THE EFFECT OF BUDGET CUTS ON C-SECTION RATES AND BIRTH OUTCOMES: EVIDENCE FROM SPAIN

Abstract

Using data from Spain, we show the impact of significant health-sector budget cuts introduced in 2012 on the rates of cesarean sections and on infant health outcomes at birth, which we use as a proxy for the quality of birth centers. Exploiting a difference-in-differences fixed-effects approach at the hospital level, we estimate a 3% increase in C-sections as a result of the budget restrictions, with no significant consequences on health outcomes at birth. Given the additional evidence in the literature on the negative short- and long-term effects of non-medically indicated C-sections, our paper provides important policy implications for population health.

JEL classification: I18, H51, J13

Keywords: Inappropriate healthcare, Health spending cuts, Cesarean Sections

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1. Introduction

Austerity measures are a common tool used by governments to restore the financial viability of their public budgets. This practice has become particularly relevant in the last ten years as a result of the 2008 economic recession, as several governments have introduced strong budgetary cuts with potentially important effects on the underlying population. By 2012, 34 US states had implemented budget cuts in education and health (Gordon, 2012). France and the UK tried to exempt the healthcare sector from budget cuts, while Italy, Spain, Greece, and Portugal were among those European countries that cut public spending on the healthcare sector the most (Stuckler et al. 2017). These cuts can affect the health of citizens through several mechanisms. It is not a simple matter of less access with possible short- and long-term effects; since the health system is under more pressure, its quality could decrease as well. On the brink of a new recession triggered by the COVID-19 pandemic, President Trump has announced new cuts to the US healthcare system. Hence, it has become even more important to understand the implications of budget cuts on the healthcare system.

However, given that budget cuts are generally triggered by economic downturns, it is difficult to disentangle the effect of the budgetary restrictions on health from the effect of the economic cycle. In our setting, we believe that we are able to separately identify these effects, as the relevant budget cuts were introduced four years after the onset of the economic crisis and during a period of ongoing recession; therefore, there was no economic shock coinciding with the budgetary restrictions. Thus, we exploit the budget cuts introduced into the Spanish healthcare system in 2012, while the economic crisis affected Spain very acutely in 2008. We focus our analysis on a specific impact of the budgetary restrictions: the quality of birth care. The choice of birth centers as our outcome of interest (i.e., maternity wards) is driven by three main reasons. First, deliveries are among the main causes of hospitalization in developed countries, so if budget cuts affect the performance of birth centers, they are affecting one of

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the main treatments provided by hospitals. Second, the quality of birth care is relevant for its potential impact on health at birth, whose importance in determining individuals' future health and economic performance is widely acknowledged by the economics literature (Corman et al. 1987, Behrman and Rosenzweig 2004, Almond et al 2005, Currie 2009, Almond and Mazumder 2011). Third, while proxying for the quality of provided care can generally be quite debatable, for births, common wisdom suggests that a high incidence of C-sections should be considered indicative of low quality. While a C-section can improve the health of both the mother and the newborn for high-risk pregnancies (Card et al. 2019, Jensen and Wust 2015), the high C-section rates observed in many countries are often cited as a clear example of treatment overuse. Based on the distribution of risk factors, the World Health Organization defines a 15% incidence rate as acceptable (WHO, 2015), while the actual rates in developed countries have well surpassed both this figure and what is generally suggested by obstetric indications (Barili et al., 2020).

Applying a difference-in-differences framework at the hospital level and including hospital fixed effects, we compare delivery methods—the proportion of C-sections versus vaginal births—as well as infant health outcomes at birth before and after the implementation of the budget cuts, exploiting the fact that some hospitals were more exposed to reductions in capacity than others. Given our outcome of interest, we use the number of beds in use in the maternal and infant wards as a proxy for exposure to the budgetary cuts. In absolute terms, financial restrictions more severely affected larger hospitals with higher budgetary endowments. A common method to implement the budgetary restrictions in a prompt manner for these hospitals was to close down some hospital floors, reducing the number of beds in use. While our main outcome of interest is the incidence of C-sections, we also check whether any change occurred in the proportion of underweight babies, the proportion of live births, and the maternal death rate in treated hospitals.

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We find that budget cuts in public hospitals resulted in a significant increase (3%) in C-section deliveries, with no changes in the main health outcomes. Given that the risk profile of Spanish mothers did not deteriorate during that period but rather improved, as shown in Aparicio, González and Vall Castello (2020), we interpret the observed increase in C-sections as an increase in the use of inappropriate/unnecessary health procedures. Our analysis of the available health outcomes rules out the possibility that in the short term, there was a deterioration in health conditions, while we cannot provide strong evidence on the long-term effects.

We test the robustness of our results, showing that they are not driven by a decrease in bed availability in other wards, such as psychiatry or trauma centers. Our results cannot be explained by anticipatory effects or by the reduction in obstetrical personnel that took place in the same years.

Our work contributes to several strands of literature. This is the first paper that studies the impact of strict budget restrictions at the hospital level on birth-care quality. It differentiates itself from studies analyzing the impact of the Great Recession, as the relevant budget cuts were introduced four years after the onset of the economic crisis and during a period of ongoing recession (for the effects of the Great Recession on health in the Spanish context, see, for example, Aparicio, González and Vall Castelló, 2020 or Urbanos-Garrido and López-Valcarcel, 2015). We also contribute to the literature addressing the relationship between healthcare workers' incentives and neonatal health. Using distance to the nearest hospital and differences in C-section rates across hospitals as instruments, Card et al. (2018) find that C-section delivery causes a relatively large increase in emergency department visits for infants, mainly due to acute respiratory problems in California. Furthermore, the authors do not report any increase in emergency department visits for mothers during the first year after giving birth and, in the case of babies with predetermined risk factors, they show a reduction in infant mortality. Regarding the impact of non-medically required C-sections, the literature mostly

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considers two behavioral channels. The first is time-constrained decisions by physicians. Facchini (2016) suggests that lower staffing follows an increase in C-section deliveries. Costa-Ramon et al. (2018) investigate the impact of C-sections on neonatal health, providing evidence that non-medically indicated C-sections are strongly driven by the physician's incentive to gain leisure time (finding that this type of C-section occurs more often at the beginning of physician shifts). The second channel is the financial incentives of physicians. As noted by several studies (Gruber et al., 1999; Allin et al. 2015), when the compensation for C-sections is higher than that of vaginal deliveries, C-section use also increases. Additionally, C-section use might also increase as a consequence of changes in the liability system. However, during our observational period, there were no changes in either the payment system or the liability system.

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2. Background

2.1. The Spanish National Health System (NHS) and maternity services

The Spanish NHS provides universal coverage for all residents, ensuring healthcare free of charge except for some small copayments on certain products and services. Once individuals are registered as residents in the country, they receive a healthcare card that grants them access to all the public services of the NHS. The quality of the system is relatively high; according to the 2018 survey on the quality of the national healthcare service, *Barometro Sanitario*, 21% of respondents say that the Spanish NHS works well; 47.1% state that the system works well, although some changes are needed; and 26.2% mention that the system needs fundamental changes even if some of the aspects work well, whereas only 4.7% of respondents state that the Spanish NHS is bad and needs to be entirely redesigned.

The Spanish NHS is financed almost completely through tax revenue. A general budget for each autonomous community (AC) is established yearly by the national government to cover the public provision of healthcare. The national government establishes the framework for the

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provision of care, setting the population that is covered, the copayment system and a common portfolio of services, which can be extended afterwards by each AC (Giovanella and Stegmüller, 2014). Since 2002, the ACs have had great discretion regarding how to allocate the annual budget. As a consequence, ACs differ in terms of healthcare provision, as reflected in variations in healthcare public expenditure per capita as well as in management systems (Costa-Font and Ferrer-i-Carbonell, 2017; Costa-Font and Rico, 2006; Jimenez-Rubio and Garcia-Gomez, 2017).

It is important to note, however, that in public hospitals, healthcare during pregnancy and delivery is provided completely free of charge, and none of the tests/visits/operations needed during pregnancy, delivery and postpartum care are subject to any copayment. Although vaginal deliveries and C-sections entail a different burden on the healthcare system, they are both completely free of charge for patients.

Pregnant women undergo prenatal checks at the closest primary healthcare center to their home address, and they are automatically assigned to the closest hospital with maternity services for delivery. Hospitals with maternity services are classified by the Ministry of Health according to the complexity of the deliveries that each hospital is able to attend to. This is a fixed classification that did not change during our sample period, and the main aim of this classification is to minimize costs for the system as a whole, as only a small number of hospitals specialize in risky pregnancies. After performing the necessary tests on the future mother and the fetus, the midwife confirms whether the foreseeable risk of the birth complies with the capacity of the hospital where the patient was assigned based on residence. In case the automatically assigned hospital does not fulfill the requirements to cover the forecasted birth risk, the woman is re-assigned to the closest hospital that does fulfill the requirements (Generalitat de Catalunya 2003, 34). There are five risk levels to which hospitals are classified that, in general terms, are defined by the risk level of the pregnancy, the potential weight of the newborn, and the expected total weeks of gestation (see Appendix, Table 1A).

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2.2. *Budget cuts in the Spanish healthcare system*

Spain was hit first by the financial crisis in the third quarter of 2008 and then by a sovereign debt crisis in 2011. This was followed by a banking bailout program for Spanish banks that was approved by the European Union in 2012, after which the Spanish government started to enact a new set of austerity measures (Martinez de Rituerdo and Perez, 2012). In April 2012, the Royal Decree-Law 16/2012 (RDL) implemented urgent measures to guarantee the sustainability of the National Health System (NHS) and to improve the quality and safety of health services. In summary, it reduced the size of the covered population, increased copayments (particularly for the elderly), and reduced the overall healthcare budget. As hospitals in Spain are managed relatively autonomously, each hospital was responsible for applying the budgetary reductions in a way that was considered optimal by the managerial board of each hospital. A list of the specific restrictions implemented at the hospital level is not available, but anecdotical evidence published in newspapers and by healthcare-worker organizations (Sevillano, 2015; Cervero-Liceras et al., 2014) suggests that the main actions taken were a reduction in the number of hospital beds in use (defined as all beds regularly maintained and staffed and immediately available for use), a reduction in the number of healthcare workers, a change in the suppliers of hospital products, and restrictions on subcontracting for a number of services, among others (Sevillano, 2015; Cervero-Liceras et al., 2014).[1]

As shown in Figure 1A and Table 2A in the Appendix, the overall expenditure on the public healthcare system had increased steadily from 2003 until 2009, then stagnated in 2010 and 2011 and decreased substantially from 2012 until 2014. In 2015, 2016 and 2017, there seems to be a recovery, although the data for 2016 and 2017 are still provisional. A similar picture

[1] Data from Eurostat show that the number of beds in use in public Spanish hospitals dropped from 214 per 100,000 inhabitants in 2008 to 203.5 in 2014. Other European countries that introduced budgetary cuts and experienced a similar (or even greater) reduction in the number of beds in use were Greece, Portugal, and Romania.

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emerges when considering only public expenditure on Spanish hospitals; as shown in Table 2A, there were positive increases in hospital expenditure with respect to the previous year of approximately 7-14% each year between 2002 and 2009. Then, hospital expenditure remained constant in 2010 and 2011, while dropping by -3.1% in 2012 and by -3.7% in 2013 (data available on the webpage of the Spanish Ministry of Health, Consumption and Social Welfare). Anecdotal evidence associates healthcare austerity measures with negative effects on both the quality of the healthcare system (such as increases in wait lists) and the health of the population (such as the number of years in good health) (Sevillano, 2015; Cervero-Liceras et al., 2014; La Vanguardia, 2016).

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3. Data and Methods

3.1. Data description

Our main dataset comes from the Spanish Ministry of Health, Social Services and Equality and covers the period 2010-2015. It provides information at the hospital level on a number of characteristics and capacity measures for all Spanish hospitals, which, however, cannot be identified due to anonymity requirements (i.e., information on the location/municipality of these hospitals is not available). The dataset includes all public hospitals located in the 52 provinces of Spain.[2] Private hospitals are dropped from the sample because they were not affected by the public budget cuts, as were hospitals without a maternity service since our focus is on delivery methods. As a result, we are left with 232 public hospitals with a maternity service.[3] In Figure 2A of the Appendix, we can see that the evolution of the infant health and delivery method variables follows a very similar path in public hospitals (those included in our sample) to those in the sample including all hospitals with a maternity service

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[2] As a robustness check, we dropped the hospitals from Ceuta and Melilla, two provinces located in northern Africa, since they might have peculiarities of their own. The results do not change as a consequence of this adjustment. The results are available upon request.

[3] We additionally drop 5 hospitals that closed during our sample period. We provide descriptive trends for the main outcomes of interest for the hospitals in our sample and for all hospitals in Figure 2A.

in Spain. Thus, the trends in outcomes in the hospitals included in our sample are comparable to the nationwide average evolution in the outcome variables analyzed.[4]

We focus on four outcomes, all observed at the hospital-year level, to provide an overall picture of birth center quality: the proportion of C-sections to total deliveries, the proportion of children born underweight, the proportion of children born alive, and the proportion of maternal deaths in each hospital.

Following the WHO (2015), being underweight is defined as weighing 2,499 grams or less. The proportion of children born underweight is calculated as the number of children born weighting less than 2,499 grams over the total number of children born (multiplied by 100). Low weight is a predictor of health problems in adulthood, so it is important to check if the incidence of underweight births has changed due to the budget cuts. This could be directly related to the fact that performing a C-section requires scheduling the delivery in advance, and as a consequence, newborns could be more likely to be underweight.

We define maternal death as those deaths of pregnant women that occur in the hospital or within 42 days following the end of a pregnancy (regardless of the duration of the pregnancy) if the death can be related to the pregnancy or the treatment of it (multiplied by 10,000), as reported in the data from the Ministry of Health. Hence, deaths of pregnant women due to traffic accidents, for example, are excluded from this definition. Although delivery-related deaths are extremely rare events, we check whether any effect could be detected for this outcome precisely because of its severity. Finally, the rate of children born alive is defined as the number of live births over the total number of deliveries (multiplied by 100). Since there are some deliveries where more than one child is born, this number could be larger than 100. Table 3A in the Appendix provides a detailed description of the variables used in the analysis and some descriptive statistics.

[4] According to the Spanish Ministry of Health, 80% of deliveries in Spain are done in public hospitals, while 20% are conducted in private hospitals.

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3.2. Econometric strategy

Even though reducing the number of hospital beds in use was relatively popular as a strategy to cope with the budgetary cuts, not all hospitals were able to implement it. In particular, larger hospitals with several floors of beds in the same ward could more easily close down part of a ward than smaller hospitals that had with fewer available beds and therefore did not have this margin of adjustment. Instead, smaller hospitals focused on reducing other types of expenditures, such as those related to the provision of services and external contracts.[5]

Our identification strategy exploits this differential impact of the budgetary restrictions on larger and smaller hospitals in the public sector to understand the impact of reductions in hospital capacity on health outcomes. The control group includes public hospitals that did not experience any reduction in the number of beds in use between 2011 and 2013, which are primarily smaller hospitals. The treatment group includes public hospitals that reduced the number of beds in use between 2011 and 2013. To nail down the impact of these restrictions on the quality of maternity care, we focus on the reduction of beds in maternity care wards (i.e., obstetrics, gynecology and neonatology). Figure 1 shows the differences in the descriptive evolution of the number of maternity ward beds in use in the treatment and control groups. The trends were relatively stable in both groups before the introduction of the budgetary restrictions in 2012. However, once the financial cuts were introduced, the total number of beds in use in public hospitals in the treatment group dropped from an average of more than 80 beds (2010) to an average of slightly more than 70 beds (2013). This number remained relatively stable in 2014 and 2015. In contrast, the control group had an average of 50 beds during the same period. Since, along with size, other factors could change in a way that allows us to detect structural differences in hospital quality, Table 1 shows the mean of some additional baseline characteristics during our sample period to assess the similarities and

[5] Unfortunately, there is no information available on the margin of adjustment that small hospitals used, even if they were potentially less affected by the budgetary restrictions.

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differences between treated and control hospitals. We collect information on the unemployment rate in the area, the percentage of the population with private insurance, the percentage of the population that is rural, the mean size of the population in the local area, the size of the female population of childbearing age, the number of hospitals per 100,000 habitants, the absolute number of hospitals, the percentage of immigrants in the population and the percentage of non-EU immigrants. On average, there are no striking differences in these factors during the entire observational period. To provide a sense of the significance of these differences before the cuts, we conduct a t-test along each dimension mentioned above for 2010, which is the first year of the pre-policy period in our dataset. Table 2 reports the significance level of the mean differences, and we can observe that the two groups were not significantly different in 2010.

Obviously, there could be time invariant differences between the treated and control hospitals, such as in the managerial structure, economies of scale due to overall size, or delivery practice styles. To account for these time-invariant differences, our econometric strategy includes fixed effects at the hospital level (δ_h), and we estimate the following econometric model for each health outcome H for hospital h in year t:

$$(1) H_{ht} = \alpha + \beta_1 \cdot (Post_t \cdot Treated_h) + \delta_h + \theta_t + \gamma_{act} + UR_{act} + \epsilon_{ac}$$

where $Treated_h$ is a dummy variable that equals 1 if hospital h experienced a reduction in capacity as proxied by the number of beds in use in the maternity ward between 2011 and 2013 and 0 otherwise. *Post* is a dummy for the posttreatment period (≥ 2012); thus, β_1 is our differences-in-differences estimator. Any other significant nationwide factor that could have impacted newborn health or the choice of delivery is captured by the year fixed effects, θ_t. To take into account the differences in governance across autonomous communities (ACs) and their potential variation over time, we also include an AC-specific linear trend, γ_{act}. Finally,

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to control for the effect of any changes in business cycle conditions on health at birth, we include the unemployment rate at the regional level, UR_{Pt}. Including the local unemployment rate also accounts for any potential change in the risk profile of mothers at the regional level. We cluster the robust standard errors, ϵ_{ac}, at the AC level.

Of course, one limitation of our analysis (which is common to most diff-in-diff models) is that we cannot control for any unobserved time-varying differences in treated and control hospitals that may coincide with the implementation of the budgetary cuts in 2012.

The identifying assumption of our econometric approach is that the trend in outcomes for the treated hospitals would have been parallel to the trend in outcomes for the control hospitals if not for the budget cuts. In an ideal setting, we would have several years of data from before the introduction of the cuts to test this assumption. However, data before 2010 were not available, so we estimate a model with leads and lags of our treatment, using 2011 as the reference year. In Figure 2, we plot the lead and lag coefficients for the number of beds in the maternity ward (by which we define our treatment variable) and for all our outcomes of interest. For most of the graphs, there is no evidence of pretrends, although there is some evidence of a slight reduction in C-section rate for the control group both before and after the implementation of the policy, which is a limitation of our study, as the estimated treatment effect will capture a combination of the increase in C-sections in treated hospitals and the small decrease in C-sections in control hospitals.[6]

4. Baseline Results

Table 3 presents the results of equation (1) for our four health outcomes of interest. The results show that the hospitals that were most exposed to the budgetary restrictions in 2012 increased the use of C-sections by 3% (from the mean C-section rate) (Column 1). However, there was no significant increase in the rate of underweight births (Column 2).

[6] The purely descriptive trends for C-sections are plotted in Figure 3A.

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There are several studies in the literature that suggest some negative long-term effects of cesarean delivery, including childhood asthma (Sevelsted et al., 2016; Hyde et al., 2012) and neurological problems (Oreopoulos et al. 2008). Card et al. (2018) also provide evidence that C-section deliveries causally increase emergency department visits for the newborn during his/her first year of life due to acute respiratory conditions. Similarly, but specifically with respect to non-medically indicated C-sections, Costa-Ramon et al. (2018) suggest that these procedures lead to a significant worsening of neonatal health, reducing APGAR scores by almost one point in very healthy babies, on average.[7] One of the medical explanations for the negative effects of C-sections is that as newborns pass through the vagina, they are exposed to microbiota that act as a protective device and decrease the risk of immune and metabolic disorders in the long term (Dominguez-Bello et al., 2016).

What we provide regarding health outcomes is an analysis of the effect of the budget cuts on short-term birth outcomes, but we cannot provide an analysis of the potential long-term consequences, which are reported in other papers in the literature. Regarding maternal health, C-sections have been associated with some postpartum maternal health problems, including urinary dysfunction, gastrointestinal dysfunction, dyspareunia, difficulties breastfeeding, psychological health challenges, intensified exhaustion, lack of sleep, and bowel problems (Thompson et al. 2002, Guilliam, 2006, Tonei, 2019). In contrast, Card et al. (2018) report that C-sections do not significantly increase the probability of hospitalization or emergency department visits for mothers during the first year after giving birth. We cannot observe any of these maternal health variables in our sample, but we do have information on the rate of maternal death during delivery. As reported in column 4, the introduction of the budgetary cuts does not lead to any significant increase in the probability of the mother dying during

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[7] The Apgar score is an index for neonatal health as tested one and five minutes after birth. It is an index from 1 to 10, where 10 is the value for perfect health. Five criteria are evaluated: skin color, pulse rate, reflex, activity and respiratory effort. A score of 7 and above is considered normal, 4 to 6 fairly low, and 3 or less is regarded as critically low.

delivery (or immediately after it). This is relevant for two reasons: first, if the increase in C-sections was to avoid complications, then we would expect a significant decrease in the most severe consequences of delivery. At the same time, if there are unobservable factors that are correlated with the number of beds in maternity wards (e.g., the quality of the devices used or medicine administered), then we could expect to see changes in the worst outcomes of delivery. Nothing of this sort appears to happen. However, it is important to note that maternal death during delivery is an extremely uncommon outcome in our sample (with a mean of 0.26%) so that the lack of change in such a rare event is not unexpected.

In the literature, there is no clear evidence on the relationship between C-sections and infant mortality rates in high-income countries. Some papers show a positive correlation (Xie et al. 2015), while others, such as Card et al. (2018), provide evidence that having a baby in a hospital with a high rate of C-sections leads to a reduction in mortality for newborns with high risk factors. Thus, we proceed by estimating equation 1 on the rate of live births, and we do not detect any significant effect (Column 3).

The observed increase in C-sections could be due to a rearrangement in the risk profile of pregnant women across hospitals caused by the budgetary cuts, especially if more complex deliveries became more concentrated in treated hospitals. This would explain our findings as a composition effect more than a direct change in the selection of delivery procedures. While we cannot completely rule out composition effects driven by budgetary cuts given the lack of patient-level data, this explanation seems unlikely in our context. Composition effects can be driven either by the supply side or by the demand side. On the supply side, as explained in section 2.1, risky pregnancies are assigned by midwives to specific hospitals that are equipped with the required technology to treat these risky procedures (see Table 1A). This classification is stable over time, as this type of specialization requires large investments in both technology and personnel. Therefore, during our sample period (which is relatively short), there were no changes in the risk classification of hospitals with respect to the treatment of complex

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deliveries. On the demand side, it seems quite unlikely that women with riskier medical profiles would decide to show up in hospitals that have undergone major budget cuts, as these cuts to attracted considerable attention from the media and the public.[8] Finally, we do not have evidence of an average deterioration in mothers' conditions in Spain: if anything, there was an improvement in their health, as shown by Aparicio, González and Vall Castello (2020).

4.1 Alternative Outcomes

There are at least three explanations for the high use of C-sections in developed countries: the fear of medical malpractice claims (Bertoli and Grembi, 2018), the financial incentives brought about by increases in the price of C-sections, and the time incentives of the obstetricians/midwives (either to gain more leisure time for himself/herself or to treat other patients). During our observation period, there were no changes in the liability or reimbursement systems. Moreover, economic incentives seem unlikely to play a sizable role given the characteristics of the payment system in Spanish hospitals. Spanish hospitals are reimbursed according to their fixed installed capacity and overall volume of treatments/procedures, classified in broad categories. For delivery methods, the reference category is "obstetric procedures", which includes all hospitalizations related to obstetric treatments regardless of the specific type of procedure. Hence, hospital reimbursement does not depend on the distinction between vaginal deliveries and C-sections.[9]

In contrast, there is no clear expectation regarding the role of time incentives on our results. To explore this in depth, we analyze the impact of the budget cuts on the number of personnel working in maternity wards at the hospital level. Our dependent variables are the log of the number of employed midwives and employed obstetricians, as well as the log of the number

[8] See Appendix Figure 4A for anectodical evidence.

[9] The Spanish system uses DRGs to assess and benchmark hospital performance and to enable DRG-based case payments between autonomous communities through the Cohesion Funds. Hence, DRG-based payments serve to reimburse autonomous communities for the care provided by their hospitals to patients coming from other autonomous communities (Cots et al., 2011). DRGs are used to determine hospital payments only within Catalonia, which sets approximately 35% of the budget of its hospitals through DRGs.

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of contracted midwives and obstetricians.[10] The rationale behind these tests is that if the number of midwives and obstetricians is reduced, then those medical workers who are left in the maternity ward are exposed to more intense time pressure to treat patients. Moreover, one can reasonably expect that the workers who are more at-risk of being fired are contracted workers rather than regular employees. As seen in Table 4, we do find a significant reduction in contracted obstetricians of 3.8%.[11] Thus, it seems reasonable to expect that the reduction in the number of obstetricians in treated hospitals increased the workload of the remaining staff. This, coupled with the reduction in the number of beds in use, had the combined effect of raising C-section rates.

4.2 Obstetric personnel as alternative treatment definitions

Following the argument in the previous section, we proceed by classifying the treatment and control groups based on obstetric staff reductions. Consistent with the definition used in the main specification with the number of beds in use in maternity wards, we label as control hospitals those public hospitals that did not experience any reduction in the number of obstetric personnel between 2011 and 2013, distinguishing between employed and contracted obstetricians. The treatment group includes public hospitals that reduced the number of obstetric personnel between 2011 and 2013. We can see in Table 7 that when we use this alternative treatment definition, none of the coefficients for our outcomes of interest are significant. Of course, as previously shown, the reduction in the number of contracted obstetricians is significantly stronger in treated hospitals. Thus, the observed increase in C-sections triggered by the budgetary cuts results from a combination of the decrease in the number of beds in use and the reduction in obstetricians. However, Table 7 suggests that the stronger driver of the effect on C-section rates is the reduction in the number of beds.

[10] Contracted workers are those with a temporary contract.

[11] See Figure 5A in the Appendix for the descriptive trends in the overall numbers of midwives and obstetricians.

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Overall, the evidence provided frames the increase in C-sections as a consequence of the implementation of the budgetary cuts in public hospitals, which were materialized through a reduction in the number of beds in use in maternity wards and an associated reduction in the number of contracted obstetricians.

5. Robustness tests

5.1. Falsification Test

To provide evidence for the robustness of our results, we randomly assign treatment status to the pool of hospitals in our sample.[12] Thus, in our treatment group, we have some hospitals that were truly treated and some hospitals that were not treated. As shown in Table 5, no effect on C-section rates, underweight births, live births, or maternal death rates is found when using the placebo treatment assignment, which reinforces the validity of our findings.

5.2. Alternative Definitions of Treatment

As an alternative robustness check, we use the decrease in beds in other wards to explain the effect of the budget cuts on maternal wards. If our results are driven by events at the hospital level, then cuts in maternity wards should not be the only channel driving the results. For this purpose, we define the treated and control hospitals based on reductions in the number of beds in use in psychiatry wards, as well as in trauma centers. As shown in Figure 3, the leads and lags of these alternative treatments confirm that the cuts were implemented between 2011 and 2013.

However, when we use cuts in these wards to explain the change in quality measures in maternity wards, we do not find any significant results, as shown in Table 6.

Finally, to explore the effects of different treatment intensities, we divide our treatment variable into three groups: treatment 1 is equal to one if the decrease in beds in maternity

[12] For this purpose, the STATA command *randtreat* was applied.

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wards was above 0 and below 10%, treatment 2 is equal to one if the drop is between 10 and 20% and treatment 3 is equal to one if the drop in beds is above 20%. We use these thresholds because 10% corresponds to the mean drop in beds and 20% corresponds to the 25 percentile of this distribution. As we can see in Table 8, the effects of the budgetary restrictions on C-section rates are stronger for hospitals that experience a drop in beds between 10 and 20% than for those that have a reduction in beds of less than 10%. However, this is not the case for the group of hospitals in which beds drop by more than 20%. We interpret this evidence as suggesting that the greater the intensity of the budgetary cuts, the stronger the response in the use of C-sections. However, it is not reasonable to expect that the number of C-sections keeps growing as the reduction in beds increases. Beds cannot be reduced indefinitely without negatively impacting, sooner or later, the capacity of the ward to attend to C-sections and, in general, deliveries. When the reduction in the number of beds is particularly severe, a further increase in the number of C-sections is no longer feasible.

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6. Conclusion

As reviewed in this paper, the existing literature analyzing the specific impact of healthcare austerity measures on population health is scant. In this paper, we use hospital-level data from Spain to study the impacts of budget cuts on delivery methods, since deliveries are among the primary causes of hospitalization. We focus on the effects of restrictive budgetary policies on the occurrence of C-sections, on the probability of babies being born with low birth weight, on the probability of babies being born alive and on the probability of mothers dying as a result of delivery. We use detailed longitudinal information on public Spanish hospitals and exploit different levels of budget cut severity across hospitals of different sizes based on cuts that were introduced into the healthcare system in 2012. Specifically, we use the number of beds in use in maternity wards as a proxy for the intensity of the budgetary restrictions. When the need to reduce public expenditure emerged, larger hospitals were more affected due to their

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larger budgetary allocations, and a common method applied by these hospitals to reduce expenditures was to cut the number of beds in use. We use a difference-in-differences strategy and include hospital fixed effects to capture the impacts of budget cuts within each hospital on our four health outcomes of interest.

Our results show a 3% increase in C-section rates as a result of the budgetary cuts, while we do not find evidence of any increase in the proportion of babies with low birth weight. We find consistent evidence that these negative effects are mostly driven by the reduction in the number of available beds in the maternity wards, which together with reductions in obstetricians with a temporary contract in treated hospitals, increased the workload of the obstetricians left in the hospitals. Given the evidence in this paper as well as results reported in the literature on the additional negative short- and long-term effects of non-medically diagnosed C-sections (in terms of lower Apgar scores and negative long-term health outcomes), we believe that our paper provides important policy implications for population health.

We believe that our results are important, as they show evidence of changes in healthcare delivery due to the financial restrictions introduced in hospitals that could lead to medium- and long-term effects on the affected children and their mothers. This result is new within the literature, which has not focused much on the effects of restrictive budgetary policies.

This paper has some limitations worth noting. First, our data begin in 2010, which is two years before the implementation of the budgetary cuts. It would be ideal to have a longer time span before the policy is introduced, but unfortunately, the Spanish government does not provide this information for the years prior to 2010. Second, our data are collected at the hospital level and not at the patient level. Therefore, we are unable to conduct a more fine-tuned analysis at the individual level. Finally, there are many other dimensions of the health status and health outcomes of the population that may be affected by restrictive budgetary policies that we are

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unable to identify with our dataset. Thus, we provide evidence of the impacts of budgetary restrictions on birth centers at the hospital level, but these represent a potentially smaller part of the overall effect on population health.

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