 ***	1.120	19.0%	0.025 ***	0.006	17.4%	3.134 ***	0.770	17.9%	0.017 ***	0.004	18.5%	0.535 ***	0.150	18.2%
N*T	798,760			114,821			798,760			114,431			798,760			73,136		

Notes: Standard errors are cluster-corrected at the birth month level. The *unconditional* marginal effects for health care expenditure are reported in 2005 NT$. Marginal effects in percentage terms are calculated using the sample mean of the dependent variable. All models include year, week and township fixed-effects and the set of control variables reported in Table 1. ***,**,* indicate statistical significance at the 1%, 5% and 10% level.

Table 5. Marginal effect estimates for health care utilization models by election characteristics.

	Use (0/1)			Expense (NT$/day)		
	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%
Closeness of election ≦ 25% (all elections)	0.016 *	0.008	12.1%	2.272 *	1.614	8.9%
Closeness of election ≧ 75% (all elections)	0.023 **	0.004	16.1%	3.900 **	1.953	14.9%
Competition index (1-HHI) ≦ 25% (all elections)	0.011 *	0.006	7.7%	2.819 *	1.531	11.0%
Competition index (1-HHI) ≧ 75% (all elections)	0.021 **	0.008	15.2%	4.173 **	1.892	16.3%
Turnout rate ≦ 25% (all elections)	0.006	0.006	4.2%	1.876	1.404	6.8%
Turnout rate ≧ 75% (all elections)	0.015 **	0.007	10.9%	3.470 **	1.389	13.2%
Campaign expenditure ≦ 25% (township mayor election)	0.001	0.008	0.5%	0.917	0.922	3.2%
Campaign expenditure ≧ 75% (township mayor election)	0.024 **	0.010	17.0%	4.210 **	1.913	16.5%

Notes: Standard errors are cluster-corrected at the birth month level. The *unconditional* marginal effects for health care expenditure are reported in 2005 NT$. Marginal effects in percentage terms are calculated using the sample mean of the dependent variable. All models include year, week and township fixed-effects and the set of control variables reported in Table 1. ***,**,* indicate statistical significance at the 1%, 5% and 10% level.

Table 6. Marginal effect estimates of health care utilization models by gender and income level.

	Use (0/1)			Expense (NT$/day)		
	Mar. Eff.	S.E.	%	Mar. Eff.	S.E.	%
Panel A. By gender						
Men	0.019 ***	0.006	15.6%	4.834 ***	1.485	19.1%
Women	0.015 ***	0.003	9.3%	2.104 ***	0.752	7.9%
Panel B. By income level						
Income level 1	0.009	0.008	6.0%	2.854	1.958	9.9%
Income level 2	0.021 ***	0.009	13.5%	5.579 ***	1.689	18.4%
Income level 3	0.020 *	0.011	12.9%	2.099 *	1.069	8.3%
Income level 4	-0.052	0.050	-35.3%	-1.647	9.023	-7.5%

Notes: Standard errors are cluster-corrected at the birth month level. The *unconditional* marginal effects for health care expenditure are reported in 2005 NT$. Marginal effects in percentage terms are calculated using the sample mean of the dependent variable. All models include year, week and township fixed-effects and the set of control variables reported in Table 1. ***,**,* indicate statistical significance at the 1%, 5% and 10% level.

Table 7. Marginal effect estimates of health care utilization models by type of illness.

	Use (0/1)			Expense (NT$/day)		
ICD-9 category	Mar. Eff	S.E	%	Mar. Eff	S.E	%
A. Mental disorders	0.0001	0.0004	2.6%	0.025	0.050	4.4%
B. Circulatory system disorders	0.0001	0.0002	13.1%	0.012	0.012	7.9%
C. Respiratory system disorders	0.0065 **	0.0032	13.0%	0.489 **	0.203	15.6%
C1. Acute Respiratory infections	0.0064 **	0.0030	15.3%	0.465 **	0.227	16.4%
D. Digestive system disorders	0.0051 ***	0.0016	17.8%	0.854 ***	0.263	17.0%
D1. Oral cavity, salivary glands and jaws	0.0037 ***	0.0011	18.7%	0.733 **	0.322	18.1%
D2. Esophagus, stomach and duodenum	0.0008 ***	0.0002	20.6%	0.084 ***	0.020	18.7%
E. Injury and poisoning	0.0012 *	0.0007	10.3%	0.232	0.292	12.9%
E1. Fractures, wounds and burns	0.0013 **	0.0005	11.1%	0.002	0.003	14.2%
F. Infection, parasitic diseases, neoplasms, and congenital anomalies	0.0005	0.0007	9.7%	0.035	0.027	2.4%

Notes: Standard errors are cluster-corrected at the birth month level. The *unconditional* marginal effects for health care expenditure are reported in 2005 NT$. Marginal effects in percentage terms are calculated using the sample mean of the dependent variable. All models include year, week and township fixed-effects and the set of control variables reported in Table 1. ***,**,* indicate statistical significance at the 1%, 5% and 10% level.

Figure 1. RD plots for total health care use and expenditure.