What is Pushing Brazil Not to Push?

BY

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THESIS

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This thesis is dedicated to my daughter, Anna Julia and all the mothers in Brazil.

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1. INTRODUCTION

In April 2014, the judicial court of Rio Grande do Sul mandated that Adelir, 29 years old and 42 weeks pregnant, be forced to have a C-section against her will instead of a natural birth. On Twitter, activists organized under the hashtag #*SomosTodasAdelir* ("We Are All Adelir") questioned the C-section culture that characterizes Brazil. Adelir's coerced C-section also spurred the development of advocacy groups for freedom of choice with respect to delivery and women's movements for better conditions of birth.

While not under the same extreme conditions as in Adelir's case, most births in Brazil end up being performed through C-sections. Over the past forty years, Brazil has experienced a persistently high incidence of C-sections. Currently, Brazil has the highest rate of C-section in the world, with a registered rate of 54%. In the private sector, this rate is as high as 88%, with some hospitals recording C-section rates of 100%. The high incidence of C-section in Brazil stands in stark contrast to the recommended rates by the World Health Organization, which recommends that C-sections not exceed 15% of births (WHO, 1985).

Data from the most recent and only national survey regarding birth in Brazil that interviewed almost 24,000 women[1] indicates elective C-sections are a common practice; over 1 million women (30% of births) undergo a C-section without medical justification and more than a third of women schedule a C-section without ever experiencing labour. Only 5% of the women in Brazil experience a birth with no intervention.

Approximately 30% of women begin prenatal care already intending to give birth by C-section. Over 1 million women undergo a C-section without medical justification and more than a third schedule a C-section without ever experiencing labour. Only 5% of women experience a birth with no medical intervention. Such high incidence of C-section impacts infant and maternal

[1] *Nascer no Brasil*. ENSP. Fiocruz (http://www6.ensp.fiocruz.br/nascerbrasil/).

health. Brazil has a high rate of infant prematurity, 11.3%, and a high rate of neonatal and maternal mortality, 10.6 infants and 64.8 women per 1000 live births (Datasus, 2011). The high prematurity rate is likely related with the fact that 35% of C-sections are scheduled before full term gestation, between 37 and 38 weeks of gestation (Fiocruz, 2014).

In developed countries with high standards of care, attention has focused on strategies to reduce overutilization of C-section on the premise that additional C-sections provide no extra health benefit to the mother and child, but are associated with an increase in maternal and infant morbidity-mortality. In addition to the health consequences, C-sections impose greater costs on the health care system. In developed countries, a 1% increase in the rate of C-section is associated with an increase of $9.5 million in healthcare costs (Villar et al., 2006). In the US, the increase in the use of C-section raised annual medical costs by $3 billion from 1996 to 2013 (Johnson and Rehavi, 2013). Similar estimates of such costs for Brazil go undisclosed, but the differences in fees are only the most obvious cost. C-sections may require prolonged hospital stay including neonatal intensive care and more assistance to the mother and infant.

Developing countries with high-rates of C-section, face an extra burden on already constrained budgets. Lack of adequate infrastructure, in terms of hospital beds, resources and medication, technology, skill and labour resources impose additional challenges to childbirth to the extent that natural birth may not be safely performed, perpetuating the status quo of C-sections.

It has been a subject of much debate whether the “epidemic Caesarean rates” observed in Brazil are a consequence of incentives in the health system, behavior of physicians, or a result of the demand (preferences) from patients. Indeed, natural births in Brazil seemed to have acquired a reputation for being extremely painful (pain relief was reported to be used in only 25% of natural births), interventionist (54% of the women undergoing vaginal births receive an episiotomy, 36% experience the use of fundal pressure - Kristeller's maneuver, and 92% give birth in horizontal position) and have been even considered demeaning (Fiocruz, 2014).

This thesis investigates the reasons behind the high rates of C-section in Brazil, focusing on three types of incentives associated with C-sections. I first examine the incentive related to physicians' demand for leisure to study whether time constrained physicians exploit C-section's scheduling properties to conveniently minimize work life disruptions and accommodate their schedule by shifting off births from most desired leisure consumption points. To differentiate shifting effects from inducing effects, I further exploit a traditional Brazilian holiday, the Carnival, to determine the extent of deliberated inducement of C-sections related to leisure. I find evidence consistent with physicians shifting C-sections away from weekends and nights in a scheduling effect, particularly in the private sector. However, I find no support for the hypothesis that physicians purposely convert natural births into C-sections to alleviate work burden during a desired leisure periods.

I next investigate whether such convenience benefits associated with C-sections come at the expense of lower quality of birth. I focus on birth choices of the gold standard consumer, the physician. I test whether physicians, who are presumably the most aware about the risks and benefits involving a C-section, undergo less of this procedure as compared to other women of equivalent socio-economic status. Contrary to evidence found for North America and Asia (Johnson and Rehavi, 2013; Chou et al. 2006), I find that physician-mothers undergo as much, or more, C-sections as compared to mothers of equivalent socioeconomic status. This is worrying, given that infant prematurity and mortality rates are higher for infants born from C-sections scheduled before full term (Engle and Kominiarek, 2008). I estimate the impact of C-section on infant outcomes and find that, positive outcomes are associated with C-section in the private sector.

Finally, I investigate physicians' financial incentives to perform C-section. I develop a model of physician behavior that emphasizes the time costs associated with natural births and C-sections. To my best knowledge, this is the first study to address such costs. Standard utility-based models that investigate the SID hypothesis [Gruber et al., 1999; Alexander (2013)] typically assume that that time costs incurred by physicians are similar regarding birth alternatives. This is because in most cases the physician is supported by a delivery medical staff and can remotely assist births, being physically demanded only towards the final or most decisive moments of birth. Because time costs are assumed to be equal between C-section and natural births in many settings, analytical models have focused on exploiting the effect of fee differences between the two types of birth. For other health systems, in which physicians incur significant costs from performing natural births, it is important to incorporate the time factor and the impact of fees relatively to time inputs.

In health systems characterized by low quality associated with natural births (low degree of pain management, low emphasis on the midwifery approach and obstetric violence), disutility faced by physicians from over treating (Evans, 1974; Fuchs, 1978) can be alleviated from serving patient's preferences.

Having a model of physician utility, I then investigate the impact of a change in public reimbursement fees by the government in October, 2007. Brazil provides an interesting setting to test for financial incentives because of the structure of physician compensation. Public physicians generally receive a fixed salary, while private physicians are remunerated on a fee-for-service scheme. The two systems are interconnected through the existence of a third group of physicians that work in private facilities which are also affiliated with the public system, which I am able to identify in my sample, using reimbursement data from the Universal Health System (SUS). Controlling for changes that affect the private and public system, I find that physicians respond to financial incentives and the group impacted by the fee change increased C-section rates following the policy intervention.

Besides childbirth being an important matter on its own in terms of costs and health outcomes, the study examines births in a large health system in which universal health system coexists with private provision. The study uses national data and variations in clinical standards, patient demand and physician compensation to draw comparisons in the use of C-section. From a theoretical standpoint, the study contributes to a broader literature on supplier-induced demand (SID) as it exploits a setting in which the trade-offs faced by physician and patients are different than the ones faced in North America and many western European countries, particularly with regards to opportunity costs faced by physicians from performing natural births. This study also provides an interesting setting to investigate incentives operating in a “post-inducement” phase.

Overall, my findings suggest that the high rates of C-sections in Brazil are a result of low quality associated with natural birth and high opportunity costs faced by physician factors reinforcing the “C-section culture” that prevails in the country.

This study is organized as follows. Chapter 2 describes the evolution of C-section in Brazil, emphasizing the changes since 1970s. It also describes the main health policy strategies adopted during this period including the transition from a multi-tier, fragmented system to a unified system in 1988, while also highlighting the main government actions designed to discourage the excessive practice of not medically necessary C-sections. Chapter 2 also presents the current organization of childbirth assistance, emphasizing differences between the private and the public models of assistance. Chapter 3 discusses institutional, legal and cultural issues that have contributed to maintain the C-section norm in the Brazilian system, reinforcing the C-section industry. Chapter 4 lays out the theory and predictions concerning different incentives related to childbirth: medical convenience and timing (physician work-life balancing), patient's preferences and financial incentives. An analytical model of physician utility is proposed in this chapter. The data sources and main variables used in the study are presented in Chapter 5. Chapter 6 tests the hypotheses developed in Chapter 4, presenting the method, empirical tests and results for each prediction. An additional section on infant outcomes is also discussed. Finally, Chapter 7 outlines the conclusions of this thesis.

2. EVOLUTION OF C-SECTION AND THE PRESENT STATE OF BRAZILIAN CHILDBIRTH ASSISTANCE

This chapter discusses the evolution of C-section in Brazil over the past forty years, relating it to the strategies of healthcare assistance adopted in the country during this period. Since the 1970s, Brazil has undergone important demographic, political and socio-economic changes that have had a great impact on the model of health provision. After the recognition of citizens' right to health under the democratic Constitution of 1988, Brazil has developed one of the largest universal health care systems in the world, the *Sistema Unico de Saude* (SUS), which provides free-of charge health care to all individuals.

I discuss how these changes have shaped the actual model of childbirth assistance, and how the logic of reimbursement for medical procedures has incentivized the use of more intensive procedures, such as C-sections. I also discuss the main policies adopted by the government in attempt to control the increasing trend of C-section in Brazil since the 1980s, most of which having only short-lived effects.

Finally, I present the current state and organization of the model of childbirth assistance in the country, emphasizing differences in the public and private sector highlighting differences in the standards of care, the model of assistance and physician compensation.

2.1. <u>C-sections as the Norm in Brazil: How Did It All Started?</u>

Between 1970 and 2011, the C-section rate in Brazil almost quadrupled. In the late 1960s, the C-section rate in Brazil had reached the upper limit of the guidelines regarding childbirth practices recommended by the World Health Organization (WHO, 1985). Ten years later, C-section rates more than doubled in the country, increasing from 14.6% in 1971 to 31% in 1980. The upward trend continued through the 1990s and, by the end that decade, 40 out of 100 births in Brazil were performed through a C-section. The most recent available data from the

Ministry of Health indicates that the majority of births, 54% overall, end up being delivered through a C-section, making Brazil the country with the highest incidence of this procedure in the world.

Such rapid and persistent increase in C-section rates has been accompanied by significant political, social and demographic changes in Brazilian society over the past four decades, which has, during this period, transitioned from a military regime in the mid-1960s to a democracy by the mid-1980s; from a low-income, agricultural and predominantly rural to a middle income, industrial and urbanized country. Between 1970 and 2010, the number of people aged 60 years or older has doubled and reached 10.8% (IBGE, 2010) and urbanization rate jumped from 56% to 87%. Fertility rates decreased from 5 children in 1970 to 1.81 in 2011 (World Bank, 2014). Improvements in living conditions and access to health have resulted in significant decreases in infant mortality, from 115 infants per 1000 live births to 15.6 (IBGE, 2010), in poverty rates from 68.3% to 10.1% (Rocha, 2013) and in life expectancy at birth, which increased to 74.6 years from 57.6. These changes have had a large impact on the organization of health care, which transitioned from a multi-tiered system in the 1970s to universal health assistance by 1988, with the creation of SUS (*Sistema Unico de Saude*) and the constitutional recognition of a citizen's right to health and the State's obligation to provide it.

2.1.1. From Private to Public Provision

Health assistance in Brazil, in an organized form, began in the context of national movements for social benefits and evolved in the context of the development of social security policies in the country. Until the beginning of the nineteenth century, medical care was diffused and only available to individuals who could afford for it or obtain it from philanthropic charity institutions. After 1920, some forms of medical assistance began to be offered in employment contracts of workers belonging to the largest private firms in the country. During the 1930s, social protection policies expanded the provision of medical care to certain categories of employment (i.e. industry, banking, retail) instead of workers of individual companies, and such employment funds gradually became organized into formal *Institutes of Pension*. Such institutes were designed to provide social security and medical benefits to employees with the State being a contributing source.

Government provision of social security progressively increased after the Institutes of Pension until it became completely unified and controlled by the State in 1966 with the introduction of a National Institute of Social Security (INPS), when Brazil was under the military regime. Under the newly created INPS, social and medical assistance were extended to all urban workers in the country[2].

The political changes undergone in Brazil and the introduction of the INPS significantly impacted the organization of health assistance during that time. In order to meet the increased demand for medical benefits resulting from the expansion of the social security system through INPS, the government decided that the private sector would provide the increased level of services. At the time, public health spending was mostly directed to population health (such as immunization and food and drug control) and its infrastructure was not able to accommodate outpatient and in hospital care on a larger scale. Therefore, the government opted to concentrate efforts in the development of a private health network by investing heavily in the sector through generous subsidies (e.g., low, even zero interest rates) aimed at expanding private sector capacity. This strategy could be financed through funds accumulated from previous social

[2] Rural workers and domestic employees were not entitled to receive social and medical benefits and, together with indigents, were assisted by philanthropic organizations.

security contributions and by the high economic growth experienced in Brazil between 1968 to 1973, the so-called “Economic Miracle” in which average annual growth rate was 11.2%.

During this period, the private health sector experienced a sharp expansion. The number of private hospital beds increased from 74,543 in 1967 to 348,255 in 1984, an increase of 465% (Mendes, 1995). By 1974, private hospitals handled 96% of all social security enrollees’ hospital admissions (Oliveira and Teixeira, 1985). Without having a clear model of organization, the expansion of private provision was oriented more towards the financial interest of private sector groups than to the needs of the population (Castro, 2002). Wosny (2008) emphasized the characteristics of the medical system that emerged: hospital centered, focused on treatment rather than prevention, extremely costly for the government and facing quality complaints. A system that was "specialized, high-technology, hospital-based curative care” (Potter, 1998).

In 1977, the National Institute for Medical Care (INAMPS) separated from INPS and became the federal agency linked to the Ministry of Social Security charged with the goal of providing medical and dental assistance to social security enrollees and their dependents. In 1987, social security enrollees accounted for 64% of all hospitals stays, with less than 20% of these being in public hospitals. For outpatient care, 50% occurred in public facilities with the government financing over 70% of it.

> *The private role in provision is clear from these statistics, but what is equally evident is that the government is the major payer of services, especially for hospital care...* (Lewis and Medici, in Hopkins, 1988).

The slowdown of the economic activity with the international oil crisis in 1974 and consequent increase in unemployment rates drained significant resources from social security funds, while the government faced large piles of medical bills on the other side. As the constrained social security system entered financial crisis, the government gradually began to turn attention to public health as a lower cost alternative and gradually started contracting services from states and municipalities, as well as philanthropic and educational institutions. The private sector, now facing significantly less public funding turned to the ascending middle class in the country and focused on the provision of supplementary medicine, which increased rapidly in the 1980s. By the end of that decade, almost a quarter of the population (22%) had access to private health insurance plans (Mendes, 1995).

Changes in the political arena with the end of the military regime and intensification of democratization movements began a health reform movement led by the civil society, which argued that health was a social and political issue that needed to be addressed by public policies. In 1986, the National Health Conference laid the basis for the adoption of a universal health system in the country. In 1988, the unified health system, *Sistema Unico de Saude* (SUS), was created. The SUS aims to deliver comprehensive, universal preventive and curative care to all citizens and also visitors in the country. Today, the SUS is the exclusive health provider for 80% of the population. In 2011, a total of 3.2 billion outpatient procedures, 453.7 million medical consultations, 9.9 million of chemo/radio therapies, 2.3 million births, 282 thousand cardiac surgeries, 98 thousand oncologic surgeries and 21 thousand transplants occurred under SUS[3], evidence of the substantial system that has emerged in Brazil.

2.1.2. C-section Evolution and Government Policies

During the 1970s, C-section rates more than doubled jumping from 14.6% in 1970 to 31% in 1980. Over that time, social security births paid by INAMPS, represented 75% of the total births in the country. The increase in C-sections and other intensive procedures during this period is attributed to the form of compensation used by INAMPS to remunerate services (Faundes and Cecatti, 1991). C-sections and other procedures were remunerated on a fee-for-service basis at private market level fees. The fact that C-section constituted a more profitable

[3] Ministry of Health.

procedure than natural births may have created financial incentives for the use of C-sections (Faundes and Cecatti, 1991; Hopkins, 2000).

Presuming that financial incentives were behind the rapid rise of C-sections, the government introduced equalization of birth fees in 1980. However, the policy change did not reverse the upward trend in C-sections since, even though physicians were not paid more for C-sections, hospitals continued to bill the government twice as much the cost of natural births for accommodations and other expenses related to C-section care (Barros et. al, 1991). Also, the policy applied only to births publicly funded through INAMPS, not addressing births taking place in the private sector, which were financed through out-of-pocket payments and health insurance. Even after this policy, C-sections remained a rising trend throughout the 1980s.

The introduction of the universal health system (SUS), which in principle could organize and manage childbirth by imposing stricter guidelines regarding intensive and unnecessary practices, was not enough to reverse the increasing trend of C-sections in the 1990s. By the end of 1997, 40% of the births were performed through C-section.

In 1988, aiming to improve birth assistance and reduce the practice of unnecessary C-sections, the government introduced a series of health policy measures. The fee for natural birth was increased and a reimbursement cap was imposed for caesarean births financed with public funds. Any C-section performed after a 40% rate had been reached in a public institution would not be reimbursed. The 40% cap was gradually narrowed to 30% by 2000. Also, for the first time in Brazil, anesthesia for natural birth began to be covered by SUS and finally, obstetric nurses became entitled to be reimbursed for childbirth and natural birth centres were created (Brasil, 1998; 1999). Following these changes, there was a noticeable downturn in C-section rates of publicly funded births, which fell from 32% in 1997 to 23.9% in 2000 (Victora et. al, 2011).

In 2000, the Ministry of Health and administrators from various states formally established an agreement to combine efforts to reduce C-section rates to 25% by 2007. This agreement did not reach its intended goal. C-section rates have been growing persistently since 2000 for both public and private births, as depicted in Figure 1. Other efforts designed to improve the model of obstetric attention include the introduction of a national programme of Birth Humanization in 2002[4], aimed at improving access and quality of care for prenatal care, labor and delivery in the public system, through the recent Stork Network, a national maternal and child health program launched in 2011 sharing the same goals. Another government strategy to reduce C-sections under SUS is the increase of natural birth centres. Despite all government efforts, Brazil's C-section rates have continued to rise, reaching 54% overall and 38% among births financed by SUS.

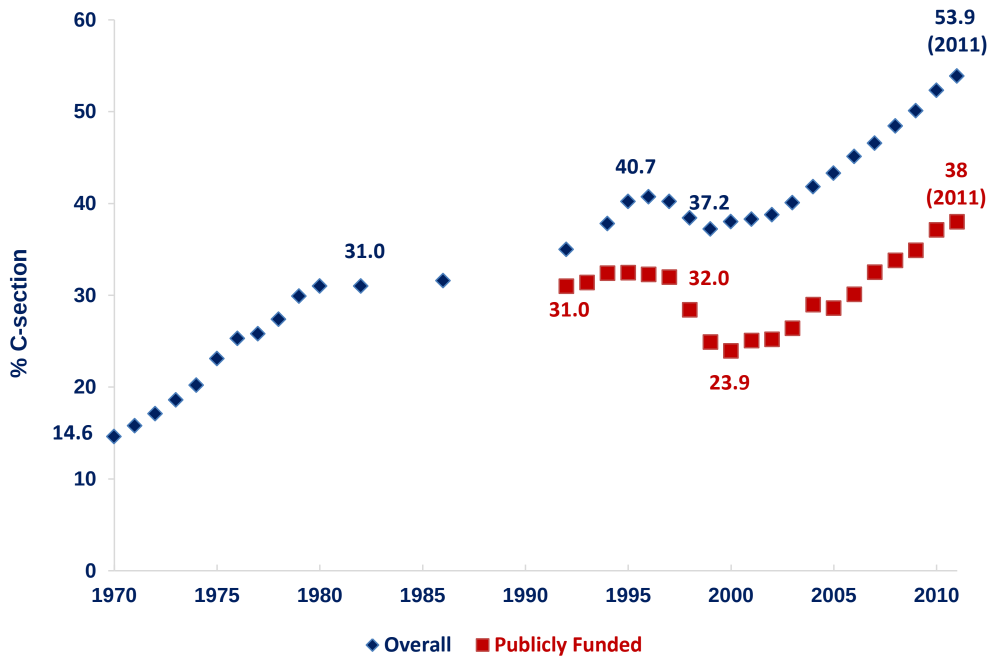
2.2. Current Organization of Childbirth Assistance

Data from a recent (and the only) survey of birth conducted on a national scale indicate that 80% of births during 2011 and 2012 were financed through public funds (SUS). The remaining 20% were financed via private funds, either health insurance or out-of-pocket payments (Fiocruz, 2014).

Total public and private health spending in Brazil corresponds to 8.9% of GDP in 2011, which is low when compared to the US (17.7%), but close to the average of OECD countries (9.3%) and other countries with universal health systems such as Canada (11.2%) and Australia (8.9%). However, per capita spending in Brazil is $1,043, well below the US ($8,508) and the OECD average ($3,339). The public sector accounts for 45.7% of health spending, which is less than observed in OECD countries (72.2%), UK (83%), Canada (70%), US (47.5%), Mexico (47.3%), Argentina (61%) and Chile (46.9%), (OECD, 2013).

[4] Ministry of Health, Ordinance n. 569, of June, 2000.

Figure 1 – Evolution of C-section rates in Brazil (1970-2011)



Source: Data obtained from the following: Datasus/Ministry of Health (Information System of SUS), Faundes and Cecatti (1991), National Regulatory Agency for Private Health Insurance and Plans (ANS).

Approximately 70% of Brazil's hospitals are private. Capital and human resources vary significantly between the private and public sector. In 2010, there were 1.8 physicians per 1,000 population, a rate below the OECD average of 3.2. Brazil has 1.5 nurses per 1000 population, far below other OECD countries (8.7) (OECD, 2013). A report from the Federal Council of Medicine (CFM) on physician demographics indicates significant inequality in the distribution of physicians across sectors, with the private sector having four times as many physicians as the public sector (CFM/CREMESP, 2011). The number of hospital beds is 2.4 per 1000 population, half the OECD average (4.8 beds). Hospitals beds available for SUS patients are even less, corresponding to 1.8 per 1000 population.

The unbalanced infrastructure is also visible in the availability of hospital equipment, which is more highly concentrated in the private sector despite it serving only one quarter of the population. Only 7,489 hospital machines out of 43,050 are available for public patients, the remaining being exclusively available for private care. Of the 366,497 life support equipment in the country, only 42,640 can be used by SUS patients. Only 15,111, out of the 57,441 X-Ray machines in use, are available for SUS care. For mammography equipment, corresponding figures are 1,676 and 3,843[5].

The disparities in financial, technology and human resources almost always reflect in the quality of treatment received by patients in public and private hospitals. In the next section, I discuss birth under the two models of assistance, emphasizing the typical standards of care and the economic incentives existing in both environments.

2.2.1. Private Assistance

Women who can afford to deliver in private hospitals often do so, paying for birth expenses via private insurance or directly out-of-pocket. Direct payment is more frequent among

[5] Datasus (http://tabnet.datasus.gov.br/tabdata/cadernos/cadernosmap.htm).

highest income women. Data from the National Household Sample Surveys (IBGE)[6] indicate a relative decline in public funding with an increasing participation of private health insurance. In 2008, 56.3% of health services were publicly financed, while 26.47% were financed through health insurance and 18.8% via direct payments. In 2003, the corresponding proportions were 57%, 25.9% and 14.8%, while in 1981 they were, 68%, 9% and 21%, respectively.

Health insurance coverage, contracted on an individual basis or provided through employers, pays for most of health services in private, for-profit hospitals that do not maintain affiliation with SUS. The National Regulatory Agency for Private Health Insurance and Plans (ANS), created in 2000, is responsible for regulation of the private health insurance market. According to ANS data, there are 1,274 for-profit health insurance companies in Brazil covering 25.9% of the population[7]. The distribution of health insurance coverage varies among rural (6.4%) and urban areas (29.7%) and among regions, with the southeast and south regions registering three times as many beneficiaries as the north (13.3%) and northeast (13.2%). Access to private health insurance is positively related with age and income. Only 2.3% of people with monthly wage up to 1/4 of the minimum wage[8] have health insurance, while this proportion increases to 82.3% for people with monthly wages five times or more than the minimum wage[9].

For childbirth assistance, women often seek private care for freedom of choice and access to individualized treatment. Private patients who contract maternity plans are virtually guaranteed to retain the same physician from prenatal care to labour and birth delivery. This

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[6] National Household Sample Surveys of 2003-2011, conducted by the Brazilian Institute of Geography and Statistics (IBGE). http://www.ibge.gov.br/home/estatistica/pesquisas/pesquisa_resultados.php?id_pesquisa=40.)

[7] National Regulatory Agency for Private Health Insurance and Plans (ANS). http://www.ans.gov.br/the-sector/sector-data.

[8] Current minimum monthly wage in Brazil is $306.

[9] National Household Sample Surveys of 2003-2011, by the Brazilian Institute of Geography and Statistics (IBGE). Available at http://www.ibge.gov.br/home/estatistica/pesquisas/pesquisa_resultados.php?id_pesquisa=40.

physician loyalty is valued by mothers, who view familiarity with the physician as a safeguard against the unpredictability surrounding the birthing process. In addition to a more personalized assistance, private patients have more flexibility in the choice of physician and are better able to select doctors that share their vision of the type of birth experience. Following a periodic schedule of monthly consultations and several gestation examinations[10], private patients are able to maintain closer bonds with their physicians[11] and thus have more opportunity to exchange information, align expectations and agree on a plan for the birth.

Besides being able to build a closer relationship with physicians, private patients often have access to better facilities for pre-natal and birth care since private hospitals are generally better supplied than public ones. Private patients are generally able to receive more personal and comfortable assistance, more orientation and medical information and are often more respectfully treated by the medical staff (Hopkins, 2000; Fiocruz, 2014).

For their private patients, physicians often work in hospitals on an on-call basis, and are physically present accompanying their patients for the entire duration of labour and delivery. Alternatively, physicians in private hospitals may also belong to hospital staff and work pre-determined shifts. In private hospitals, physicians can usually exercise much greater discretion over their decisions and activities. Peer reviews and ethical checks are rare in private hospitals.

In terms of compensation for birth deliveries, physicians in private hospitals are generally paid on a fee-for-service basis. Even though variations exist, health insurance companies typically pay $150 for uncomplicated births, regardless if through C-section or vaginal delivery.

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[10] In general, physician request an average of four ultrasound exams be performed: one in the first trimester around the 7th or 8th week of gestation, to determine gestational age, two in the second trimester: one between the 11th and 14th week - nuchal translucency and the other between 18th and 24th weeks for morphologic analysis. Finally, in the last trimester, physicians require a last ultrasound at around 34 weeks to determine the fetus growth. It is common that many private clinics offer a service of 4D ultrasound and photo and filming of the birth.

[11] It is customary for a private patient to be provided with her physician's personal contact information, such as cell phone and email address, thus being able to contact her physician for any health concern.

2.2.2. Public Assistance

The vast majority of women rely on public assistance for birth and other health services. Even though different practices exist across the country with some hospitals adhering to the recommended practices for childbirth, public hospitals in general lack resources, adequate infrastructure in physical installations, equipment and human resources.

Public funding for SUS comes from social contributions and taxes collected at the municipal (28.64%), state (26.69%), and federal (44.68%) levels. A total of R$138.70 billion[12] was spent on public health actions and services in 2010. The public network consists of publicly owned facilities and privately-owned facilities that are affiliated with SUS through contracts for provision of health services to public patients. This last group is responsible for the largest share of health care delivery in Brazil as roughly 38.7% of beds in the private sector are available to the SUS through contracts.

The SUS provides prenatal, birth and post-partum care free of charge to all patients. Prenatal care is often offered at local health centers or clinics and birth delivery takes place in a public or affiliated hospital. In public birth hospitals, it is common that capacity constraints force patients themselves to search the hospitals during labour until they find availability, which can be a serious problem in high risk pregnancies, contributing to neonatal mortality (Hopkins, 1998; Fiocruz, 2014).

Women are not allowed to choose among physicians for prenatal care or hospitals for the birth, undergoing labour and delivery with the attending medical staff on shift. Overcrowding of public hospitals often requires patients to share a common room for labour, which excludes male companions from being able to accompany their wives. In public hospitals, while more defined

[12] Deflated by annual average of consumer price index. Source: Ministry of Health.

and with stricter guidelines for birth practices are in place to limit the practice of unnecessary C-sections, the technology offered for natural birth management is usually poor and does not generally follow the recommended standards. Natural births in public hospitals have a reputation for being extremely painful, with infrequent administration of pain medication, and very impersonal or even demeaning treatment (Fiocruz, 2014).

Staff physicians always attend C-sections, but vaginal deliveries are usually more attended by medical students, obstetrical residents or midwife-nurses, with the physician being called on more complicated births. Hopkins (1998) reported that it is very rare that public patients know the name of the attending physician of birth, while among private patients, the full name of their doctors is known.

The SUS reimburses public births according to a fee schedule following a diagnosis related group (DRG) type which specifies the diagnostic code, description, type of care (outpatient, inpatient), complexity, age, sex, financing source, maximum patient stay for the procedure, amount due for hospital services and for physician services. For uncomplicated C-sections, the SUS fee schedule in place pays a total of $272.9, out of which $197.8 is due to hospital services and $75 is due to physician's services. Corresponding values for natural births are $221.7, $133.8 and $87.9, (Figure 2).

Even though the SUS fee schedule reimburses hospitals on a diagnosis basis with a pre-determined maximum cap to be reimbursed, physicians attending public births differ with respect to compensation received for births. Physicians hired by SUS and working at public facilities are paid a monthly fixed salary. However, physicians that attend SUS births at private hospitals are contracted by the government on a fee-for-service basis, according to the amounts established in the national SUS schedule. From Figure 2, one can see that natural births pay only about $12 more than C-sections to physicians.

Figure 2 – SUS Fees for Births

Procedure	**03.10.01.003-9 - Natural Birth**	**04.11.01.003-4 - Cesarean Birth**
Group	03- Clinical Procedures	04- Surgical Procedures
Sub-group	10 - Delivery and Birth	11 - Obstetric surgery
Type of assitance	Inpatient	Inpatient
Complexity	Medium Complexity	Medium Complexity
Financing Source	Medium and High Complexity	Medium and High Complexity
Sex	Female	Female
Average stay	2 days	2 days
Minimum age	9 years old	9 years old
Maximum age	60 years old	60 years old
Reimbursement due to		
Hospital Services	R$ 267.60 ($133.8)	R$ 395.68 ($197.84)
Physician Services	R$ 175.80 ($87.9)	R$ 150.05 ($75.03)
Total due	R$ 443.40 ($221.7)	R$ 545.73 ($272.9)

Source: Datasus/Sigtap/ Ministry of Health. http://sigtap.datasus.gov.br/tabela-unificada/app/sec/inicio.jsp.

3. BRAZIL'S C-SECTION NORM: INSTITUTIONAL, LEGAL AND CULTURAL ASPECTS

There has been much debate regarding the reasons behind the epidemic rates of C-section in Brazil and the extent to which it can be attributable to physician motives, patient demand and the model of obstetric assistance adopted in the country. According to the researcher and coordinator of the national survey regarding births in Brazil, Maria do Carmo Leal, (Fiocruz, 2014) the C-section norm is a result of factors related to physicians convenience and cultural preferences in the society.

> *There's a (C-section) culture in society, many women today really have come to believe that C-section is a good way to deliver babies. And for doctors as well, it is convenient that C-section happens because it organizes their lives, scheduling one C-section after another, and not having to stay available for the time that can't be controlled, which is the (natural) time birth of each child. It is true that doctors can induce the woman to do a cesarean section, but the whole system is organized in a way to promote it. "(Agencia Brasil, May, 2014, my translation)*

In this Chapter, I exploit several factors that have contributed to create a C-section norm in the country in which, C-sections have become the default choice in many cases. Brazil is often portrayed as a country with an aesthetic-based preference for C-sections, but as this chapter highlights, there are other fundamental reasons rationalizing this choice. Factors related to physicians work life, to the model of reimbursement, to concentration of the birth process in the hands of the physician are important to consider. Also, the standards of care in the model of childbirth assistance and women's experiences regarding birth must be considered. I discuss these factors and how they have contributed to the consolidation of Brazil's C-section culture.

3.1. Physician Factors

> *It's not that doctors are mercenaries, but what they earn to be present for a very important moment is little more than what a television repairman gets who shows up on his schedule (…)This doctor-patient connection where the woman wants her doctor present, the poor remuneration for doctors, their need to juggle several jobs — all this makes it impossible for a practitioner to reconcile his work schedule with unpredictable vaginal births."(Fox News, Aug. 2012, Moraes Filho - Brazilian Gynecologists and Obstetrics Association.)*

C-sections take less time than natural births, with a predictable start and end time that can be completed within an hour. Indeed, the main procedure, from the first incision in the women's abdomen to actual birth, can only take fifteen minutes. Vaginal births, on the other hand, progress gradually, through stages of dilatation, according to the body's physiology and can last anywhere from six to eighteen hours, with more difficult labour lasting even longer.

Requiring significantly different amounts of time, it is plausible that time inputs may play a role in physicians' decisions regarding birth procedures under certain circumstances. In well-developed health systems with high clinical standards, differences in time inputs between C-sections and natural births have been ignored since, generally, patients are assisted by the medical staff on call, who can simultaneously monitor several births, so that physicians are mostly demanded only at the final stages of birthing or in the presence of complications. This implies that for non-complicated cases the actual time spent by the physician on both C-section or natural births can be regarded as virtually equivalent (Gruber et al. 1999). In such systems, incentives regarding births have concentrated more on the financial and convenience aspect of C-sections.

In Brazil, however, physicians' time costs are important and often cited as one of the main reasons physicians opt for C-sections. Physicians deliver 89% of the births and differently than in other countries, birth assistance in Brazil can be highly individualized. To be financially compensated for births, private health insurance companies often require that physicians be physically present for the entire duration of the birth, even though compensation does not vary with actual time spent with the patient. Low utilization of non-physician professionals in Brazilian maternity wards (e.g., doulas, midwives and obstetric nurses), which if utilized could, in principle, assist most of the birthing process and mitigate time costs incurred by physicians, aggravates the cost of natural births.

In the following, I discuss each of these factors related to physicians and how they contribute to reinforce natural births as the high cost option for physicians compared C-sections.

3.1.1. Physical Availability During Births

> *Until then [1970s], babies were delivered by midwives under the supervision of the obstetrician who stepped in only when there were some complications, as it is in many European countries today… But the rules have changed and the physician needs always to be in the delivery room [to receive]. (Etelvino Trindade, President of the Brazilian Federal Association of Obstetricians and Gynecologists, Globo.com. Apr, 2014, my translation).*

Since private health plans began to emerge as an alternative to the failing social security system of the 1980s for the growing middle class, a traditional selling point for maternal health insurance plans was the guarantee that mothers would be assisted by the same physician for all maternity-related needs: from prenatal care to labour and delivery. Physicians would be entitled for reimbursement as long as they remained physically and actively available to the patient assisting the entire birthing process. This physician loyalty became highly valued by private patients as it represented access to a more individualized treatment.

> *Women would feel betrayed from a switch in physicians between the prenatal and delivery assistance. (Carlos Navarro, obstetrician and faculty of the Federal University of Parana, Gazeta do Povo. Mar. 2011, my translation).*

The necessity of having to remain physically available to attend the entire duration of a birth can require several hours of a physician’s time. Being involved in a prolonged delivery and often having to perform much of the hands-on procedures, the physician cannot go on to other patients, is impeded to work in his office, is unable commute to other jobs or even consume leisure. Lasting significantly shorter than natural births and being more predictable, C-sections can come handy as a practical solution in this environment, expediting the birthing process and minimizing stand-by time, releasing the physician to attend more patients and move along his work schedule. The practicalities associated with C-sections are so much valued that they have become the default procedure to follow, especially in private hospitals. “In the supplementary medicine, the natural [procedure] has become to perform C-sections”, says Jose Fernando Vinagre from the Federal Council of Medicine (*Folha de Sao Paulo*, Nov. 2011, my translation).

The time spent with the patient for the entire duration of labor and delivery go largely uncompensated once the physician is paid for the birth only, regardless of actual hours worked. This has caused physicians to advocate for compensation for extra work hours. Many private physicians have decided to charge an upfront “availability fee” that can range anywhere from $700 to $2,000, where patients are guaranteed the physician from pre-natal care to be present at the birth. Such surcharges, defended by the medical councils in the country have been motivating a lot of controversy and have been considered unlawful by the National Regulatory Agency for Private Health Insurance and Plans (ANS), which regulates supplementary private health including maternity plans in the country.

> *We are paid almost the same for a natural birth and a C-section. In the surgical procedure everything gets done in one hour. But women in labor can take up to 12 hours to deliver a child. Who reimburses us for this time working? (Mario Viana, gynecologist and president of the Medical Union of the Amazon – Noticias Saude, Jan, 2014, my translation).*

The routine use of C-sections in private hospitals is believed to migrate to public hospitals, since many physicians hold jobs in both sectors, a finding of the recent medical demography survey conducted by the Federal and Regional Council of Medicine (CFM/CREMESP, 2011). According to the former Secretary of Health Attention, Helvécio Magalhães, the incidence of C-sections in public SUS hospitals has been affected by the private sector. As he states: “between 70 and 80% of the physicians work in both sectors: the public and private, transporting the practices of private medicine to SUS. (*Folha de Sao Paulo*, Nov. 2011, my translation).

The higher time costs associated with natural birth resulting from the requirement that physicians be actively available during the entire labour and delivery are aggravated by the fact that physicians undertake a lot of the hands-on tasks and do not delegate much of the obstetric care to other professionals, as I discuss next.

3.1.2. Low Utilization of Non-physician Professionals

> *The human capital structure in [Brazilian] hospitals is fairly poor. There is not a multidisciplinary medical team composed of midwives, obstetric nurses, doulas and anesthesiologists working together. This would be the ideal team to assist a woman in labor. (Braulio Zorzella, Gynecologist and Researcher, Globo.com, Abril, 2014, my translation)*

In principle, the (high) opportunity cost of having to stand-by the patient during birth could be mitigated if the physician were able to delegate some stages of the birthing process to other health professionals, such as midwifes, doulas, and nurses, and attend only the final moments or be called upon for certain complications. This would release the physician from routine procedures, allowing him flexibility to attend several births concomitantly, occupying a more managerial position than actual all hands on role. However, even though obstetric nurses, doulas and midwifes are a regular presence in North American and European maternities, they remain rare in Brazil.

> *We have to change this culture, and get women comfortable having their child with the doctor or nurse on duty. (Fox News, Aug. 2012, Moraes Filho - Brazilian Gynecologists and Obstetrics Association)*

Despite government initiatives to stimulate obstetric nurse participation in childbirth, such professionals have faced controversy and limited performance. Initiatives to decentralize the birth process from the physician's hands, such as introduction of midwifery centres, have been received with great criticism.

> *It is nonsense! Women and science have conquered years of quality in assistance, of studies regarding birth, of complications that might occur, to regress in time in the actual City of Rio de Janeiro!... Create a midwifery centre, with nurses doing birth deliveries! They know that nurses, with all due respect, do not have capability of acting in birth*

complications. (Aloisio Tibirica – Regional Council of Medicine – Rio de Janeiro, in Fernandes (2004), my translation)

…The idea of Midwifery Centre is a fantastic historic retrogression…(Mauro Brandao, Regional Council of Medicine, in Fernandes (2004), my translation).

Merighi (2002) reported difficulties faced by obstetric nurses in their work environment, where they are often impeded from acting directly on birth assistance activities because of physicians' unwillingness to share responsibilities. This is aggravated by the absence of clear protocols for birth assistance and division of labour and rare ethic reviews in hospitals, all contributing to more discretionary practices. The relationship between physicians and nurses is often hierarchical and even authoritarian (Angulo-Tuesta et. al, 2003).

…But should we wait more to see if dilation will increase? …Never question the indication of a C-section. …They hate and are very strict about that…(Anonymous nurse in (Angulo-Tuesta et. al, 2003).

Other reasons limiting more active non-physician participation in birth assistance include physicians' fear of losing market share to these other caregivers, couples with patients' resistance to rely on births conducted by non-physicians (Riesco and Fonseca, 2002). Legal aspects involved in the subject constitute another reason to make physicians more averse to delegate responsibilities, since current legislation states that nurses can only assist births as part of a team that must include a physician[13].

The inability to rely on a multi-professional team of assistance and the consequent impossibility of delegating some steps of the birthing process to obstetric nurses or other professionals demands a higher time commitment from physicians, particularly in the case of a natural delivery, which is expected to last longer. If the labouring patient could be assisted and monitored at a higher degree by a non-physician professional, this would release the physician of some steps and enable her to be dedicated to a higher number of births, decreasing her

[13] Law n° 7.498/86 and Decree n° 94.406/87 that regulates nurse assistance in Brazil.

opportunity costs and possibly increasing the quality of birth assistance. Being averse to delegate responsibilities to non-physician professionals, for various reasons (lack of preparations and training, fear of litigation actions, aversion to sharing payments) imply that physicians are in charge of much of the birth, imposing a high opportunity cost on physicians, who may often feel the need to accelerate the process to move along their work schedule.

In private hospitals this time incentive is reinforced by the financial incentive (i.e., higher accommodation and other charges, although not physician fee) to perform C-sections, leading physicians to maximize the quantity of procedures. "They schedule and bill as many as eight procedures a day rather than wait around for one or two natural births to wrap up. It's a money machine." *(The Atlantic, Apr, 2014, my translation).*

In public hospitals, as opposed to private facilities, patients are assisted by the physician on duty who typically works in pre-determined shifts. Since the physician must be available for the duration of the shift, there would be no reason *a priori* to believe that incentives related to abbreviating the birthing process would be present. However, it is common practice among physicians in the public sector to dump cases and cut short the natural evolution of a patient's labour between shifts with all cases being "resolved" within the same shift (Freitas, 1999). In the public sector, the urge to expedite births by using C-sections is based more on reasons related to reputation and peer relationship as illustrated below.

> *If you feel that the patient is taking too long, you have to make something…I would feel ashamed of handing over a crowded shift to the next physician (Diniz and Chacham, 2006, my translation).*
>
> *It takes long [natural birth], and the idea is we have to make it fast. It's impolite for doctors to leave cases for the doctors on the next shift– there's a sense that you need to either accelerate it or do a C-section. (Simone Diniz, associate professor in the department of Maternal and Child Health at the University of São Paulo, The Atlantic, April 2014).*

3.1.3. Low Payments, Busy Work Life and Convenience

> *Doing a natural birth is complicated, especially in bigger cities, in which the doctor's life is busy and he has several jobs. A cesarean takes one or two hours, a natural birth can take more than six…This [C-section] has become a convenience (Desire Callegari, Federal Council of Medicine, Veja Saude, Mar. 2013, my translation).*

Compared to more developed countries, Brazilian obstetricians receive, in general, lower payments for birth assistance. Health plans remunerate $150 for a birth on average. In the public sector, physicians earn even less. Given such low compensation, obstetricians often feel the need to commit to more than one job, to increase volume of services and/or to diversify risks associated with employment. Physicians in Brazil are overburdened. A recent publication of the Federal and Regional Councils of Medicine reports that Brazilian physicians accumulate three jobs on average, with a third of them having four or more. The same data shows that physicians also face a busy work schedule having an average workload of fifty hours per week, with a third working at least sixty hours. Jobs typically include private office practices, a position in a private hospital and a position in a public hospital. (CFM/CREMESP, 2011).

Busy work life with multiple job commitments can make physicians view the flexibility provided by C-sections as a valuable asset. Being less time consuming and more programmable, C-sections can offer a superior alternative vis-à-vis natural births and allow physicians more opportunity to manage the timing of the deliveries and accommodate their schedules in a more predictable way. Such scheduling advantages can minimize professional and personal life disruptions, maximizing physician's overall organization of his work-leisure balance.

> *A cesarean, scheduled in advance, is more advantageous [to the doctor], because of the unpredictability of a natural birth. With the scheduled C-section, not only the doctor does not lose time, but also he does not need to cancel other arrangements, patient's appointments, trips, etc… (Brazilian Obstetrician, BBC Sao Paulo, April, 2014).*

3.1.4. <u>Medical Training</u>

Another reason contributing to the maintenance of the C-section norm is the deterioration of medical training on natural birth practices. As highlighted the former Secretary of Health

Attention in Brazil, millions of medical students graduate without ever having performed a natural birth (*Folha de Sao Paulo*, Nov. 2011).

Interviews conducted among physicians indicate a preference for C-section. Medical residents report that, although they value normal births in principle and have been instructed to perform cesareans only when absolutely necessary, the market conditions faced after graduation caused them to rely more on this procedure. Specifically, they name inadequate infrastructure in the public system, low reimbursement rates and absence of coverage for anesthesia for natural births as factors limiting this practice (Moraes and Goldenberg, 2001).

The fact that C-section procedures have been occurring with more frequency in hospitals implies that medical residents have less exposure to natural birth practices, which may contribute to reinforcing their disinclination to practice vaginal births. This situation is particularly salient in the public university hospitals, which treat higher risk patients and thus perform more C-sections. Indeed, physicians interviewed in the public maternity from Rio de Janeiro reported having a low perception of risk involved in C-sections, part of this being due to the fragmentation of the process - with physicians restricted to the surgical procedure and not following up post-operation (Dias and Deslandes, 2004). In this study the rate of C-section in university hospitals for singleton first-births is high (46.5%), supporting the idea of high exposure to this practice in medical schools.

Medical residency programs have been placing less emphasis on techniques to address natural births and the appropriate use of delivery instruments in obstetric management such as forceps and vacuum extractor, further reinforcing the use of C-section. As a Brazilian obstetrician noted: “Doctors schooled during an era in which cesareans were the norm are no longer adroit at vaginal delivery. Additional training is needed for them and to prepare midwives" (Dr. Gilberto Lopes, Brazilian Obstetrician), (SFGate, Feb. 2001).

3.1.5. Information Quality

In the public sector, inadequate infrastructure for the collection, storage and transmission of patient records and medical histories can interfere with the medical decisions concerning births. Unable to precisely track patient information such as medical history, prenatal records and pregnancy risks (pre-natal consultations, previous ultrasounds and exams), and having had no previous medical relationship with the patient, physicians may resort to C-sections to handle low-information patients, using C-sections as a precautionary path to follow. With the common belief that a caesarean can eliminate negative outcomes associated with natural birth, while posing no maternal-fetal risk, physicians seem to have formed the conviction that C-sections represent a safeguard against malpractice suits and judicial complaints. The inconsistent patient information in public and private hospitals is illustrated in the passage below from Behague et al.(2002):

> *Here [referring to the private practice] it's a pleasure to attend people, but in the public sector, you don't always know the patient, they don't always know you, you don't have a history with them... they don't have any confidence in you. For example, it's harder to convince the families in the public sector that it's normal for a woman to be in labour for 8 hours, they don't believe you.*

3.2. Aspects Related to Obstetric Assistance and Patients

3.2.1. Poor Technology in Natural Birth

The use of recommended techniques for natural birth assistance, designed to encourage a more active participation from the mother and facilitate a less interventionist approach to birth such as supplying liquids to patients during labor, encouraging patient ambulation and vertical birth, promoting the presence of a companion in the labor room for emotional support, are not generally adopted in many Brazilian maternities:

Here [in Brazil], when a woman is going to give birth, even natural birth, the first thing many hospitals do is tie her to the bed by putting an IV in her arm, so she can't walk, can't take a bath, can't hug her husband. The use of drugs to accelerate contractions is very common, as are episiotomies… What you get is a lot of pain, and a horror of childbirth. This makes a cesarean a dream for many women. (Maria do Carmo Leal, researcher at the National Public Health School at the Oswaldo Cruz Foundation, The Atlantic, Aug. 2014).

Obstetric nurses also reveal difficulty in implementing natural birth practices, facing considerable reluctance from physicians. As one doctor protested, "Do you see? It is not supposed to be like this [referring to the use of techniques for natural births], you guys [obstetric nurses] are idealizing, it has to be the traditional way, which is much faster, easier and simpler". (Angulo-Tuesta, 2003. My translation).

Limited availability of hospital beds in public hospitals often requires that mothers are obliged to share a common delivery room. This eliminates the possibility of husbands accompanying their wives even though Brazilian law mandates that all women be allowed birthing companions[14]. Long wait lines are also reported as a problem faced by public patients. A study conducted in Sao Paulo among low income women found that 76% need to travel to more than one hospital to find an available bed, with 15% travelling to three or more. Such prolonged search can be particularly harmful to high risk pregnancies. In Sao Paulo, 55% of maternal deaths occur during or immediately after the search for an available hospital bed (Diniz and Chacham, 2006).

Some physicians cite overcrowding in public hospitals and an inadequate number of hospitals beds as motivations to accelerate births, resorting to labour inducement to accomplish this goal.

Leaving the woman in labour for a long time is a loss of space and limits the number of cases that can be assisted. Thus, they induce them all. (Medical resident, Diniz 2001, my translation).

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[14] Federal Law, Nº 11,108 (Apr. 2005) regulates the right of an accompaniment in public hospitals and hospitals contracted by SUS. Normative Resolution of the National Agency of Health (Aug. 2011), extends this obligation to private hospitals as well.

I compare this to a construction site: it can't stop. We can't go by the Book and we cannot wait for Nature to act. I put everybody on pitocin[15]*.(OB/GYN Sao Paulo, Diniz and Chacham 2006, my translation).*

3.2.2. Obstetric Violence

Obstetric violence is defined as any act or intervention directed to a woman or her infant during pregnancy, labour or after delivery without her explicit consent, contrary to her autonomy, physical and emotional integrity, and preferences. A recent study that interviewed women who gave birth in public and private hospitals found that 25% were victim of some form of obstetric violence with the most common including humiliating insults, painful procedures with no consent or information, and denial of pain medication/anesthesia. This effect is more pronounced on mothers who delivered in public hospitals. For private hospital births, the rate of reported obstetric violence is 17% (*Fundação Perseu Abramo*, 2013). The most frequent verbal insults received by mothers undergoing a natural delivery included: "When you were doing it [the baby], you did not complain, but now you cry"; "If you yell, I will stop what I am doing/ I will not assist you anymore"; "If you keep yelling, your baby will be born with hearing problems."

The conditions under which natural birth is performed reinforce its negative reputation among women. Natural childbirth is perceived as primitive, ugly, inconvenient, an alternative for the poor, and as something that will harm the perineum, according to Simone Diniz, one of the major researchers in maternity health in Brazil.

Many doctors unnecessarily overuse fundal pressure – pushing on the pregnant woman's stomach – to speed things along, and that they administer the labor hormone oxytocin more frequently than needed. The vast majority of women who give birth vaginally also have episiotomies, or surgical cuts to the vagina that are intended to make delivery easier. (Simone Diniz, associate professor in the department of maternal and child health at the University of São Paulo, The Atlantic, Apr. 2014)

[15] Pitocin is a synthetic oxytocin injection is used to induce labor or strengthen labor contractions in delivery.

There is no justification for episiotomies to be routinely performed in natural births. Its use is recommended in less than 30% of the cases and when there is evidence of maternal and newborn distress or when it is verified that the perineum specifically constrains the progress of labor (Enkin et al., 2000). A study done among Latin American women found that episiotomies were performed on 90% of the women having vaginal births in hospitals and cost $134 million. Current data indicates an episiotomy rate of 54% (Fiocruz, 2014). As Diniz and Chacham (2006) concluded, when Brazilian women don't get "cut from above" by C-sections, they are "cut from below", referring to the excessive use of these practices in the hospitals of Sao Paulo.

3.2.3. <u>Pain Management</u>

Fear of pain is reported as the main factor motivating maternal request for C-section (Faundes and Cecatti, 1991, Hopkins, 2000, Porter, 2001). Before 1998, epidurals were only covered by INAMPS for C-section births and this is why many women resorted to C-sections during that period. Despite the Ministry of Health introducing legal coverage for anesthesia medication for natural birth in 1998, its use has been limited in practice. Data from the Health Administration of the State of Sao Paulo shows that 76% of the women in SUS hospitals in Sao Paulo do not receive anesthesia during labor of a natural birth (*Secretaria do Estado de Sao Paulo, 2010*). Besides limited resources and infrastructure to accommodate the demand for anesthesia in natural birth, a faculty member of the Public Health School of the University of Sao Paulo, Carmen Diniz, stresses that reimbursement of this procedure has been controversial, due to shortage of anesthesiologists.

The degree of pain experienced by women giving birth in Brazil is closely related to ability to pay for births. Women who deliver by a natural birth in a private hospital are usually able to receive epidurals, while women who deliver in public hospitals are generally only able to receive local anesthesia, if that (Diniz and Chacham, 2006).

3.2.4. Tubal Sterilization

The epidemic of caesarean sections begins in the 70s, when it began to be sold as a solution (single surgery) for permanent sterilization. (Ana Cristina Duarte, advocate of the movement for birth humanization in Brazil, BBC Brasil, Apr. 2014)

Traditionally, tubal sterilization has been the most common contraceptive method in Brazil. Until 1996, there remained many gray areas in law enforcement's perspective on tubal sterilization. Even though there was not any specific law that prohibited voluntary sterilization, its practice was interpreted as a passive crime in the Brazilian Criminal Procedure Code, to the extent that it would harm a human organ and result in failure and loss of reproductive function of a woman. Since tubal sterilization by patient demand was considered unlawful under these terms, it was common practice in private and public hospitals to bundle it with C-sections, as a hidden procedure that would not be stated formally in hospitals records (Barros et al., 1991; Faundes and Cecatti, 1991, 1993; Hopkins, 1998; Berquo and Cavenaghi, 2003) or miscode the procedure as a breast or ovary cyst surgery. Out of the total tubal sterilizations in 1986, it is estimated that three-quarters occurred during a C-section (PNSMIPF, 1986).

In 1986, among women between 15 and 44 years old, 66.2% used contraceptive methods and 26.8% of them resorted to tubal sterilization. By 1996, these numbers increased to 76.7% and 40.1% (PNSMIPF, 1986; PNDS, 1996). Eighty percent of women whose last child was delivered by C-section were surgically sterilized compared to only twenty percent who delivered vaginally (Rutenberg and Ferraz, 1988). For many women, the chance to get sterilization was a primary or contributing factor for delivering by C-section (Janowitz et. al, 1985).

The high incidence of sterilization and the association between this procedure and C-sections led to the 1997 introduction of a national law concerned with family planning and natality control in Brazil[16]. In 1999, this law was modified to add the requirement that tubal sterilization during birth or until 42 days after birth were prohibited, expect in cases where previous successive C-sections and further C-surgeries would pose risks to the mother[17].

[16] Law 9,263/1996. Regarding sterilization: voluntary sterilization is permitted in the following situations: in women with full civil capacity and over 25 years of age, or at least two living children, once complied with the minimum of sixty days of the manifestation of the will and the surgical procedure, during which the person concerned will be afforded access to fertility regulation services, including counseling by a multidisciplinary team in order to discourage early sterilization.
[17] Ministry of Health, Law 048 of Feb. 11, 1999.

4. HYPOTHESES DEVELOPMENT

I analyze incentives related to C-sections in Brazil. I begin with the incentive related with the fact that physicians can influence the timing of births to conveniently minimize work life disruptions and maximize leisure. Then, I investigate the incentive concerning patient's preference towards C-section. Finally, I exploit financial incentives influencing physician's choice regarding birth. In this Chapter, I review the related literature and formulate predictions concerning each of these incentives.

4.1. Medical Convenience

4.1.1. Previous Literature

There are two main ways births can be advanced to take place earlier than under natural circumstances. One way is through the use of a uterus stimulant substance (e.g. synthetic oxytocin), which induces labour to begin or accelerates labour evolution once it is already in progress. A second way is through the use of C-sections, in which births occur with the use of a surgical intervention. C-sections may be scheduled on the basis of clinical indication[18] or be motivated by other factors related to physician and maternal demand. In such case, C-sections are said to be elective or planned. Even though the introduction of electronic fetal monitors have contributed to increased indications for C-sections by more accurately diagnosing fetal distress [McCusker et al. (1988)], recent increasing trends in C-section rates have been attributed to factors beyond clinical indication and related to physicians' and patients' choices.

One such factor is time convenience. Several studies investigate patients' and physicians' influence on birth timing. Patients may adjust births timing for several reasons. They may have

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[18] Most common indications for medically scheduled C-section include dystocia, breech, fetal distress, and a previous C-Section.

strong preferences for specific dates. Lo (2003) analysed Taiwanese births, finding a significantly higher incidence of C-sections on days considered to be luckier for marriage in Chinese culture. Patients may, on the other hand, have aversion to specific dates. Gans and Leigh (2012) study the occurrence of C-sections on inauspicious dates such as February 29th and April Fool's Day, documenting a significant decrease in C-sections on such 'inauspicious' dates. Patients are, however, less able to shift off births when the adjoining days fall on weekends. Financial gains may also motivate parents' decision to deliberately alter birth dates and "make the cut" regarding eligibility for a benefit based on date of birth. Child-related tax benefits have been investigated in different countries showing that patients do alter timing of births to accommodate for benefit eligibility (Dickert-Conlin and Chandra, 1999; Gans and Leigh, 2009, Neugart and Ohlsson, 2009).

For different reasons, physicians, as advisors to patients, may also have discretion regarding births, such as when to schedule a labour induction or whether to perform a C-section, and it is plausible that non-medical factors influence this decision. C-sections tend to last shorter than natural births and involve a surgical event which can be conveniently programmed according to physician's time constraints, providing more flexibility to adjust the work schedule and organize the consumption of leisure.

> *He [the attending doctor] was saying, 'I was at a birthday party, and I want this done fast because I want to go back and finish my whiskey,' she said. (The Atlantic, April 2014).*

Many studies investigate the relationship between birth timing and physician's demand for leisure, finding that C-sections are more often performed on working days than weekends (Burns et al, 1995; Brown, 1996; Chandra et al. 2004; Lefreve, 2013). This so called 'weekend effect', in which births are avoided on weekend days has increased over time, as documented by Chandra et al. (2004). Confirmation of the weekend effect is also provided by studies that have examined incidence of C-sections on weekdays according to other non-western calendars. For example in Israel, where Sunday is a working day, Cohen (1983) finds significantly more births on Sunday as compared to Saturday, which is a leisure day. Besides demand for leisure on weekends, work-related events have also been shown to affect birth timing. Days coinciding with obstetrician's professional meetings and important conferences are accompanied by a significant decline in the number of births (Gans et al., 2007).

Evidence of influence on birth timing also comes from studies that have studied the distribution of births for different times of the day. Brown (1996) finds that C-sections occur less often between midnight and 3am. Interacting weekend days with time intervals, the study finds a sharp increase in the rate of unplanned C-sections on Fridays between 3pm and 6pm, a "friday rush hour" effect. Spetz et al. (2001) find a significantly higher probability of C-sections between 4pm and midnight. The occurrence of less C-sections at night and on weekends has been found in other countries such as China (Fang, 2008), Greece (Mossialos et al., 2005a, b), Thailand (Hanvoravongchai et al., 2000), Germany (Neugart and Ohlsson, 2009), Australia (Gans and Leigh, 2008) and Brazil (Gomes, 1999).

Nevertheless, as pointed out by Lefreve (2013), a higher incidence of C-sections during working hours and on weekdays may simply be due to a scheduling effect. Physicians and patients may prefer to deliver during regular commercial hours and on weekdays when hospitals are expected to be operating at a higher capacity. This does not mean that physicians are deliberately converting natural births that would fall during leisure time to not fully medically justified C-sections to maximize leisure time. This form of supplier-inducement has not been confirmed by Lefreve's findings.

4.1.2. **Hypothesis Development**

As discussed in Chapter 3, physicians in Brazil face a demanding work schedule that involves multiple job commitments, but are simultaneously required to provide individualized assistance to private patients, having to physically attend the entire birthing process, a requirement aggravated by the fact that other non-professionals have limited participation in births. Such constrained circumstances impose additional challenges to physicians and a higher opportunity cost from natural births.

Using national natality data, I investigate the presence of convenience-related incentives for performing C-sections in Brazil. I test whether physicians take advantage of C-section scheduling properties to conveniently accommodate their working schedule, while controlling for other determinants of C-section choice. In this analysis it is important to account for differences in the incentive environment between public and private health facilities. In private hospitals, physicians have more discretion in scheduling C-sections as compared to public facilities, which are subject to stricter guidelines imposed the Ministry of Health

I examine the distribution of Brazilian births across days of the week and times of day and I test whether fewer C-sections are performed on weekends and during late night hours, as these provide more incentive for leisure opportunities.

Finding significantly less C-sections occurring during late night hours and on weekends would show a scheduling effect occurring in C-sections (*Scheduling Hypothesis*). However, as previously discussed, for planned C-sections there is a natural tendency by the physician and patient to schedule the surgical procedure during regular working hours when hospital facilities operate at a higher capacity. The fact that C-sections are shifted away from weekends and late night hours does not necessarily mean that physicians, anticipating leisure periods, intentionally choose to perform C-sections to avoid having to be called during leisure. In such case

(*Inducement Hypothesis*), one would observe an increase in the number of C-sections in the period preceding the leisure and a fall in natural births. To differentiate between these two predictions, I focus on Carnival, the most important holiday in Brazil, and examine whether the number of natural births falls before the week of the holiday.

4.2. Patients Preferences

4.2.1. Previous Literature

Expectant mothers seek obstetric advice for prenatal care and birth delivery. Like most physicians and as advisors and prescribers of medical services OB/GYNs have, in principle, considerable discretion over treatment choices. The opportunity to exert such influence on patients stems from the asymmetric information that exists between physicians and patients and the fact that patients must rely on physicians for medical decisions. As emphasized in Arrow (1963), such asymmetry is inherent to the physician-patient relationship:

> *Because medical knowledge is so complicated, the information possessed by the physician as to the consequences and possibilities of treatment is necessarily very much greater than that of the patient, or at least so it is believed by both parties. Further, both parties are aware of this informational inequality, and their relation is colored by this knowledge.*

Aware of their ability to influence patients' medical lives, physicians could purposely induce patients to consume services differently than the patients would choose if endowed with the same information level as the physician. This idea is well developed and is referred to as supplier-induced demand (SID)[19]. Under the SID hypothesis, physicians, when faced with incentives to do so, may take advantage of their superior position and influence patients to consume more services than medically indicated. Such undue influence would not be unlimited since physicians are assumed to incur disutility from prescribing unnecessary treatment (McGuire and Pauly, 1991; McGuire, 2000).

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[19] SID models are not restricted to medical relationships only. They are pertinent to other agency relationships between buyers and expert sellers, Dranove (1988).

An interesting way to investigate inducement is therefore to focus on the source of its existence, i.e., the degree of information asymmetry between patients and physicians, and compare treatment choices when such asymmetry is reduced or even eliminated. Comparing informed patients (physicians) versus non-informed patients, physicians have the medical background to access the risks and benefits of alternative procedures, are better able to judge indications for a procedure, and possess the authority to side step procedures motivated by non-clinical reasons or conversely to induce extra beneficial services when treatment falls short. Uninformed patients, on the other hand, are not able to do so as they lack medical expertise to critically evaluate treatment alternatives.

A series of studies investigate physician inducement by examining treatment choices for varying degrees of information asymmetry. Using self-reported occupation as a measure of medical information, Bunker and Brown (1974) compare surgery rates performed on faculty members of the Stanford University medical school and their spouses to three groups of less informed patients: lawyers, ministers and business graduates. As discussed, physician-patients and their spouses are relatively better informed about the net benefits of alternative treatments and thus less susceptible to undergo intensive treatment motivated by physicians' personal benefits. The study considers seven surgical procedures for which physicians are assumed to have more discretionary decision, *"… the indications for which have been commonly thought to be imprecise and subject to abuse"*. Interestingly, the study finds that physician patients and their spouses undergo between 20% to 30% more surgery and had higher rate of "nonessential" procedures compared to the other control groups.

One potential problem associated with such analysis is that physicians (and their spouses) may face lower cost regarding intensive care from more comprehensive insurance benefits or may enjoy professional courtesy and privileged access to health services. These would cause an upward bias on physicians' demand for medical services. Aware of this issue, Hay and Leahy (1982) employ survey data and a series of controls related to price factors, access to care, and perceived health status. After controlling for the possibility of differentiated price and easier access, the authors' results do not invalidate the previous Bunker and Brown findings, concluding that physicians use significantly more medical services compared to other patients.

Other studies have found contrasting results with physicians undergoing comparatively less intensive treatment. Domenigetti et al. (1993) find that physician-patients have much lower rates of surgical services than other non-physician patients. Schmid (2013) proposes a refinement of the measure of information that controls for the probability of visiting a physician and going to the hospital. The empirical results indicate that in Switzerland the number of visits and the length of stay decrease with a higher level of consumer information, consistent with the SID hypothesis.

In childbirth, more specifically, the inducement hypothesis has been investigated by examining the extent to which the physicians opt for the more intensive birth alternative: C-section. C-sections are generally assumed to be relatively more valuable to the physician for convenience and/or financial reasons, but bringing no additional benefit, and possibly harm, to the patient when they are not medically indicated (Engle and Kominiarek, 2008). Since physicians possess medical knowledge necessary to evaluate the indication of a C-section and are aware of the risks and benefits associated with the surgery, they are expected to undergo fewer C-sections. Physician-patients are also in better conditions of avoiding C-sections that appear to be not fully medically justified.

Analyzing a large sample of deliveries, Chou et. al (2006) confirms the SID hypothesis demonstrating that female Taiwanese physicians and their relatives undergo significantly less C-sections (34% and 21%, respectively) compared to women of equivalent socioeconomic status and controlling for risk factors associated with the pregnancy. This finding is corroborated by a recent study in the US conducted by Johnson and Rehavi (2013). This study finds that Californian and Texan physicians are 7% and 8%, respectively, less likely to undergo a C-section compared to other well-educated patients. Johnson and Rehavi's findings show that the most informed consumers - those able to deter non-clinically indicated motives - avoid more intensive treatment and undergo less C-sections.

I investigate this hypothesis for Brazilian physicians by asking whether physician mothers undergo less C-section as compared to other well-educated mothers. It is interesting to observe choices made by the most informed consumer in a country where clinical standards differ from well-developed health systems. Before developing this hypothesis, I will review studies about patients' preferences regarding birth in Brazil.

4.2.2. **Patients Preferences and Inducement in Brazil**

> *There are patients who absolutely refuse to have natural childbirth, well-informed patients who maintain this position out of fear … It's a cultural situation. I've seen it develop over generations. (Paulo Marinho, medical director at Perinatal. Source: NBC News: Brazilian Women Rebel Against C-section Births)*

Studies conducted on women's preference regarding birth in Brazil are mostly survey based. Results from the most recent, and only, survey conducted on a national scale, which interviewed 24,000 women across the country, show that 28% begin prenatal care planning to deliver by C-section, while this rate is only 10% in other countries. One third of the women who opted for a C-section stated fear of pain as the main reason justifying their choice. The same study finds that 85% of women undergoing a C-section had a previous C-section, confirming that the “once a C-section, always a C-section” practice is common in Brazil (Fiocruz, 2014).

Oliveira and colleagues (2002) find that even though physicians frequently stated medical reasons for a C-section (including a previous C-section, fetal stress and breech presentation), 47.5% of women that underwent a C-section mentioned reasons that did not coincide with the medical justification on their medical record.

Another study conducted among hospitals in the Sothern region of Brazil, finds that before arriving to the hospital, 40% of the women expected to undergo a C-section. They considered a vaginal birth as a risky and negative experience, while C-section was associated with better quality of care (Behague et al., 2002). According to the study, women in the public sector unable to pay for a C-section resorted to many indirect methods to obtain the procedure, such as pressuring the on-call obstetrician, seeking an obstetrician known to perform more C-sections, or proposing side payments to the physician. Fear of substandard care, particularly in the public sector with poor infrastructure and resources, can justify this preference for C-sections as access to a differentiated good: more attention from the physician, possibility of accompaniment and no need to share labour rooms.

Other studies, also interview-based, conclude that natural birth is still the preferred method among women utilizing the public as well as private health system (Barbosa at al., 2003; Carniel et al., 2007). According to those studies, women prefer natural birth, but end up having C-sections because of physician influence (Barbosa at al., 2003; Potter et al., 2001; Silva and Costa, 2002; Hopkins, 2000). Potter et al. (2001) find that approximately 76% of women who gave birth in a public facility and 70% of women who gave birth in private facilities had stated a preference for vaginal birth deliveries. A similar finding is in Perpetuo et al. (1998), which concluded that more than 70% had undergone a C-section surgery contrary to their expectations. Also in line with these results, Faundes and Perpetuo (2002) highlight that even though almost 80% of the women in their sample preferred natural birth, a C-section was performed on 72% of the private patients and on 31% of the SUS patients. According to the study, 64% of the pregnant women underwent a C-section for wrong or dubious medical indications.

The evidence presented above should be interpreted with caution. First, the surveys are subject to the response bias of stating natural birth preference as the expected recommended choice, but also, as many studies document, women's preferences for natural birth changed as the delivery period approached, suggesting that other factors were in place.

4.2.3. Hypothesis Development

Even though there is a strong perception that physicians' influence plays an important role on the high incidence of C-sections in the country, there is no study that examines physicians' preferences regarding birth choices in Brazil.

I focus on this question and investigate if Brazilian physicians, who are presumably the most informed patients and thus the most aware of the risks associated with C-section, undergo this procedure less often than other women of equivalent socio-economic status. Assuming that physicians consider C-section as a profitable procedure, but unsafe to mothers and infants when not clinically indicated, we would expect physician-patients in Brazil to undergo less C-section as compared to other well-educated mothers, as documented by previous literature.

To investigate if female Brazilian physicians (informed patients) undergo less C-section as compared to other comparable mothers (uninformed patients), I exploit institutional differences that provide different incentives for C-section. For births occurring in public health facilities, physicians are paid a fixed salary and thus intensive treatment is not financially reimbursed on the margin. For births occurring in private health facilities, physicians receive fee-for-service and thus have more financial incentives to provide additional C-sections. In private health facilities, according to the SID hypothesis, physicians, being aware of the risks associated with non-clinically indicated C-sections, are expected to undergo less of this procedure as compared to less informed patients. Public facilities are subject to stricter guidelines from the Ministry of Health regarding birth practices, thus we expect the rates of C-sections in public facilities to be lower than private facilities for both physicians and non-physicians. Finally, for public facilities, since C-sections are not reimbursed on the margin, physicians and non-physicians should undergo the same amount of C-section.

4.3. Financial Incentives

4.3.1. Previous Literature

The supplier inducement demand (SID) hypothesis states that physicians can move patients away from their optimal level of care when incentives to do so are present. Early models on SID, attributed to Evans (1974) and Fuchs (1978), defined supplier inducement and established a constraint on the physician's ability to induce extra services by assuming the physician balanced net income against some form of disutility or 'psychic cost' from inducing unnecessary services onto the patient.

The notion that physicians can influence patient demand contrasts with the standard economic assumptions of full information, consumer autonomy and independence of the demand and supply schedules as highlighted in Reinhardt (1989):

> *The issue of physician-induced demand obviously goes straight to the heart of probably the major controversy in contemporary health policy, namely, the question of whether adequate control over resource allocation to and within health care is best achieved through demand side…or through regulatory controls on the supply side.*

Initial empirical literature on inducement has focused on physician availability and cross-sectional relationships between physician-population ratios and market outcomes, such as price and utilization. The idea is that an increase in the availability of physicians negatively affects individual earnings, providing incentive for inducement activities. Several studies document a positive relationship between supply of physicians and surgery rates (Fuchs,1978; Cromwell and Mitchell;1986, Wilensky and Rossiter, 1983; Birch,1988, Grytten et al. 1990).

In childbirth, more specifically, Tussing and Wojtowycz (1992) study the determinants of caesarean section in New York while also testing for the SID hypothesis. The study finds no positive statistically significant relationship between OB/GYN density and rates of caesarean, however omitted regional differences correlated with density and utilization may affect the results. This early empirical literature has been subject to criticisms in addressing the endogeneity of OB/GYN supply. Using childbirth as an example, Dranove and Wehner (1994) find that the two stage least square method applied by previous studies could lead to incorrect conclusions, for example that number of births would increase with an increase in physician supply.

The early literature has been followed by studies that exploit exogenous changes in physicians' gains, instead of merely changes in physician supply. Good evidence in this respect can be found in the study by Gruber and Ownings (1996), who exploited the change in income of OB/GYNs from the fall in fertility rates among US women between 1970 and 1982. The negative income shock resulting from lower number of children being born presumably provides incentives for physicians to substitute towards the higher reimbursed procedure (C-section) to recoup losses from the income shock. They find that a 10% decrease in fertility rate increases the likelihood of a C-section by 0.97 percentage points. The magnitude of the effect found by Gruber and Ownings is rather small, a one percent increase in caesarean section procedures increases income by only 0.5%, even though the income drop resulting from the fertility shock is about 5%.

A related literature is concerned with the impact of changes in physicians' reimbursement fees. Reimbursement fees directly affect the marginal utility of income, creating ready incentives for inducement activities. Besides providing direct incentives for inducement, fee change also offer an advantage from an empirical perspective since they stem from administered price changes and can be regarded more readily as exogenous to the physician's practice and the patient.

> *…Even if physician supply levels were the factor of interest, studies that employ physician/population ratios are not necessarily the most direct test of supplier-induced demand. This is because the supply of physicians per se (or increases thereof) is not the catalyst in the hypothesized inducement decision. Rather, it is the impact that an increased supply has on fees (and, ultimately, on incomes) that prompts a reaction. .... In the demand inducement model, a fall in price provides a cue to physicians to generate additional demand. A more direct test of the demand inducement hypothesis is therefore to examine the impact of changing fees on use. This approach is important… because demand inducement may exist even when physician supply is static. (Rice and Labelle,1989).*

Facing a fee reduction, physicians may respond to lost revenue by increasing volume of services or by substituting towards more profitable procedures. According to the theory, the strength of the income effect relative to the substitution effect following a fee change is key to determining the behavioral volume response (McGuire and Pauly, 1991; McGuire, 2000). Through an income effect, a fee reduction reduces income and provides incentive to increase volume of services. Through a substitution effect, the physician substitutes towards more relatively profitable services. Thus, overall the impact of a fee decline in the quantity of the services is ambiguous and given this theoretical ambiguity, empirical literature has attempted to shed light on the question by examining the settings under which the substitution effect would be preponderant and vice-versa.

Evidence of inducement, and thus the dominance of the income effect, is found in the US for Medicare policies. A well-known study is provided by Rice (1983). In 1976, Medicare redefined fees according to Colorado-wide averages, which resulted in a relative decrease in reimbursement rates for physicians located in urban areas, while the opposite held true for physicians located elsewhere in the state. The study finds evidence consistent with demand inducement, with urban physicians responding negatively to price declines (by increasing intensity of medical services and surgery, and quantity of surgical services and laboratory tests), while non-urban physicians responded positively.

Nguyen and Derrick (1997) find that, regarding the fee change policy mandated with the introduction of the Omnibus Budget Reconciliation Act (OBRA89), ‘losing’ medical practices recouped about 38 cents for every dollar decrease in price. Among the ‘winners’, there was no significant change in behavior. At the specialty level, the study finds mixed results regarding the volume response among losing practices (for radiologists, for instance, volume actually decreased following the fee decrease). A Medicare policy which reduced thoracic surgeons’ income by approximately 26% is investigated by (Yip, (1998) who finds a negative and significant income effect, mainly for more intensive procedures (i.e. CABG-3 or CABG-4), and evidence of spillover into the private sector following the policy change.

Evidence concerning the market of pharmaceutical drugs is provided by Jacobson et al (2010) who find that physicians switched from administering drugs that experienced the largest cuts in reimbursement (like carboplatin and paclitaxel) to other high-margin drugs in the treatment of lung cancer (such as docetaxel) after a Medicare fee change.

Evidence of inducement, and thus preponderant income effects found in the studies above mentioned does not necessarily apply to Medicaid physicians as argued in Gruber et al. 1999, because Medicaid doctors tend to derive a relatively smaller share of income from Medicaid patients as compared to Medicare, making it possible that substitution effects dominate income effects, and resulting in a positive response to fee changes. Exploiting cross-section variations in differential reimbursement for births in nine states over five years, the authors find evidence consistent with the substitution effect, specifically; each $100 dollar increase in fees raises caesarean rates by 0.7 percentage points.

In Gruber et al (1999), California and Florida account for 60% of the sample which can make estimation sensitive to their importance. In a recent replication of the study, Grant (2009) re-estimated Gruber at al.'s model with the inclusion of state trends and also refining controls of maternal distress. The results of this replication report only about one-quarter of the original predicted effects.

Apart from dataset specification, measurement and state trend considerations, another problem is that states may set up reimbursement fees according to their C-section rates and thus, higher fee differentials reflect higher demand for C-section. Gruber's inclusion of state fixed effects partially alleviates this problem. Finally, the absence of a control group, unaffected by the fee changes, prevents controlling for external factors unrelated to the fee changes that impact the probability of C-section, factors which may have occurred simultaneously with the changes in fees. Reduced reimbursement may have been an important strategy used to decrease C-section rates, but probably not the only factor in place.

Other studies regarding childbirth fee incentives have focused on the private health insurance market. Keeler and Fok (1996) exploits a fee equalization policy from a large

Preferred Provider Organization in California Blue Cross that increased the natural birth fee by 3% and reduced the C-Section fee to equalize it to the natural fee, an average decrease of 18%. After adjusting for risk factors, the authors find a nonsignificant decrease in the rate of C-section. According to them, this finding is consistent with the results of equalization policies for other states. The non-significant finding, however, may be due to a cancelling out of the income and substitution effects predicted in the theory, rather than the absence of inducement behaviour, and this may be behind the reason the authors recommend fee equalization, despite the empirical finding.

A recent study, closer to my own, considers the impact of fee changes on differently compensated physicians. Using Medicaid reimbursement data, Alexander (2013) finds that after an increase in the relative reimbursement for C-sections, fee-for-service physicians increase the use of this procedure while for salaried physicians the level of C-sections performed remain unchanged. Even though the study provides additional evidence of inducement, the absence of a control group unaffected by the policy change does not allow to separate other concomitant environmental changes that may have affected the C-section trends among both types of physicians.

Besides financial remuneration, other incentives affect the choice for C-section, as discussed in Chapter 3. In the next section, I present a model that incorporates time input as a determinant of C-section. In my empirical analyses I consider the impact of a fee change policy instituted in Brazil by SUS. My setting allows the inclusion of different control groups, unaffected by the policy change, to account for other environmental changes in place.

4.3.2. **Model of Physician Utility**

Standard utility-based models that investigate the SID hypothesis [Gruber et al.,1999; Alexander (2013)] typically assume that that time costs incurred by physicians are similar regarding birth alternatives. This is because in most cases the physician is supported by a delivery medical staff and can remotely assist births, being physically demanded only towards the final or most decisive moments of the delivery. Because time costs are assumed to be equal between C-section and natural births in many settings, analytical models have focused on exploiting the effect of fee differences between the two types of birth.

> *Cesarean delivery is a particular useful example [to study the impact of fee changes] because the underlying costs of the procedure in terms of physician time and intensity are considered to be similar to the alternative, vaginal birth, yet reimbursement has traditionally been higher. (Gruber et al., 1999)*

However, the equal time assumption does not hold for the Brazilian case. As discussed in Chapter 3, the model of individualized private assistance in which the physician needs to be physically present during the entire duration of birth, coupled with the busy physician work life with multiple jobs requiring a commute to different job sites, imply that time costs faced by physicians are important in the private sector. In the public, even though physicians may face less direct time pressures, once they are hired and paid on a per-shift basis, there may also exist incentives privileging C-section, as many private physicians transport practices from the private to the public sector (Hopkins, 1998) and also because C-sections, lasting significantly shorter, allow cases to be solved during the same shift (Freitas, 1999).

Because in other health settings, the time factor may be less important since physicians are only most actively involved in the final moments of birth (or during complications), traditional models of physician utility have considered simple nominal differences in reimbursement fees between the two types of births. For Brazil however, time differences are relevant, as discussed in Chapter 3, and to these physicians it only makes sense to calculate reimbursement fees relative to time requirements when considering financial compensation from births.

In this section, I thus develop a model of physician behavior that emphasizes the time costs associated with natural births and C-sections. Physicians decide how many hours to allocate to C-section versus natural births and can influence the proportion of births in each category by choosing to perform more of one type, for example, C-sections, without a clear medical indication.

I assume that C-sections represent a more efficient use of the physician's time input. This assumption captures the practicalities of the opportunity costs facing physicians in Brazil. C-sections can be performed using much less of the physician's time, and they can be more programmable - minimizing life disruptions and maximizing quantity of patients.

The physician can be viewed as producing two goods: natural births and C-sections, with C-section requiring much less of the physician's time input. Accordingly, define t_N as the time, measured in hours per birth, required by the physician to perform a natural birth and t_C as the time required to perform a C-section. It is assumed that $t_N = kt_C, k>1$.

Denote C as the number of C-sections and N the number of natural births performed by the physician. The physician spends a total of $\overline{H}$ working hours in birth practices:

$$t_c C + k t_c N = \overline{H} \qquad (1)$$

Physicians are reimbursed W_N dollars for a natural birth and W_C for a C-section. I assume that physicians incur a monetary cost of a unit of time given by $m > 0$. Thus, physician income can be written as:

$$Y = W_N N + W_C C - (t_C C + k t_C N)m \qquad (2)$$

In countries with high clinical standards, patients are assumed to prefer the clinically indicated amount of C-sections. However, as discussed in Sections 2.2 and 3.2, given the poor quality and low standard associated with natural births, particularly the limited implementation of recommended practices and even obstetric violence, many women would feel unhappy with a natural birth, even if clinically indicated. In this sense, C-sections in Brazil have value that go beyond purely medical indications and women have a willingness to pay for those attributes.

Following existing literature (Maguire and Pauly, 1991; Gruber et al.1990), I assume that physicians incur disutility from deviating from the clinically indicated rate of C-section, C^*_{CLIN}. However, this disutility is alleviated by introducing patients' preference towards C-section, C^*_{PAT}. If the physician is being a good agent for the patient, and the patient may suffer violence and low-quality care in natural birth, then the physician would derive utility from satisfying patient preferences. I incorporate this into the physician's problem by assuming a quadratic loss function, L, in which deviations between the actual C-sections and the clinically determined level of C-section C^*_{CLIN} and patients preferred level of C-section, C^*_{PAT} are assigned a monetary value. The physician is assumed to weigh differently the two effects, i.e. $\alpha \in [0,1]$.

$$L = \gamma[C - \alpha C^*_{CLIN} - (1 - \alpha)C^*_{PAT}]^2 \qquad (3)$$

The physician chooses C and N to solve the following problem:

$$\max_{C,N} U = Y - \gamma[C - \alpha C^{*}_{CLIN} - (1-\alpha)C^{*}_{PAT}]^2$$
$$\text{s.t.}\, t_C C + k t_C N = \bar{H} \qquad (5)$$

Substitute N=(H-t_cC)/kt_c from eq. 1, into the objective function, to solve the unconstrained problem:

$$L = W_N\left[\left(\frac{\mathrm{H}}{\mathrm{ktc}}\right) - \left(\frac{\mathrm{C}}{\mathrm{k}}\right)\right] + W_C C - Hm - \gamma[C - \alpha C^{*}_{CLIN} - (1-\alpha)C^{*}_{PAT}]^2 \qquad (6)$$

Taking the first-order condition:

$$\frac{\partial L}{\partial C} = W_c - W_N(\frac{1}{k}) - 2\,\gamma[C - \alpha C^{*}_{CLIN} - (1-\alpha)C^{*}_{PAT}] = 0 \qquad (7)$$

$$W_c = W_N\left(\frac{1}{k}\right) + 2\,\gamma[C - \alpha C^{*}_{CLIN} - (1-\alpha)C^{*}_{PAT}] \qquad (8)$$

From the first-order condition, choosing another C-section needs to be worth the gain relative to time against any inducement disutility incurred by the physician. Next, I identify three groups of physicians and analyze the incentives underlying the choice of birth type faced by each group.

4.3.3. <u>Hypotheses Development</u>

A different set of incentives exists for physicians working in public and private hospitals, as Hopkins (1998) emphasizes:

> *The paradox is that the same doctors I worked closely with in the public hospitals also attend private patients. Their rates of cesarean section among private patients are as high as any other obstetrician who attends deliveries in the private hospitals. It is clear that doctors apply different criteria in deciding on cesareans depending on who is their patient*

and in what hospital she delivers. But it is also clear that different sets of incentives are operating in the public and private sectors.

Next, I identify three groups of physicians and discuss the implications of the model for group.

4.3.3.1. Private Physicians

Physicians working in private hospitals are reimbursed per birth, on a fee-for-service basis, through private insurance fees and out of pocket payments. For these physicians, C-sections pay at least as much as natural births. Thus, in the model above, $W_N \leq W_C$.

As C-sections are more time efficient compared to natural births and also reimbursed more highly, the physician's problem described in the model above would involve a corner solution in which only C-sections would be performed, if it was not for the assumption that physicians face disutility from deviating from the clinically indicated amount of C-sections.

For private physicians however, this disutility is mitigated given the fact that physicians face less strict guidelines and protocols regarding birth procedures, and thus have more discretion in deciding between birth alternatives. To the extent that patients directly contract physicians' services for their maternity medical needs and are able to maintain a close relationship with the physician, as discussed in section 2.2, physicians in the private sector value patients' preferences as relatively more important than the amount of clinically indicated C-sections. In the physician's loss function defined in eq. 3, α can be considered as being less than 0.5, with physicians weighing C^*_{PAT} higher than C^*_{CLIN}.

In other words, private physicians tolerate a higher amount of C-sections, because patients' desire for C-section is deemed more important than following the clinically recommended amount of C-sections. This can be seen by the high rates of C-section verified among private hospitals. Patients' preferences cause the disutility from inducing extra C-sections to be less strong, causing the observed C-section equilibrium to occur almost at a corner point.

4.3.3.2. Public Physicians

Public physicians, on the other hand, receive a fixed salary per shift, $Y = \bar{Y}$, and the time incentive to abbreviate births, even though it does not affect income earned, may impact physicians' behavior more indirectly - either allowing them to consume more resting time during the shift, to "solve all cases" during the same shift (Freitas, 1999), or to garner a better reputation (Diniz and Chacham, 2006) as discussed in section 3.1.2.

In public hospitals, the presence of institutional guidelines and stricter protocols regarding birth practices imply that public physicians, as opposed to private, regard deviations from the clinically amount of C-sections relatively more highly than following patient preference for C-section. In the physicians loss function described above (eq. 3), α can be considered as being higher than 0.5, with physicians weighing C^*_{CLIN} higher than C^*_{PAT}.

As a result, even if patient preferences would reduce the disutility from inducing C-sections, public guidelines operate in the opposite direction, increasing loss from performing C-section above the clinically recommended rate. This is the reason we observe fewer C-sections taking place in public facilities, even though the rates remain much higher than recommended by international organizations.

4.3.3.3. Private Contracted by SUS Physicians

In Brazil, there are also physicians that attend public births but work in private hospitals. Such hospitals are affiliated with SUS. This group of physicians attend both public and private patients and are remunerated differently for each type. In attending public patients, private physicians are reimbursed according to fees defined by the national SUS schedule. The SUS schedule reimburses natural births higher than C-sections as a financial incentive to promote natural births in its network, i.e. in terms of the model $W_N > W_C$.

The differential in income is however, rather small (natural birth fee is $87.5 while C-section fee is $75), especially when compared to the large time input necessary to perform natural births, i.e. k is large in the model.

From the first-order condition (eq. 8), choosing another C-section needs to be worth more than the income lost from a natural birth plus any inducement disutility. However, since k is large, even a large increase in W_N may have little impact.

For these physicians, time costs associated with natural birth are much larger in comparison to the fee earned, which makes C-section more profitable when considering reimbursement relative to time i.e. $\frac{W_C}{t_C} \gg \frac{W_N}{t_N}$. Given the substantial difference in time costs between the two procedures, the difference in the fees may not be enough to compensate the physician for the hours spent with the patient during a natural birth delivery. As stated by some obstetricians, even if the (nominal) fee for natural birth quadruples in Brazil, it is still not enough to make physicians switch to the procedure.

4.3.3.4. Effect of a Change in the SUS fees

Under this setting, what would be the effect of a change in the SUS schedule? In October 2007, with the goal of stimulating natural births in hospitals, the government increased the fee for natural birth by 27% and the fee for C-section by 23%.

> *We are seeking financial incentives to improve natural birth. We are seeking to reduce cesareans. For women and children's health, the more beneficial is a natural birth. The financial benefit for us is secondary at the moment.* (Agenor Alvares, former Ministry of Health, Agencia Brasil, May 2006, my translation).

The effect of this policy is as yet unknown, although given what we know about time difference and patient preferences, it is unlikely that a small change will matter much.

Since physicians in public hospitals are paid on a salary basis, they are presumably not affected by the fee changes. Private physicians should not be impacted by the regulation either. I thus focus on private physicians of hospitals which are affiliated with SUS. This group of physicians are reimbursed according to the SUS fee schedule and thus potentially impacted by the policy change. As they receive on a fee-for-service basis, they can respond to the incentives created. I test if the increase in fees was enough to encourage physicians belonging to SUS affiliated hospitals to increase their rates of natural birth.

5. DATA

This chapter describes the five data sources and main variables of interest used in my analyses. My main source of data consists of information tabulated from birth certificates of live births that occurred in the national territory of Brazil (SINASC) provided by the Ministry of Health. My second source of data is a health facility census, also collected by the Ministry of Health (CNES). A third data source contains inpatient hospital data from procedures covered by SUS (SIH). Other sources used are mortality data provided by the Ministry of Health (SIM) and occupation data tabulated by the Ministry of Labor (CBO).

SINASC is an acronym for *Sistema de Informacao Sobre Nascidos Vivos.* This Information System on Live Births contains all live births that occurred in the national territory. The system was developed by the Ministry of Health to collect vital statistics. The SINASC form is filled out by a nurse or by hospital staff where the birth took place. One copy is retained by the health facility in which birth took place, another goes to the secretary of health of the municipality where the mother lives and a third copy stays with the mother to be used for birth registration purposes. Even though completion of the form is voluntary, health facilities have willingly adhered to the program. Since its implementation in 1990, coverage has increased. In 2006, it is estimated that 91.8% of total births were covered by the SINASC. The coverage has increased to 97% in 2010 and reached the total 100% of births in 2011. The SINASC collects information on the birth (location, facility, time and date), on mother characteristics, and on pregnancy, delivery, and newborn characteristics as shown in Table 1.

The CNES, a National Health Facilities Census, was instituted in 2000 by the Ministry of Health to increase network identification and improve health service management. It currently covers over 264,995 health facilities, including all hospitals and most ambulatory centers. The information includes infrastructure, type of services provided, and labor force.

The SIH, a Hospital Impatient Information System processes and reimburses all inpatient care provided to public patients regardless whether the care occurred in the public facilities or through the contracted facilities from the private sector.

From the natality data (SINASC) I construct variables related to the birth, the mother and the infant (Table I). I also collect income per capita information for each municipality.

From 2006 to 2009, there are 10,831,167 births registered in hospitals or other health facilities in Brazil. I focus on mothers that are 50 years of age or younger and delivering their first births (parity zero) that are a single gestation above 22 weeks. First births allow eliminating the bias arising from having obtained a previous C-section, since in Brazil a previous C-section virtually guarantees the procedure will be used again in the following birth (Hopkins, 1998). Higher-order gestations and gestations below 22 weeks naturally carry a higher risk and thus are more likely to require a C-section. Using Birth_Facility_Id, I merge census information available from CNES, which allows me to classify facilities as belonging to the public and private sectors. Merging data from SINASC and CBO allows me to match occupation codes to their respective descriptions.

My final sample consists of 4,558,077 births. Table II presents the summary statistics of my sample stratified by type of facility and by type of birth, Panel A and B, respectively. From Panel A, I note that 52.6% of the births were delivered through C-sections in the country between 2006-2009, and 61.7% of these births took place in private health facilities.

TABLE I – SINASC VARIABLES

Variable	**Description**	**Categories**
Place_Birth	Place of birth	1: Hospital or other health facility 2: Home or Other
Birth_Facility_Id	ID of the health facility of birth	
Birth District_ Id	ID of the district of birth	
Birth_Municipal_Id_Birth	ID of the municipal area of birth	
Birth_Municipal_GDP	GPD of the municipal area of birth	
Date_of_Birth	Date of birth	
Time_ of_ Birth	Time of birth	
Ces	Type of birth	1: C-section 0: Vaginal
Mother_District_Id	Mother's residence district Id	
Mother_Municipal_Id	Mother's residence municipal Id	
Age	Mother's age	In years
Race	Mother's race	*White* *Black* *Yellow* *Pardo* *Indigenous*
Married	Mother's marital status	1: Married 2: Single, widowed or divorced
Years of School	Mother's number of school years	Up to 11 years
		Secondary: 12 years of more
Occup	Mother's occupation	Mother's self-reported occupation according to the National Table of Occupations (CBO)
Live_Children	Mother's number of live children	
Deceased_Children	Mother's number of deceased children	
Gestation term	Number of gestational weeks	Term_27: 22 to 27 Term31: 28 to 31 Term_36: 32 to 36 Term_41: 37 to 41 Term_42plus: 42 or more
Pregnancy	Gestation type	1: Single 2: Double 3: Triple or more
Care	Number of pre-natal consultations	1: None 2: 1 to 3 3: 4 to 6

		4: 7 or more
Female	Infant’s gender	1: Female 0: Male
APGAR_1	APGAR obtained the first minute	
APGAR_5	APGAR obtained the fifth minute	
Weight	Infant’s weight	In grams
Anomaly	Congenital Anomaly	1: presence of anomaly 0: otherwise

The average mother in the sample is 23 years old. A total of 50.2% of the women in the sample are pardo[20], followed by white (48%). Yellow, black and indigenous women account for 1.8% of the sample. Married women correspond to 34% of the mothers and most mothers have years of schooling corresponding to secondary or less education. 92.6% delivered between 37th and 41st weeks of gestation and 30% of the mothers had had between 4 and 6 prenatal consultations, with 62% having 7 or more. Regarding infants, 48% are female and average weight is 3, 142 grams. Congenital anomaly exists in 0.7% of the babies.

Table II, panel B suggests that C-section is more likely among women who are white, older, married, more educated, and who undergo more pre-natal consultations. This is stronger among women in the private sector. Such results, higher social-economic status women undergoing more C-sections, are consistent with previous research (Tussing and Wojtowycz 1992; Barros et al., 1991, Hopkins, 2000).

C-section rates in Brazil are positively related with education and income levels. To see how unadjusted C-section rates vary across different levels of education, I consider the mother's years of education and self-reported occupation. Table III reports caesarean rates among different levels of education - across the combined private and public sectors, as well as each separate sector.

The proportion of C-section among first-birth singletons of women at least 22 weeks pregnant increases with education status in both public and private institutions. The biggest effect seems to be between primary and secondary education attainment. The proportion of C-section in private facilities starts at an already high level for women with no education (40%), increases to about 60% for women having fundamental education and reaches 90% for women

[20] In Brazil, *pardo* is a race/skin color category used by the Brazilian Institute of Geography and Statistics (IBGE) in Brazilian censuses. It is a Portuguese word that encompasses various shades of brown (Telles, 2014).

TABLE II – SUMMARY STATISTICS

Panel A: Summary statistics by facility type

Variable	Full		Public Facility		Private Facility		Diff
	N	Mean	N	Mean	N	Mean	
ces	4,558,077	0.526	1,744,618	0.378	2,813,459	0.617	-0.239 ***
public	4,558,077	0.383	1,744,618	1.000	2,813,459		
age	4,558,077	23	1,744,618	21	2,813,459	24	-2.308 ***
white	4,558,077	0.480	1,744,618	0.314	2,813,459	0.582	-0.269 ***
black	4,558,077	0.014	1,744,618	0.018	2,813,459	0.011	0.007 ***
yellow	4,558,077	0.002	1,744,618	0.002	2,813,459	0.002	0.000 **
indigenous	4,558,077	0.002	1,744,618	0.004	2,813,459	0.001	0.002 ***
secondary	4,558,077	0.196	1,744,618	0.098	2,813,459	0.257	-0.160 ***
married	4,558,077	0.341	1,744,618	0.227	2,813,459	0.411	-0.184 ***
term_31	4,558,077	0.007	1,744,618	0.009	2,813,459	0.006	0.003 ***
term_36	4,558,077	0.056	1,744,618	0.065	2,813,459	0.051	0.013 ***
term_41	4,558,077	0.926	1,744,618	0.911	2,813,459	0.935	-0.024 ***
term_42plus	4,558,077	0.007	1,744,618	0.010	2,813,459	0.005	0.005 ***
care_3	4,558,077	0.055	1,744,618	0.089	2,813,459	0.034	0.055 ***
care_6	4,558,077	0.301	1,744,618	0.395	2,813,459	0.243	0.152 ***
care_7plus	4,558,077	0.623	1,744,618	0.485	2,813,459	0.709	-0.223 ***
female	4,558,077	0.486	1,744,618	0.486	2,813,459	0.486	0.000 ***
weight	4,558,077	3142	1,744,618	3121	2,813,459	3154	-33.3 ***
anomaly	4,558,077	0.007	1,744,618	0.008	2,813,459	0.006	0.002 ***

Panel B: Summary statistics by type of birth

Variable	Full		Vaginal deliveries		C-sections		Diff
	N	Mean	N	Mean	N	Mean	
ces	4,558,077	0.53	2,162,716	0	2,395,361	1	
public	4,558,077	0.38	2,162,716	0.50	2,395,361	0.28	0.226 ***
age	4,558,077	23	2,162,716	21	2,395,361	24	-3.604 ***
white	4,558,077	0.48	2,162,716	0.38	2,395,361	0.57	-0.195 ***
black	4,558,077	0.01	2,162,716	0.02	2,395,361	0.01	0.004 ***
yellow	4,558,077	0.00	2,162,716	0.00	2,395,361	0.00	0.000 ***
indigenous	4,558,077	0.00	2,162,716	0.00	2,395,361	0.00	0.002 ***
secondary	4,558,077	0.20	2,162,716	0.11	2,395,361	0.28	-0.172 ***
married	4,558,077	0.34	2,162,716	0.23	2,395,361	0.44	-0.206 ***
term_31	4,558,077	0.01	2,162,716	0.01	2,395,361	0.01	0.001 ***
term_36	4,558,077	0.06	2,162,716	0.05	2,395,361	0.06	-0.004 ***
term_41	4,558,077	0.93	2,162,716	0.93	2,395,361	0.93	0.000
term_42plus	4,558,077	0.01	2,162,716	0.01	2,395,361	0.01	-0.001 ***
care_3	4,558,077	0.05	2,162,716	0.08	2,395,361	0.03	0.052 ***
care_6	4,558,077	0.30	2,162,716	0.38	2,395,361	0.23	0.153 ***
care_7plus	4,558,077	0.62	2,162,716	0.51	2,395,361	0.73	-0.217 ***
female	4,558,077	0.49	2,162,716	0.50	2,395,361	0.48	0.019 ***
weight	4,558,077	3142	2,162,716	3088	2,395,361	3190	-102.7 ***
anomaly	4,558,077	0.01	2,162,716	0.01	2,395,361	0.01	-0.002 ***

TABLE III – BIRTHS AND EDUCATION LEVELS

	%		N	
Overall	**Natural**	**C-section**	**Natural**	**C-section**
No education	65.4	34.6	16,778	8,877
1 to 3 years	61.5	38.5	128,420	80,319
4 to 7 years	61.8	38.2	662,488	409,373
8 to 11 years	48.1	51.9	1,091,937	1,180,090
High School	30.8	69.2	201,862	453,747
College	12.5	87.5	29,399	205,996
Total			2,130,884	2,338,402

	%		N	
Private	**Natural**	**C-section**	**Natural**	**C-section**
No education	59.7	40.3	6,059	4,085
1 to 3 years	55.9	44.1	53,939	42,574
4 to 7 years	57.3	42.7	311,645	232,260
8 to 11 years	40.0	60.0	562,704	843,116
High School	23.6	76.4	118,455	383,391
College	10.7	89.3	23,577	196,590
Total			1,076,379	1,702,016

	%		N	
Public	**Natural**	**C-section**	**Natural**	**C-section**
No education	69.1	30.9	10,719	4,792
1 to 3 years	66.4	33.6	74,481	37,745
4 to 7 years	66.5	33.5	350,843	177,113
8 to 11 years	61.1	38.9	529,233	336,974
High School	54.2	45.8	83,407	70,356
College	38.2	61.8	5,822	9,406
Total			1,054,505	636,386

with college degree. In the public institutions, C-section rates are roughly 31% for women with no education, increasing to 39% for women with fundamental education, 45.8% for women with high school and reaching 61.8% among highly educated women.

Since my data do not have information about mother's income, I construct the same tables considering GDP of the municipal place of birth. There are 5,600 designated municipal areas in Brazil. This is the most detailed aggregation level for income information available (i.e. unlike the US, zipcode income information is not available). I separate municipalities into income deciles. I have also considered municipalities according to their Human Development Index (HDI). Table IV reports C-sections by deciles in terms of GDP and HDI for both public and private institutions. As we can see, the proportion of C-section is increasing with both indicators.

Figure 3 shows Brazil's regional differences in C-section rates for 2010. From the figures, the incidence of high C-section rates is widespread, but occurs more predominantly in the Southeast and South regions, where rates reach more than 60%. These two regions are the most urbanized, privatized and highest income regions in the country. The lowest rates are registered in the North region, with Acre (AC) having the lowest rate in the country, 29%, despite this being almost twice the WHO recommended rate (15%).

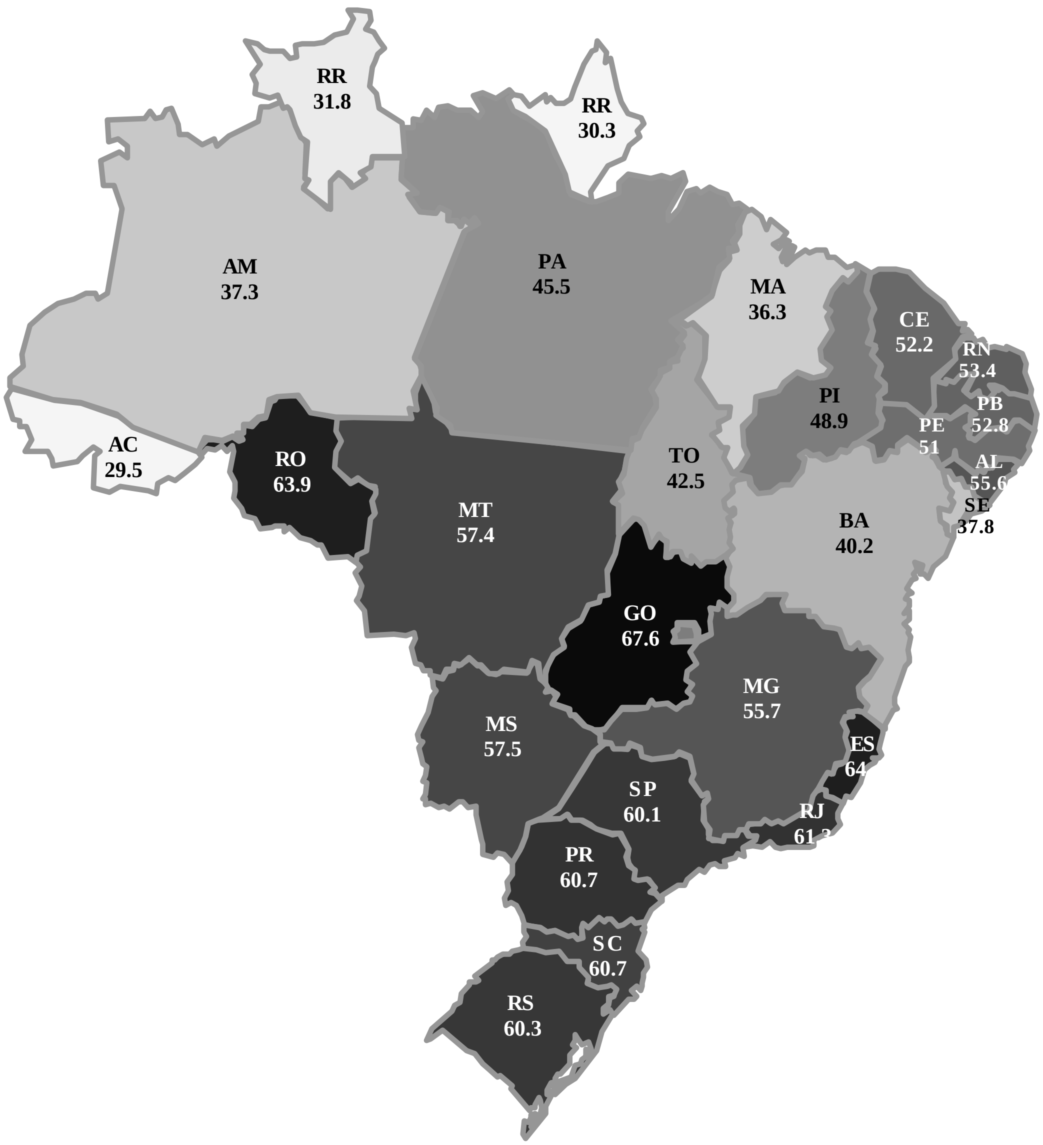
TABLE IV –BIRTHS AND INCOME

Overall	GDP				IDH			
Deciles	%		N		%		N	
	Natural	C-section	Natural	C-section	Natural	C-section	Natural	C-section
1	74.4	25.6	81,884	28,130	78.8	21.2	69,028	18,565
2	72.1	27.9	94,061	36,370	74.1	25.9	67,974	23,799
3	69.2	30.8	101,958	45,393	70.9	29.1	102,332	42,035
4	63.6	36.4	148,323	84,964	66.9	33.1	109,659	54,338
5	55.9	44.1	187,389	147,972	59.7	40.3	154,850	104,585
6	48.7	51.3	136,408	143,449	54.9	45.1	153,765	126,220
7	46.4	53.6	225,891	260,817	49.9	50.1	109,354	109,710
8	44.3	55.7	221,682	279,157	45.8	54.2	181,597	214,713
9	42.6	57.4	290,370	391,699	44.8	55.2	307,511	378,553
10	41.1	58.9	642,918	920,451	40.9	59.1	874,814	1,265,884

Private	GDP				IDH			
Deciles	%		N		%		N	
	Natural	C-section	Natural	C-section	Natural	C-section	Natural	C-section
1	68.9	31.1	18,949	8,541	75.8	24.2	12,121	3,877
2	70.3	29.7	32,567	13,728	74.5	25.5	20,605	7,059
3	64.8	35.2	36,393	19,770	67.8	32.2	31,237	14,853
4	61.7	38.3	69,840	43,337	65.2	34.8	53,563	28,628
5	53.0	47.0	116,425	103,367	57.7	42.3	92,364	67,716
6	44.5	55.5	90,860	113,140	52.0	48.0	82,940	76,532
7	39.0	61.0	110,291	172,790	45.0	55.0	56,553	69,137
8	38.3	61.7	127,065	204,390	42.3	57.7	130,133	177,852
9	36.2	63.8	175,691	309,705	37.2	62.8	153,638	259,299
10	29.5	70.5	298,298	713,248	30.8	69.2	443,225	997,063

Public	GDP				GDP			
Deciles	%		N		%		N	
	Natural	C-section	Natural	C-section	Natural	C-section	Natural	C-section
1	76.3	23.7	62,935	19,589	79.5	20.5	56,907	14,688
2	73.1	26.9	61,494	22,642	73.9	26.1	47,369	16,740
3	71.9	28.1	65,565	25,623	72.3	27.7	71,095	27,182
4	65.3	34.7	78,483	41,627	68.6	31.4	56,096	25,710
5	61.4	38.6	70,964	44,605	62.9	37.1	62,486	36,869
6	60.0	40.0	45,548	30,309	58.8	41.2	70,825	49,688
7	56.8	43.2	115,600	88,027	56.5	43.5	52,801	40,573
8	55.9	44.1	94,617	74,767	58.3	41.7	51,464	36,861
9	58.3	41.7	114,679	81,994	56.3	43.7	153,873	119,254
10	62.5	37.5	344,620	207,203	61.6	38.4	431,589	268,821

FIGURE 3 – C-section Rates in Brazilian States



6. ANALYSES, METHODS AND RESULTS

6.1. <u>Medical Convenience</u>

As discussed in Chapter 4, C-sections and other forms of birth induction allow births to be advanced to take place earlier than when they would naturally occur. In this section, I test whether physicians make use of such practices to influence the timing of births for convenience-related motives, including leisure demand. Convenience incentives associated with C-sections stem from the fact that C-sections are faster and involve a surgical procedure that can be scheduled in advance, making the procedure more flexible and predictable when compared to natural births.

In Brazil, the busy work schedule faced by physicians who hold multiple job commitments, the requirement of full-time dedication to a labouring patient and the low degree of delegation of birthing to other non-physician professionals can make C-sections even more valuable to physicians constrained by time. Since C-sections can be more easily managed, organized and arranged in advance, they can allow physicians to better plan their work routine, choose a more efficient allocation of time, and shift these procedures to more convenient times.

It is generally the case that physicians prefer to enjoy leisure time on weekends, late hours and holidays to take advantage of consumption of leisure concurrently with friends and family (Gans and Leigh, 2012). This preference for non-commercial times as opposed to regular office hours can be incorporated into the physician utility maximization model introduced in section 4.3.2.

In terms of the model, from the physician objective function:

$$\max_{C,N} U = Y - \gamma[C - \alpha C^*_{CLIN} - (1-\alpha)C^*_{PAT}]^2 \qquad (9)$$

One can think of the physician loss function as differing according to different times of the day and days of the week. Since the optimal number of C-sections depends on the loss function and the loss function may differ according to preferred leisure times, such as nights and weekends, the model predicts that different rates of C-sections will be performed during those times. Physicians, anticipating their desired time for leisure, may differently weigh the utility from adhering to the clinically determined rate of C-sections. This weight can be considered as being relatively less important than the weight on the utility from serving patients preferences.

I consider the distribution of births for days of the week and hours of the day and investigate whether the proportion of C-sections changes during desired leisure periods. Saturdays, Sundays and late night hours are commonly associated with physicians higher consumption of leisure. Besides documenting a weekend effect and night effect with physicians shifting C-sections away from these times (*Scheduling Hypothesis*), I exploit a traditional Brazilian holiday, where the incentive to abbreviate births is higher, to investigate whether physicians deliberately induce extra C-sections to maximize leisure time during this period (*Induction Hypothesis*).

My sample consists of natality data (SINASC) for singleton first births with gestation 22 weeks and older from mothers 50 years old and younger, as defined in Chapter 4, for the years 2006-2009. Using variables *Date_of_Birth* and *Time_of_Birth* available from SINASC, I classify each birth in my sample according to the day of the week and time of the day it occurred. Merging hospital census data (CNES), I am able to match health facility IDs with institutional nature and classify hospitals into public and private.

Because the natality data does not contain information on risk factors associated with pregnancy and birth, nor clinical indication justifying C-sections, I am unfortunately unable to distinguish between scheduled versus unscheduled C-sections, i.e. the C-sections performed after labour has been attempted. This does not allow me to separate between a shifting effect, occurring only in scheduled C-sections, and an inducing effect, that may convert natural births into C-sections for leisure consumption purposes. I first consider overall C-sections in my analyses, but later I differentiate a simple scheduling (timing) effect from an inducing effect by looking at the distribution of natural births around a traditional holiday in Brazil.

As shown in Table V, from a total of 4,558,077 births in the sample, 1,744,618 (38%) occurred inside public hospitals while 2,813,459 (62%) took place in private hospitals. For natural births, the share between public and private hospitals is practically even: 1,085,086 births in public hospitals versus 1,077,630 births in private hospitals. However, in private hospitals C-sections are performed almost three times as often. This implies that high rates of C-section observed in the Brazilian system are not, as commonly thought, a result of private hospitals performing "too few" natural births, but rather related to the excessive use of C-sections in such facilities. Indeed, the overall C-section rate is 53%, being 38% among public hospitals and 62% considering only private hospitals.

TABLE V- SAMPLE DISTRIBUTION

	C-section	Natural Birth	Total
Public	659,532	1,085,086	1,744,618
Private	1,735,829	1,077,630	2,813,459
Total	2,395,361	2,162,716	4,558,077

Figure 4 depicts the distribution of births across the week for public (Panel A) and private health facilities (Panel B). From Figure 4, natural births remain fairly constant across the days of the week considering both public and private hospitals. Between Mondays and Fridays, public hospitals perform a daily average of 155.6 thousand natural births. This average declines by approximately 2 thousand births for Saturdays and Sundays. Private hospitals maintain a similar weekday average, 155.4 thousand births, but during weekends, this average drops by approximately 5 thousand births. Thus, public and private hospitals perform 500 thousand and 1,200 thousand fewer natural births, respectively, per year on weekends relative to weekdays, a minor decrease considering the sample period. The total quantity of natural births on weekends does not differ much from the quantity that would prevail under uniform distribution in both public and private hospitals, suggesting that the weekend effect for natural births is small.

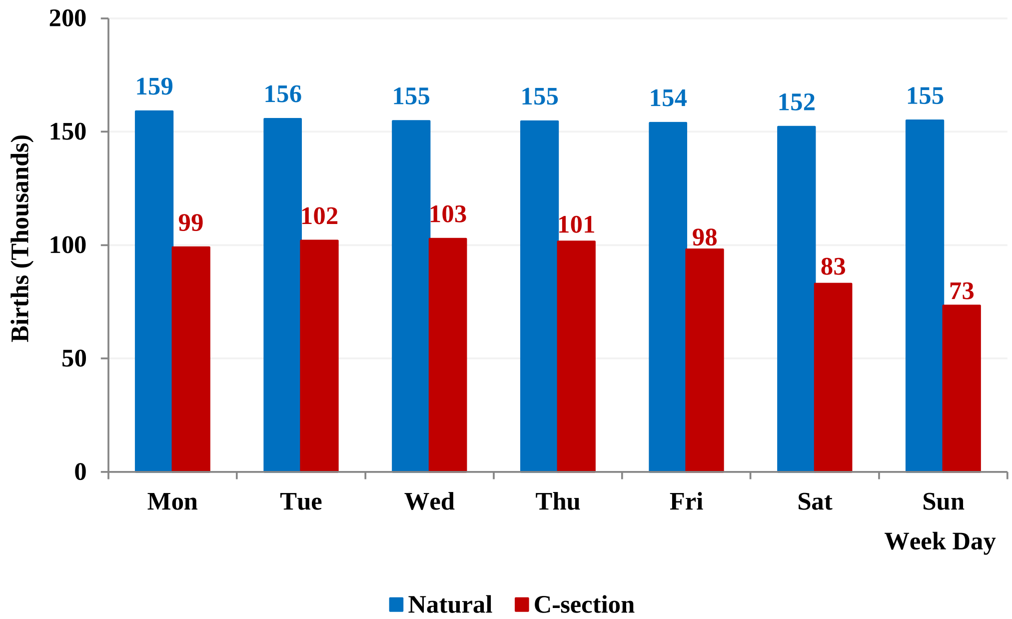
C-sections are, on the other hand, subject to significantly more variation over the week. For public hospitals, the weekday average is 100.6 thousand births. This number is below the total amount of C-sections performed on Tuesdays, Wednesdays, and Thursdays. For weekends, this average falls by 22%. On Saturdays, there are 82.9 thousand C-sections and on Sundays, 73.3 thousand. For public hospitals, a uniform distribution would require that roughly an additional 32 thousand C-sections take place over the weekend.

The discrepancy between weekdays and weekends is larger for private hospitals. The weekday average is 280 thousand births. On Mondays, Tuesdays and Wednesdays, the level of C-sections is above this average, with Mondays registering the largest difference (9.6 thousand births). On Fridays, C-sections fall below the weekday average with 11.3 thousand fewer births.

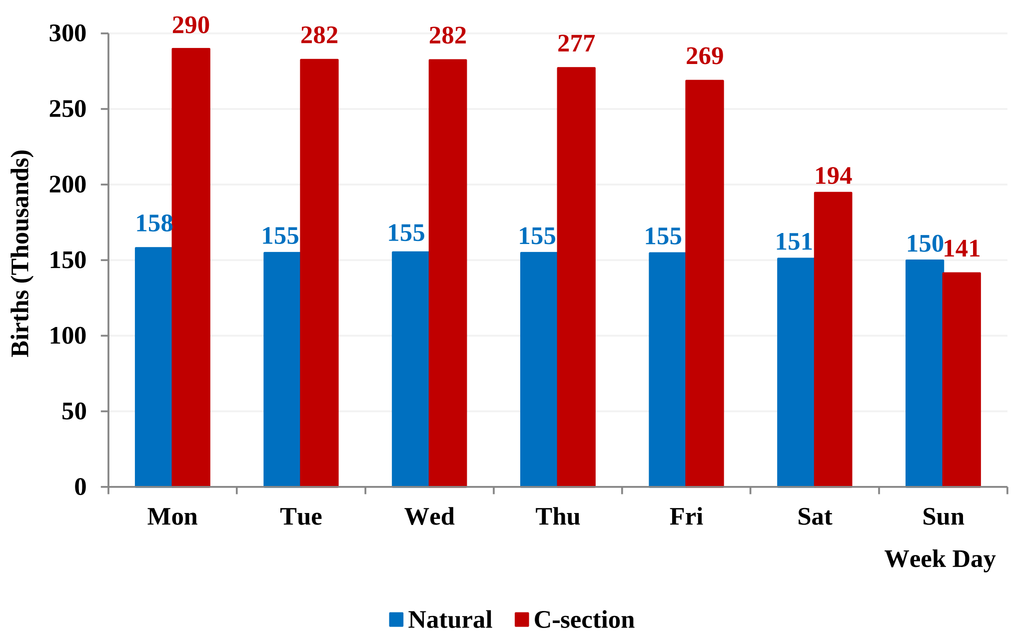
The weekday average drops by 40% on weekends. On Saturdays, C-sections fall to 194 thousand births and Sundays C-sections are the lowest, 141 thousand births, about half of the

Figure 4 – Distribution of Births across Week

Panel A - Public Health Facilities



Panel B - Private Health Facilities



quantity on Monday. A uniform distribution would require that approximately 160 thousand more C-sections occur each weekend.

The proportion of C-sections drops on weekends in both hospitals. In public hospitals, C-sections are performed less frequently than natural births for each day of the week. The average proportion of C-section is 38%, but this rate falls to 35% on Saturdays and 32% on Sundays. In private hospitals, the average rate of C-section is 62% and on Saturdays it drops to 56%. In private hospitals, Sundays are the only day of the week on which C-sections are less likely than natural births, with the C-section rate falling to 49%.

Since it is unlikely that the risk profile of patients changes over the course of the week (i.e. less risky patients showing up relatively more on weekends as compared to weekdays, which would imply a downward bias on the weekend C-section rate), the results indicate that C-section scheduling advantages are used to shift this procedure away from days for which physicians have greater incentive to enjoy leisure. Natural births do not confer similar scheduling flexibility and are subject to significantly less variation over the week. C-sections can be scheduled in advance and are employed to conveniently accommodate work-leisure demand.

The results indicate that the shift away from the weekend towards weekdays is employed to a much greater extent in private hospitals. This can be explained by financial incentives to schedule C-sections on the first hand, which are much stronger among private births given the fact that physicians working in public facilities receive a fixed compensation per shift and do not receive any more money for a C-section. Second, institutional guidelines regarding birth practices tend to be stricter inside public facilities, which may constrain physicians' ability to influence birth timing. Finally, besides having more discretionary power, private physicians usually have closer relationships with patients, which in turn may facilitate a common agreement regarding birth dates, as opposed to public patients, who are attended by the physician on duty.

I also look at the distribution of births for different times of the day[21]. From Figure 5, the distribution of C-sections takes a definitive shape. In public hospitals (Figure 5, Panel A), natural births remain within the range between 100 and 150 thousand births throughout the day, being more frequent in the morning. However, C-sections have considerably greater variance, from a low of 16,373 births at 3 am to a peak of 127,482 births at 10 am. At 7 am, a total of 17,535 C-section births are performed. This number rise sharply during morning time, reaching a peak at 10 am. Next, C-section births decline, totalling 52,363 procedures at 1pm. The number of C-section births picks up again in the beginning of the afternoon and more than doubles at 4 pm with 116,331 procedures. After 4 pm, the quantity of C-section births declines, reaching a low at 7 pm (38,031). C-section births increase less intensively during early night until 9 pm (79,372) and remain low after this time and through late night hours. Between 11pm and midnight, the number of C-section births falls by 32% and from midnight to 1 am it falls by 50%.

For private hospitals (Fig. 5, Panel B), C-sections show even more variation. Between 4 and 11 am the number of C-section births pick up intensively, increasing more than ten times, from 27,958 to 282,236. Subsequently, they decline around lunch time, reaching a low of 173,032 at 1 pm. During early afternoon, C-sections slowly increase and at 6 pm a total of 210,300 procedures are performed. A small peak occurs at 8 pm (190,708) and after then, C-sections rapidly decline at night time. Between 8pm and midnight, C-sections decrease by 67%. Between 6 am to7 am, the number of C-section births rapidly increase, from 66,457 to 194,044 births.

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[21] In Figure 4, a birth at, say, 2:59 counts as a birth at 2:00.

The rate of C-section varies for different hours of the day for public and private hospitals. For public hospitals, the rate of C-section varies between 12 and 49%. It lies above 40% for 9-11 am, 2 to 6 pm and 9 pm. Interesting to notice, the points corresponding to the minimums in C-Section coincide exactly with the moments of medical shift turnovers. Physicians in public facilities generally work according to three determined shifts: 7 am to 1 pm, 1 pm to 7 pm and 7pm to 7am. For private hospitals, C-section rate varies between 22% at 4 pm to 68% at 11 am.

The results indicate that C-section births are not uniformly distributed over the day. C-sections are very popular during morning and afternoon hours and less frequent at nighttime. Natural births, on the other hand, are subject to much less variation throughout the day. Since, there is no reason to believe that births should be asymmetric distributed across hours of the day, the results suggest that physicians are somewhat able to influence the timing of births and use the scheduling properties of C-sections to do so.

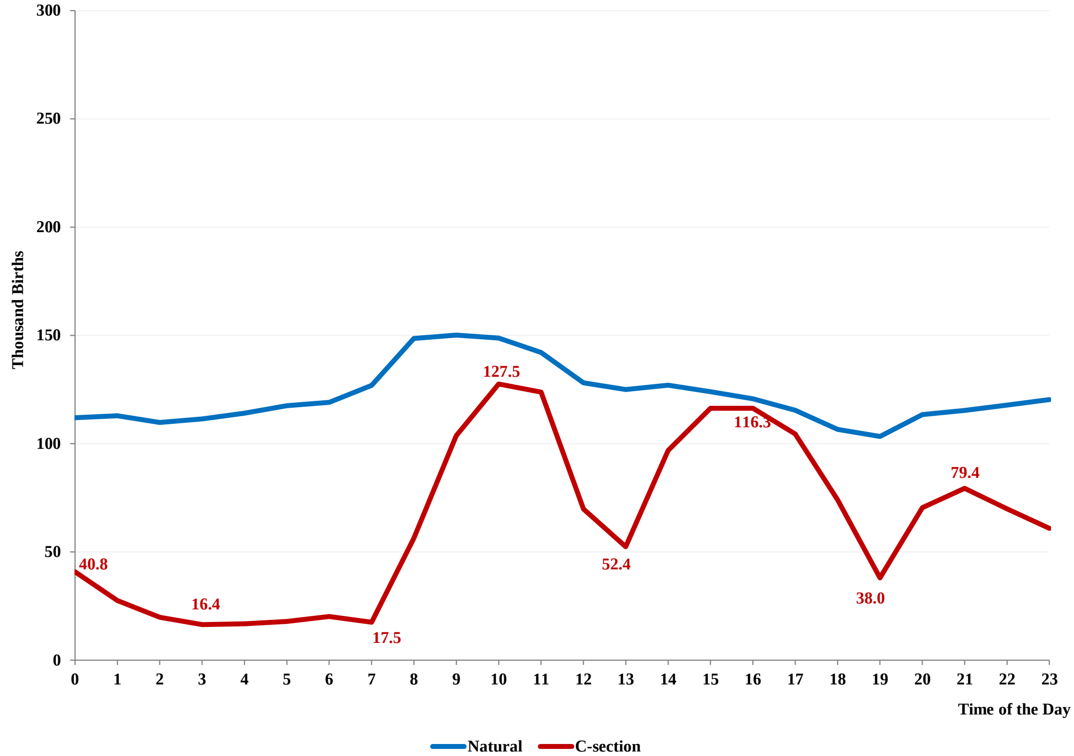
The analyses above, despite providing evidence of a weekend and time effect related to C-sections, do not take into account other factors related to the mother, pregnancy, or infant. Even though the sample excludes some risk factors that could bias the choice for C-section by considering singletons, first gestations and mothers below 50 years old, the analyses do not control for other characteristics related to the patient that may influence C-sections. Thus to investigate the leisure incentive motivated by weekends and different times of day, and the incentive related to shift turnovers, taking into account other characteristics related to the mother-infant; I estimate the following regression model:

$$\begin{aligned} \boldsymbol{es_{iht}} =\propto &+\boldsymbol{\beta}\textbf{Day of the week}_{\boldsymbol{t}} + \boldsymbol{\beta Public_h} * \textbf{Day of the week}_{\boldsymbol{t}} + \boldsymbol{\beta}\textbf{Hour of the Day}_{\boldsymbol{t}} \\ &+ \boldsymbol{\beta Public_h} * \textbf{Hour of the Day}_{\boldsymbol{t}} + \boldsymbol{\gamma x_{iht}} + \boldsymbol{\delta_t} + \boldsymbol{\theta_h} + \boldsymbol{\epsilon_{iht}} \qquad (10) \end{aligned}$$

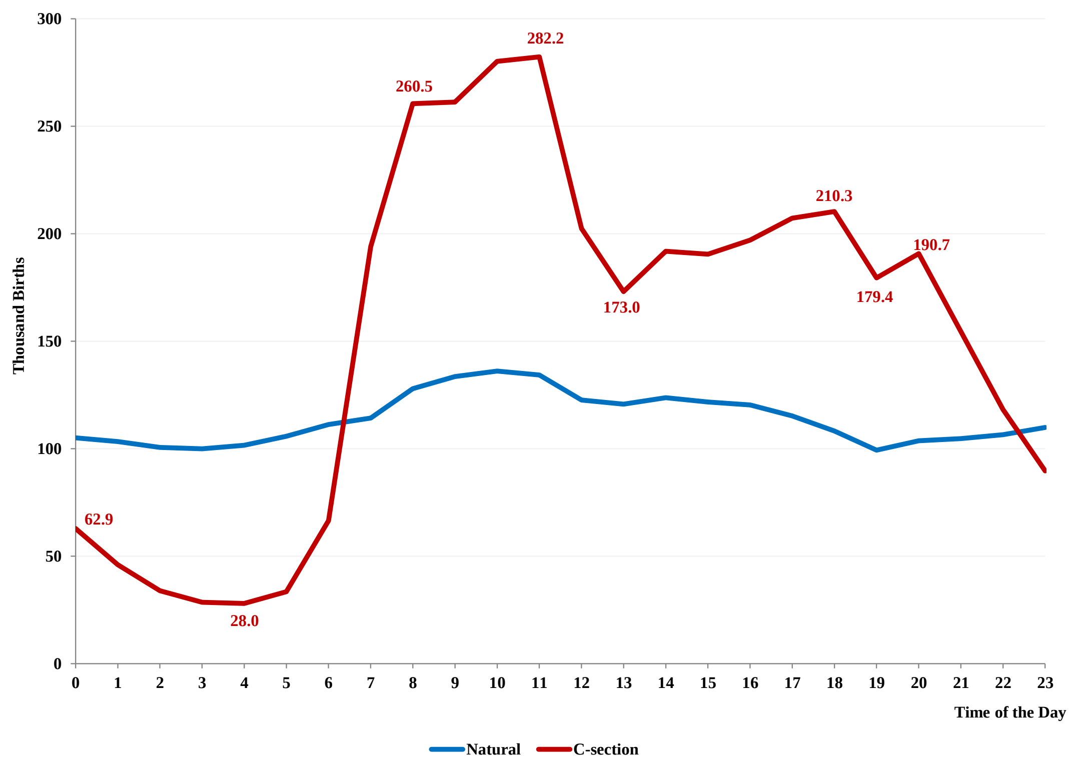
where ces_{iht} is dummy variable indicating that patient *i* had a C-section in hospital *h* in time *t*,

Figure 5 – Distribution of Births across Hours of the Day

Panel A - Public Health Facilities



Panel B - Private Health Facilities



Day of the week_t is an indicator for the day of the week according to the regular calendar, Hour of the Day_t is an indicator for the hour of the day of the birth, I interact indicators regarding days of the week and hours of the day with a dummy variable indicating that the hospital belongs to the public sector to capture the differential effect relative to private institutions. x_{iht} is a vector including maternal demographics, pregnancy characteristics, and infant characteristics. δ_t is a vector of year dummies, capturing other factors that may cause the C-section rate to change across year.

Table VI shows the results for the OLS estimates when hospitals fixed-effects are included to account for heterogeneity of health facilities, θ_{h}. From Table VI, for both private and public hospitals the probability of C-section is significantly reduced on weekends. On Saturdays, it declines by 4.4% for private hospitals and by 3.1% for public hospitals. On Sundays this decline is larger, at 8.6% and 5.7%, respectively. For the other days of the week, a small difference in the likelihood of C-sections is observed for only on Mondays and Fridays for private hospitals, while for public hospitals the probability of C-sections is not statistically different on any weekday.

In the comparison regarding birth times, the results indicate that for private hospitals the probability of C-section decreases between 1 am and 7 am. For these hospitals the difference in the probability of C-sections is highest from 9 to 11 am and 5 to 7 pm, 12 and 13% respectively. For public hospitals, the likelihood of C-section decreases from 1 am to 9 am. The probability has the highest rise between 3 and 5 pm, increasing by 10%.

Overall, my results suggest that physicians do take advantage of the scheduling properties of C-sections to shift these procedures away from most demanded leisure times such as nights, weekends and holidays. This effect is much stronger in private hospitals than in public facilities.

TABLE VI- C-SECTIONS AND TIMING

VARIABLES	CES
Monday	-0.007***
	(0.000)
Wednesday	0.001
	(0.593)
Thursday	0.000
	(0.984)
Friday	-0.006***
	(0.001)
Saturday	-0.044***
	(0.000)
Sunday	-0.086***
	(0.000)
Monday*Public	-0.005
	(0.104)
Wednesday*Public	0.001
	(0.727)
Thursday*Public	0.000
	(0.970)
Friday*Public	0.000
	(0.952)
Saturday*Public	0.013***
	(0.000)
Sunday*Public	0.029***
	(0.000)
1 to 3 am	-0.109***
	(0.000)
3 to 5 am	-0.167***
	(0.000)
5 to 7 am	-0.109***
	(0.000)
7 to 9 am	0.073***
	(0.000)
9 to 11 am	0.120***
	(0.000)
11 am to 1 pm	0.108***
	(0.000)
1 to 3 pm	0.070***
	(0.000)
3 to 5 pm	0.115***
	(0.000)
5 to 7 pm	0.129***
	(0.000)
7 to 9 pm	0.100***
	(0.000)
9 to 11 pm	0.081***
	(0.000)
Public* 1 to 3 am	-0.020***
	(0.000)
Public* 3 to 5 am	-0.012**
	(0.046)
Public* 5 to 7 am	-0.062***
	(0.000)
Public* 7 to 9 am	-0.192***
	(0.000)
Public* 9 to 11 am	-0.072***
	(0.000)
Public* 11 am to 1 pm	-0.073***
	(0.000)
Public* 1 to 3 pm	-0.070***
	(0.000)
Public* 3 to 5 pm	-0.015**
	(0.021)
Public* 5 to 7 pm	-0.048***
	(0.000)
Public* 7 to 9 pm	-0.097***
	(0.000)
Public* 9 to11 pm	-0.018***
	(0.000)

VARIABLES	CES
age	0.310***
	(0.000)
indigenous	-0.057***
	(0.000)
white	0.029***
	(0.000)
black	-0.006*
	(0.078)
yellow	-0.039***
	(0.000)
secondary	0.034***
	(0.000)
married	0.035***
	(0.000)
term_31	0.076***
	(0.000)
term_36	-0.041***
	(0.000)
term_41	-0.112***
	(0.000)
term_42plus	-0.017
	(0.202)
care_3	-0.018***
	(0.000)
care_6	0.022***
	(0.000)
care_7plus	0.065***
	(0.000)
female	-0.011***
	(0.000)
weight	0.216***
	(0.000)
anomaly	0.088***
	(0.000)
Constant	-2.189***
	(0.000)
Observations	4,558,077
R-squared	0.296
Firm FE	YES
Year FE	YES
Adj. R-Squared	0.295

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

For scheduled C-sections, it is plausible that physicians choose the most suitable moment for the surgery according to their preference for not working in certain periods. This is different than deliberating converting otherwise natural births into C-sections in order to consume leisure, an inducing behavior. I next differentiate between a scheduling or timing effect from an inducing effect by investigating if, in anticipation of important leisure times (such as a long holiday), physicians induce C-sections on natural births to minimize disruptions during leisure.

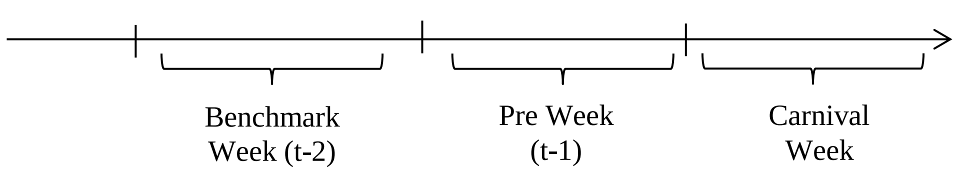
Besides nights and weekends, traditional holidays provide additional incentive for physicians to influence birth timing with the goal of maximizing leisure time. I examine births around the Carnival festival, which is Brazil's most famous holiday. In addition to its cultural importance, Carnival provides a long holiday, lasting from Monday to noon on Wednesday. Moreover, Carnival dates vary according to the civil calendar. The Carnival is held during the week that marks the beginning of Lent, which is the forty-day period before Easter, where Easter is established as the first Sunday after the full moon following the March equinox. Specifically, for the years in my analysis, Carnival dates were the following: *February 28, 2006*, *February 20, 2007*, *February 5, 2008*, and *February 24, 2009*.

I first investigate whether physicians shift C-sections away from the holiday to reduce workload during this period, similar to the weekend effect previously found. I look at the number of C-section births per day during the week 14 days prior to Carnival as a benchmark week, and compare it to the week of the holiday and the week prior the holiday. I hypothesize that the number of C-section births on the week prior to Carnival increases, while the number of C-section births during the week of Carnival decreases, compared to benchmark week. This evidence would be consistent with physicians taking advantage of scheduling properties of C-sections to alleviate their work schedule during the holiday by shifting C-sections to the week prior to the holiday (*Scheduling hypothesis*).

Natural births do not offer physicians such similar scheduling flexibility. Thus, in my second analysis of convenience, I test whether physicians induce C-sections on mothers that would otherwise undergo a natural delivery on the week of the holiday (*Inducement hypothesis*) in a sort of “clean the queue” goal. The idea is that physicians would deliberately persuade mothers, who would deliver by a natural birth on the week of the Carnival to schedule C-sections on the week before the holiday, so as to maximize physicians’ leisure time during the holiday. For this analysis, I look at the proportion of natural births and test whether the number of natural births reduces during the week of the holiday.

Figure 6 presents the timeline for my analysis. I use the week a half-month prior to Carnival as the benchmark week, and compare birth deliveries on the week before the holiday (Pre Week) and the week of the holiday (Carnival Week). My sample consists of 262,680 births. Figure 6 depicts the distribution of births across the benchmark, pre-week, and the week of the holiday. The numbers above the pre and carnival weeks indicate the change relative to the benchmark week. Thus, for the 2009 case, a total of 12,075 C-section births were performed in the week that occurred 14 days prior to Carnival. For the week prior to Carnival, 871 more C-sections were performed, while during the week of the Carnival 1,542 fewer C-sections were performed, compared to the benchmark week.

Figure 6 – Timeline for Convenience Analysis



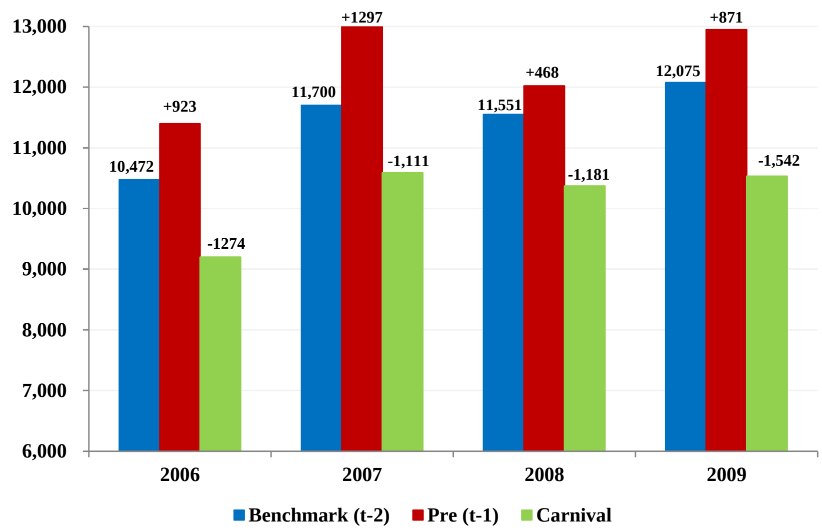
Between 2006 and 2009, a total of 87,813 births (C-section and natural) took place during the benchmark weeks, an average of 21,953 births per week. This level is fairly close to the year-round average of 21,809 births per week (4,558,077 births distributed over 209 weeks). In comparison to the benchmark, 4,314 fewer births were performed during the week of Carnival. This decrease is almost compensated by the increase in the number of births during the week prior the holiday (3,555).

The Scheduling Hypothesis is confirmed by looking at the distribution of C-section births (Figure 7, Panel A). I find that during the week of Carnival, 5,108 fewer C-sections were performed as compared to the benchmark week. Interestingly, the number of C-sections on the week prior to the festival increases by 3,559. Both figures are statistically significant when compared to remaining weeks in the sample, p-values: 0.008 and 0.072, respectively. This effect is consistent with physicians influencing the timing of C-sections, shifting them from the week of Carnival to the preceding week.

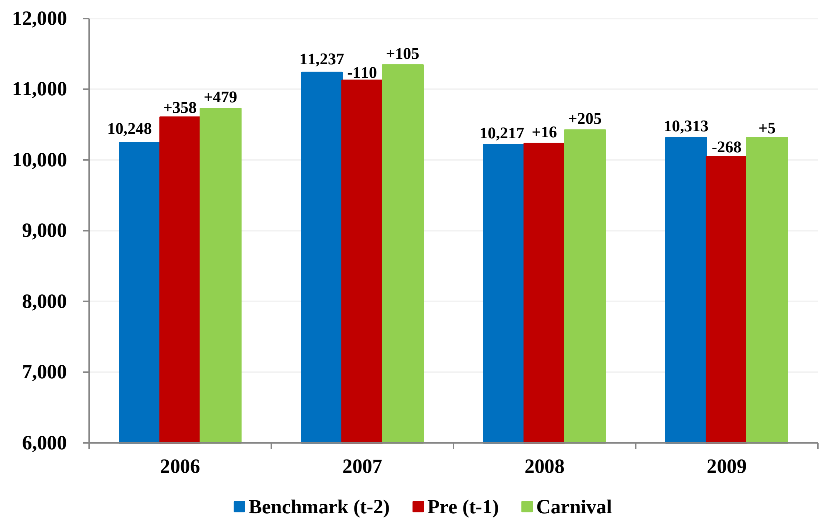
A further question is whether physicians simply take advantage of scheduling properties of C-section or if they purposely convert otherwise natural births into C-sections to maximize leisure time during Carnival. Under this assumption, a decrease in the number of natural births in the week of the holiday would be observed. Looking at the total number of vaginal deliveries on the week prior to Carnival, it does not change compared to the benchmark week. For the week of Carnival, I find a small increase of 794 natural births. When compared to remaining weeks in the sample, this increase is not statistically significant (p-value=0.411), suggesting that physicians do not deliberately induce C-sections to gain the scheduling flexibility to avoid births during Carnival.

Figure 7 – Distributions of Births around the Carnival Holiday

Panel A – C-Section Births



Panel B – Natural Births



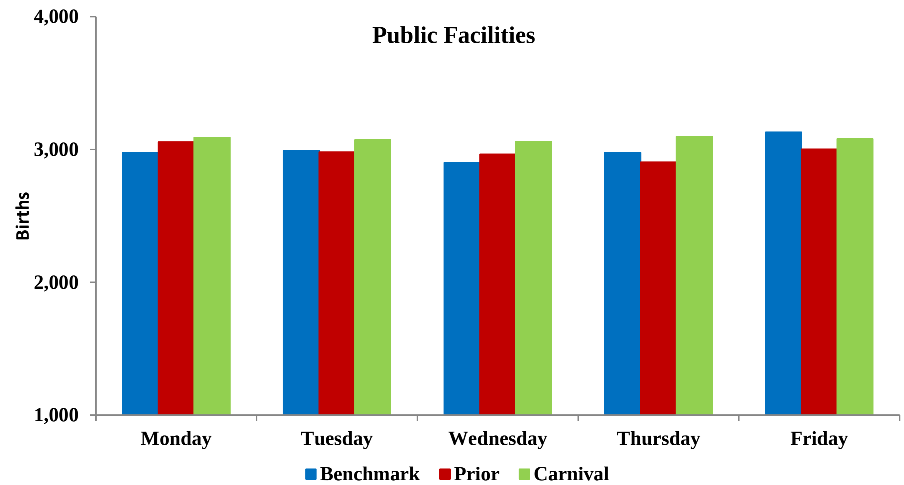
Finally, I exploit this time incentive considering institutional differences across health facilities. I do that, while also looking at the distribution of births across days of the week, within the period of interest. The official end of Carnival holiday is at noon on “Ash Wednesday” of the Carnival week. From Figure 8, Panels A and B, there are slight variations in the total number of natural deliveries across weekdays for public hospitals throughout the three-week period. Similar conclusions are reached for private health institutions with the exception of a small spike on Fridays of Carnival weeks.

Figure 8, Panel C and D depict the distribution of C-section births during the period of interest for each day of the week in public and private health facilities. First, the number of C-sections per day in private hospitals is remarkably higher. The distribution of births for the days of the weeks considered indicates that for these facilities, the number of C-sections during the week prior to Carnival is always above the benchmark week. Mondays and Tuesdays, the official days of Carnival, coincide with the largest decrease in the number of C-sections relative to the benchmark. This fall is weaker on Wednesdays (when work resumes at noon), while on Thursdays and Fridays C-sections exceed the benchmark, to compensate for the decrease at the beginning of the week. For public hospitals, variations in C-section births are much less important, even considering Mondays and Tuesdays when the incentive to consume leisure is higher. This implies that the time incentive to conveniently schedule C-sections is exploited to a much greater extent in private hospitals.

> *We observe more procedures being performed in the period prior to important holidays, (...) because we (physicians) evidently want to spend the holiday without having to hurry from home to assist a birth. But this is part of our choice (Ricardo Chaves, Obstetrician, Globo-Bem Estar, Aug, 2013, my translation)*

Figure 8- Distribution of Births around Carnival Period

Panel A - Natural Births in Public Facilities



Panel B - Natural Births in Private Facilities

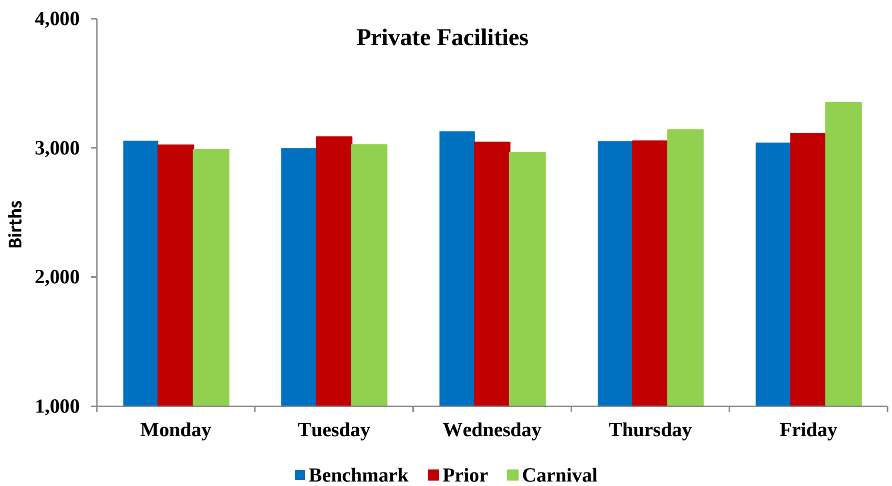
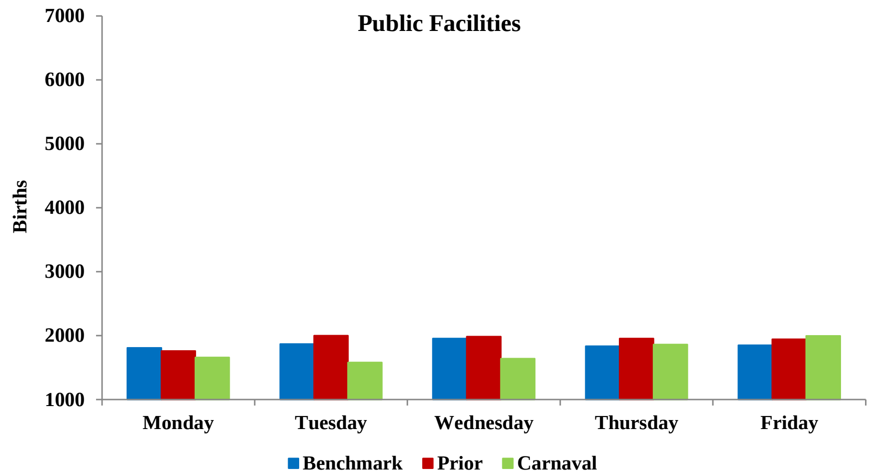
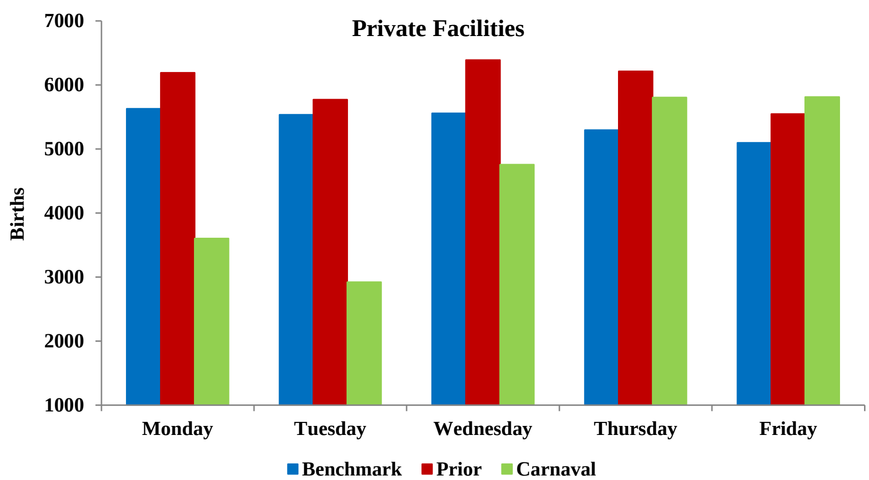


Figure 8 - Continued
Panel C - C-sections in Public Facilities



Panel D - C-sections in Private Facilities



Overall, focusing on an important holiday, I find that physicians do shift C-sections away from the days coinciding with the holiday, however, despite this timing effect, I do not find that physicians marginally convert more C-sections into natural births when they anticipate Carnival. The proportion of natural births remains unchanged. This does not mean that Brazilian physicians do not exploit inducement activities. One explanation for this result is that in Brazil, the incentives motivating inducement activities are related to the general model of obstetric care assistance, which, as discussed in Chapter 3, provides permanent incentives to schedule C-sections that are not fully-medically justifiable. Thus, all incentives related to inducing C-sections have already been exhausted and holidays do not provide a marginal incentive to induce even more C-sections. In other more advanced health systems, the marginal incentives from long-holidays present a not-already-exploited gain, and thus we may see the induction hypothesis being supported.

6.2. Patient's Preferences

According to the SID hypothesis, as discussed in Chapter 3, physicians, when faced with incentives to do so, may exploit the information asymmetry to influence patients to consume services which they would refuse to consume if they had the same medical knowledge as the physician. This is possible when physicians are simultaneously the advisors and providers of medical services. Such undue influence, however, would not be unlimited since physicians are generally assumed to incur disutility from prescribing non-optimal treatment.

For birth procedures more specifically, the financial incentive to induce more intensive procedures is clear: C-sections earn a higher fee to the physician, but pose an unnecessary risk to the mother and infant when not clinically indicated, as opposed to natural births (Belizan et al., 1999; Villar et al 2006; Johnson and Rehavi, 2013).

The opportunity to induce extra treatment, as the theory states, stems from the information asymmetry between physicians and patients. I compare treatment choices when the information gap between physicians and patients is reduced, by examining births from mothers who are also physicians and births from other non-physician mother. Physicians, endowed with medical expertise, are presumably more able to evaluate an indication for C-section, assess the risks and benefits of this procedure, and ultimately differentiate more clearly between necessary C-sections and C-sections motivated by other (private) gains. Having the authority to question more discretionary or dubious procedures, physician-patients are in better position of deterring unjustified influences as opposed to non-informed patients, who lack the background or authority to discuss between birth alternatives.

According to what the SID hypothesis predicts, assuming that medically non-indicated C-sections provide no extra benefit to the mother and infant, we would expect informed patients (physician mothers) to undergo less C-section as compared to uninformed patients, when incentives to induce C-section exist. I investigate this hypothesis for Brazilian physicians.

I begin by identifying physician-patients in my sample. The natality data (SINASC) includes mother's occupation codes listed in accordance to the official National Classification of Occupation Table (CBO) provided by the Ministry of Labor. The National Classification of Occupations (CBO) lists 2,557 occupations in the Brazilian labour market, classified into broad groups comprised of occupational families according to the competence level required. Occupation refers to the mother's self-reported regular activity performed for payment at the time of delivery. A possible caveat is that occupation may not imply actual work at time of report. However, in Brazil most doctors are actively employed. According to the Brazilian Federal Medicine Council, only a very small the proportion of doctors do not work, with only

0.8% of the doctors unemployed and 0.9% retired (CFM/CREMESP, 2011). Even if reported physicians were not actively employed, medical background acquired during medical school allows the ability to critically assess indications for C-section.

From the original sample of singletons, first births and gestation 22 weeks and higher (4,558,077 births), I classify patients into two groups according to education level - mothers having up to 11 years of school and mothers having 12 years or more. Based on the occupation listed under the CBO, I identify mothers whose occupation necessitates a college degree[22]. From the census data available from CNES, I classify births according to institutional nature as either public or private. This allows me to take into account different financial incentive environments concerning C-sections in the two types of institutions. In public health facilities physicians are remunerated on a fixed basis while in private health facilities they are compensated on a fee-for service scheme.

Table VII shows the distribution of births in the sample. There are a total of 257, 089 mothers with a college degree. The proportion of college-educated mothers in the overall sample of births is close to the national average of college-educated women, reported by the 2010 national census[23] at 7%. From the college-educated mothers, a total of 7,516 reported their occupation as "physician".

Almost all college-educated mothers deliver at private hospitals, as can be seen by the distribution of births between institutions. Only 8% of college educated mothers delivered at public hospitals, 0.91% of whom are physicians. A total of 237,380 college educated mothers delivered at private hospitals, 3.1% of whom are physicians. In public hospitals, C-section rates

[22] There are several cases in which mothers are in occupations that do not require college degree, e.g politicians. They are classified as secondary only to clear, as much as possible, my sample of college educated mothers.
[23] IBGE. http://www.ibge.gov.br/english/estatistica/populacao/censo2010/calendario.shtm

among college and physician mothers were 61.5% and 81%, respectively. For private hospitals these rates are much higher, 89% among non-physicians and 91% among physicians.

TABLE VII – C-SECTION AMONG PHYSICIANS AND NON-PHYSICIANS

	Number of Births		Public		Private		C-section rate (%)	
	n	%	n	%	n	%	Public	Private
Up to 11 yrs	3,705,387	81.29	1,596,663	91.52	2,108,724	74.95	36.6	54.7
12 or more yrs	595,601	13.07	128,246	7.35	467,355	16.61	48.8	79.4
College	249,573	5.48	19,529	1.12	230,044	8.18	61.5	89.1
Physician	7,516	0.16	180	0.01	7,336	0.26	80.6	90.8
Total	4,558,077	100	1,744,618	100	2,813,459	100		

To investigate the differential impact of medical information knowledge on the choice of C-section, I focus on college-educated mothers and compare birth choice between physicians and non-physicians professionals. I estimate the following regression model:

$$\boldsymbol{ces_{iht}} = \propto + \boldsymbol{\beta}\mathbf{Physician}_{\boldsymbol{iht}} + \boldsymbol{\gamma x_{iht}} + \boldsymbol{\delta_t} + \boldsymbol{\theta}_{\mathbf{h}} + \boldsymbol{\epsilon_{iht}} \tag{11}$$

where ces_{iht} is a dummy variable indicating that patient *i* had a C-section in hospital h at time t, $Physician_{iht}$ is a dummy variable indicating that the mother is a physician, x_{iht} is a vector including maternal demographics, pregnancy characteristics and infant characteristics. δ_t is a vector of year dummies. My coefficient of interest is β. According to the SID hypothesis, assuming C-sections pose risks to the mother and infant, physician-mothers are expected to undergo fewer C-sections as compared to non-physician mothers. They are able to deter not fully medically indicated C-sections that motivated by private benefits when incentives to induce are present. Thus, this implies that β should be negative.

Table VIII shows the results of my analyses. Column I presents the OLS estimates when hospital fixed-effects are included to account for heterogeneity regarding health facilities, θ_h. From Column I, contrary to the SID hypothesis, I find that physician mothers are at least as or more likely to choose C-section than other college-educated mothers, as evidenced by the coefficient β which is non-negative. The control variables' effect on C-sections is as expected. The probability of C-sections is higher for older, married, white mothers. It increases with prenatal care consultations, early gestations, infant weight and the presence of congenital anomaly.

I also compare the effect of information in each type of hospital. Column I-A and I-B present the estimates of the probability of C-section in public and private hospitals, respectively. The results suggest that physician mothers choose C-section more often than other college-educated mothers in public facilities, around 16% more. However, since physicians in public hospitals represent only 1% of the sample, this result must be interpreted with caution. For private hospitals, I find no evidence of differences in preferences between physician and non-physician mothers.

Overall, my findings suggest that mothers with medical background (and thus more information about the pros and cons of C-section versus natural deliveries) have the same propensity towards C-sections as mothers with no medical background. This is contrary to prior evidence (Chou et al. 2006, Johnson and Rehavi, 2013). Hopkins (1998), who conducted interviews in public and private hospitals in two major Brazilian cities, suggests that physicians' have a weak perception of the risks of C-section. The author also emphasizes the notion that

TABLE VIII- C-SECTION AMONG PHYSICIANS AND NON-PHYSICIANS

Variables	Full OLS I	Private OLS I - A	Public OLS I - B
physician	**0.007***	**0.005**	**0.162*****
	(1.925)	**(1.298)**	**(4.521)**
age	0.006***	0.005***	0.017***
	(37.807)	(32.341)	(20.043)
white	0.021***	0.020***	0.027***
	(9.536)	(9.022)	(2.882)
black	-0.017*	-0.014	-0.033
	(-1.939)	(-1.518)	(-1.095)
yellow	-0.049***	-0.050***	0.006
	(-5.140)	(-5.421)	(0.067)
indigenous	-0.082*	-0.050	-0.148
	(-1.825)	(-0.968)	(-1.258)
married	0.013***	0.012***	0.027***
	(9.241)	(8.147)	(3.822)
term_31	0.231***	0.199***	0.385***
	(17.462)	(14.301)	(8.283)
term_36	0.157***	0.152***	0.155***
	(13.720)	(12.700)	(3.831)
term_41	0.143***	0.146***	0.052
	(12.386)	(12.072)	(1.236)
term_42plus	0.141***	0.116***	0.166***
	(8.005)	(6.225)	(2.731)
care_3	-0.081***	-0.095***	-0.038
	(-7.455)	(-7.639)	(-1.197)
care_6	-0.008	-0.017**	0.031
	(-1.024)	(-2.145)	(1.169)
care_7plus	0.034***	0.027***	0.059**
	(4.586)	(3.567)	(2.260)
female	-0.003**	-0.002*	-0.015**
	(-2.476)	(-1.923)	(-2.189)
weight	0.098***	0.084***	0.241***
	(21.755)	(18.600)	(11.341)
anomaly	0.041***	0.033***	0.093***
	(5.715)	(4.608)	(3.191)
constant	-0.303***	-0.138***	-1.954***
	(-8.461)	(-3.816)	(-11.923)
Observations	257,089	237,380	19,709
R-squared	14.68%	9.59%	16.24%

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

physicians take into account patients' preferences and believe that C-sections would serve them well, as described in the model developed in Chapter 4.

> *I am less sympathetic to the doctors who ordered what seemed to me unnecessary cesareans. But they too appear to have convinced themselves that a surgical end to birth does not place a woman or her baby in danger. They also seem convinced that a cesarean provides women with what they want. (Hopkins, 1998, p.208)*

That is, my results suggest that the current high rates of C-section in Brazil are not due to information asymmetry between physicians and mothers. Instead, it is consistent with C-sections providing higher utility to mothers. This is explained by Brazil's clinical standards for birth delivery, in which natural births have a reputation for being extremely painful, and are undersupplied and do not follow recommend practices.

6.3. <u>Infant Health</u>

In this section, I investigate the relationship between C-section and infant outcomes. Elective C-sections carry risks for infant health. Infants delivered from C-sections scheduled before full term have increased risks of respiratory problems, admissions to intensive care, longer hospital stays and complications of prematurity.

In elective C-sections, infants born at 37 weeks gestations are 1.7 times more likely to face respiratory distress syndrome and transient tachypnea compared to infants born at 38 weeks. For infants born at 38 weeks this number rises to 2.4 when compared to infants born at 39 weeks. This is worrying given Brazil's high prematurity rate. The proportion of pre-term infants delivered before 37 weeks gestation is 11.3% (Fiocruz, 2014), a figure 55% above the rate in the U.K . About 35% of Brazilian infants are born at 37 or 38 weeks, which is double the rate in the US (17.5%) (Hankins et al., 2006).

Besides respiratory problems from difficulties in clearing lung fluids, pre-term infants may face more difficulties with feeding, and are at a higher risk of presenting hypoglycemia, jaundice, apnea and temperature variations. They are more prone to receiving IV fluids, sepsis evaluation and mechanical ventilation.

Brazil's infant mortality rate (deaths of infants aged under one year) was 15.3 per 1000 live births in 2011[24]. Even though this rate has been declining over the years (it was 75.3 per 1000 live births in 1980 and 47.1 per 1000 live births in 1990), it is still very high when compared to other countries such as the US (6.2), Canada (4.7), Chile (7.9), Argentina (13)[25]. Neonatal mortality (deaths in infants between 0 and 27 days of age) has shown less improvement over the years. In 2011 it was 10.6 per 1000 live births. Since the 1980s, neonatal mortality has been the main factor in Brazil's infant mortality rate, and in turn prematurity has been the main factor contributing to neonatal mortality. Studies conducted in the US show that the infant and neonatal mortality rate is higher in pre-term infants than in full term infants (Kramer et al. 2000).

In the following, I examine infant outcomes of babies delivered from C-sections and compare differences in public and private hospitals. I consider my original sample of first births, singletons with at least 22 weeks gestation from mothers less than 50 years. I estimate regressions of the following form:

$$\boldsymbol{Indicator_{iht}} = \propto + \boldsymbol{\beta}\mathbf{ces}_{\boldsymbol{iht}} + \boldsymbol{\gamma x_{iht}} + \boldsymbol{\delta_t} + \boldsymbol{\theta}_{\mathbf{h}} + \boldsymbol{\epsilon_{iht}} \qquad (12)$$

where $Indicator_{iht}$ refers to infant's health outcome, ces_{iht} is a dummy variable indicating that patient *i* had a C-section in hospital *h* at time *t*, x_{iht} is a vector including maternal demographics, pregnancy characteristics and infant characteristics. δ_t is a vector of year dummies.

[24] Source: Datasus (http://tabnet.datasus.gov.br/cgi/idb2012/c0104a.htm).

[25] Estimates developed by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA Population Division) at www.childmortality.org.

I first compute the one-minute and five-minute APGAR scores as measures for the dependent variable. Tables IX and X show the results of my analyses. The results indicate that overall, APGAR scores are negatively related to C-section deliveries as shown by the significant coefficients of variable *Ces* on Column I for both the 1 and 5 minute APGAR measures. C-section births reduce the 1-minute APGAR by 4.5% and the 5-minute by 2.7% conditional on other determinants of APGAR.

I then interact a variable indicating whether the hospital belongs to the public sector with the indicator of C-sections to account for differences in hospital types. The results are shown in Column II of Tables IX and X. From Column II, the negative relationship between APGAR scores and C-section delivery persists for births in public hospitals, with C-section deliveries decreasing the 1-minute APGAR by 15% and the 5-minute APGAR by 7%. However, considering only births taking place in private hospitals, the 1-minute APGAR score is positively related to C-sections (increase by 3.2%) and the 5-minute APGAR is not significantly affected by C-section delivery. This result can be explained by the fact that C-sections in private sector tend to be less related to high risk factors or clinical indication compared with C-sections undergone in public facilities. In the private sector, a great number of C-sections are scheduled for reasons other than clinical necessity, while public hospitals have stricter guidelines regarding this procedure.

I also consider infant birth weight as another indicator. Birth weight is a commonly used marker of infant health. Table XI shows the results with and without the interaction variable. From Column I, birth weight increases with C-section deliveries compared with natural births, however, this increase is small (110g). From Column II, the increase in birth weight from C-sections is slightly higher in public hospitals than in private. I also consider birth weight on

TABLE IX– ONE-MINUTE APGAR

	I	II
VARIABLES	APGAR 1	APGAR 1
ces	-0.045***	0.032***
	(0.000)	(0.001)
public*ces		-0.180***
		(0.000)
age	-0.042***	-0.044***
	(0.000)	(0.000)
indigenous	-0.010	-0.011
	(0.622)	(0.551)
white	0.029***	0.027***
	(0.000)	(0.000)
black	-0.028***	-0.027***
	(0.000)	(0.001)
yellow	0.050**	0.050**
	(0.041)	(0.039)
secondary	0.056***	0.053***
	(0.000)	(0.000)
married	0.019***	0.018***
	(0.000)	(0.000)
term_31	1.599***	1.600***
	(0.000)	(0.000)
term_36	2.624***	2.623***
	(0.000)	(0.000)
term_41	3.040***	3.037***
	(0.000)	(0.000)
term_42plus	2.882***	2.886***
	(0.000)	(0.000)
care_3	0.021**	0.020**
	(0.037)	(0.044)
care_6	0.069***	0.071***
	(0.000)	(0.000)
care_7plus	0.090***	0.092***
	(0.000)	(0.000)
female	0.074***	0.074***
	(0.000)	(0.000)
weight	0.510***	0.511***
	(0.000)	(0.000)
anomaly	-0.775***	-0.771***
	(0.000)	(0.000)
Constant	1.055***	1.041***
	(0.000)	(0.000)
Observations	4,399,194	4,399,194
R-squared	0.126	0.127
Firm FE	YES	YES
Year FE	YES	YES
Adj. R-Squared	0.125	0.126

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE X – FIVE-MINUTE APGAR

	I	II
VARIABLES	APGAR 5	APGAR 5
ces	-0.027***	0.005
	(0.000)	(0.304)
public*ces		-0.075***
		(0.000)
age	-0.023***	-0.024***
	(0.000)	(0.000)
indigenous	-0.040***	-0.041***
	(0.009)	(0.007)
white	0.020***	0.020***
	(0.000)	(0.000)
black	-0.018***	-0.018***
	(0.001)	(0.001)
yellow	-0.010	-0.009
	(0.584)	(0.599)
secondary	0.031***	0.030***
	(0.000)	(0.000)
married	0.012***	0.011***
	(0.000)	(0.000)
term_31	1.608***	1.608***
	(0.000)	(0.000)
term_36	2.280***	2.279***
	(0.000)	(0.000)
term_41	2.547***	2.546***
	(0.000)	(0.000)
term_42plus	2.456***	2.458***
	(0.000)	(0.000)
care_3	0.023***	0.022***
	(0.003)	(0.003)
care_6	0.071***	0.072***
	(0.000)	(0.000)
care_7plus	0.080***	0.081***
	(0.000)	(0.000)
female	0.042***	0.042***
	(0.000)	(0.000)
weight	0.436***	0.436***
	(0.000)	(0.000)
anomaly	-0.652***	-0.650***
	(0.000)	(0.000)
Constant	3.223***	3.217***
	(0.000)	(0.000)
Observations	4,387,031	4,387,031
R-squared	0.155	0.155
Firm FE	YES	YES
Year FE	YES	YES
Adj. R-Squared	0.154	0.154

Robust pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

TABLE XI– INFANT WEIGHT

	I	II
VARIABLES	Weight	Weight
ces	110.824***	102.900***
	(0.000)	(0.000)
pubces		18.498***
		(0.000)
age	36.660***	36.879***
	(0.000)	(0.000)
indigenous	-37.199***	-36.999***
	(0.001)	(0.001)
white	11.471***	11.615***
	(0.000)	(0.000)
black	-8.563***	-8.658***
	(0.000)	(0.000)
yellow	-8.515	-8.583
	(0.224)	(0.223)
secondary	3.063***	3.349***
	(0.001)	(0.000)
married	15.425***	15.610***
	(0.000)	(0.000)
term_31	474.760***	474.584***
	(0.000)	(0.000)
term_36	1,412.686***	1,412.632***
	(0.000)	(0.000)
term_41	2,154.141***	2,154.269***
	(0.000)	(0.000)
term_42plus	2,274.787***	2,274.242***
	(0.000)	(0.000)
care_3	-19.077***	-19.014***
	(0.000)	(0.000)
care_6	52.881***	52.646***
	(0.000)	(0.000)
care_7plus	115.105***	114.928***
	(0.000)	(0.000)
female	-104.802***	-104.786***
	(0.000)	(0.000)
anomaly	-156.288***	-156.623***
	(0.000)	(0.000)
Constant	831.569***	832.208***
	(0.000)	(0.000)
Observations	4,558,077	4,558,077
R-squared	0.301	0.301
Firm FE	YES	YES
Year FE	YES	YES
Adj. R-Squared	0.300	0.300

Robust pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

different days of the week for private and public hospitals. The results are shown in Table XII. From Table XII, birth weight varies according to different days of the week in both private and public hospitals. Sundays represent the days with the highest decrease in birth weight, followed by Fridays and Saturdays. This result can be explained by the weekend effect documented earlier, in which C-sections are shifted away from these days, thus declining birth weight.

6.4. Financial Incentives

In this section I analyze the effect of financial incentives on the choice of birth delivery. It is interesting to investigate financial incentives in an environment where time inputs in births are strongly considered by physicians and thus, as the model introduced in Chapter 4 highlights, it follows that physicians calculate gains relative to time differences when choosing between natural and C-section births.

I investigate financial incentives by exploring a policy change that altered reimbursement fees for births as defined by the SUS fee schedule. In October 2007, the fee for natural birth increased by 27%, whereas the fee for C-sections increased by 23%[26].

To examine the degree to which physicians are affected by the fee change, it is important to identify the group most affected by the policy. In order to do so, I identify the percentage of procedures reimbursed by SUS in each health facility per year. I do this by merging three data sets, SINASC, SIH, and CNES by facility identification (the CNES ID). This allows me to stratify health facilities into three groups according to two dimensions: the form of physician compensation, fixed salary versus fee-for-service, and the institutional nature of the hospital which is illustrated in Table XIII.

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[26] In absolute amounts fees for natural births due to physician services increased from R$125.84 to R$159.82. For C-sections from R$121.99 to R$150,05. Ordinance No. 2,488 of the Ministry of Health. October, 2, 2007.

TABLE XII– INFANT WEIGHT AND DAYS OF THE WEEK

	I
VARIABLES	Weight
ces	110.549***
	(0.000)
Sunday	-9.866***
	(0.000)
Monday	-1.545
	(0.113)
Wednesday	-2.511***
	(0.010)
Thursday	-4.335***
	(0.000)
Friday	-4.602***
	(0.000)
Saturday	-3.864***
	(0.000)
Public*Sunday	4.600**
	(0.019)
Public*Monday	-0.414
	(0.809)
Public*Wednesday	1.912
	(0.246)
Public*Thursday	3.565**
	(0.046)
Public*Friday	1.145
	(0.493)
Public*Saturday	0.910
	(0.612)
Observations	4,558,077
R-squared	0.301
Firm FE	YES
Year FE	YES
Adj. R-Squared	0.300

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

TABLE XIII– CLASSIFICATION OF HEALTH FACILITIES

Physician Compensation	Type of Hospital	
	Public	Private
Fixed	PUBLIC	…
Fee-for-service	CONTRACT	PRIVATE

The PUBLIC group consists of all public hospitals. In these facilities, physicians are publicly employed and exclusively treat public patients, being compensated by a fixed salary. On the other side of the spectrum, there is the PRIVATE group composed solely of private hospitals which only assist private patients. In such facilities, medical services are remunerated through private sources either out-of-pocket or health insurance payments generally on a fee-for-service basis. Finally, it is possible to identify a third group, the CONTRACT, constituted by private hospitals that also serve public patients, through affiliations with SUS for provision of medical services to public patients. The public services provided by those physicians are reimbursed through the official SUS fee schedule on a fee-for-service basis, making CONTRACT an interesting group in which to evaluate the impact of SUS fee change on the choice of procedures.

Using the CNES database, I classify health facilities according to the sector they belong to. If a facility is in the public system – public hospitals – it is classified as PUBLIC. If a facility is in the private network, then it is classified as CONTRACT when the facility received some reimbursement related to childbirth delivery from SUS in that year, or as PRIVATE if no reimbursement was received from SUS. Information on SUS reimbursements for birth deliveries is collected from the SIH database.

Having each facility classification as belonging to one of the three groups, I match my classification with the SINAC database, which contains information on live births in Brazil. In doing so, I am able to gather birth information regarding the type of delivery, as well as mother, pregnancy, and delivery characteristics.

In principle, if the fee change policy brought about changes in physicians behavior, the group presumably affected by this policy must be the group consisting of births delivered by physicians who are paid per service (reimbursed) by the government – the CONTRACT group. These physicians are the directly reimbursed according to the SUS fee schedule, the subject of the fee change.

It is worth highlighting however, that only a fraction of the deliveries performed in CONTRACT health facilities are funded by the government, and, therefore only a fraction were potentially impacted by the fee change. The remaining portion is funded by private sources – unrelated to the regulation change.

The sample distribution (Table XIV) indicates that out of 2,813,459 births delivered in private facilities 1,583,246 were performed in hospitals that received some reimbursement by the government during the year, thus belonging to the CONTRACT group. I focus on the fee change that took place in October of 2007.

Table XIV shows the rate of C-section by each type of facility for the time period pre-fee change (2006-2007) and for the period post change (2008 – 2009). Prior to the fee change, the rates of C-section decreased with the amount of births funded by SUS, i.e. PUBLIC (100% funded by SUS), CONTRACT (<100% but some reimbursement from SUS) and PRIVATE (0% funded by SUS). After the fee change, the rate of C-section increased in all three types of facility. In particular, the increase in the C-section rate was more pronounced in the

CONTRACT group, 4.5%, as compared to 2.0% and 2.6% in public and private hospitals, respectively.

TABLE XIV - C-SECTION RATES BY HOSPITAL TYPE

	PUBLIC	CONTRACT	PRIVATE	Total
Pre	36.8%	46.8%	76.6%	2,242,767
Post	38.8%	51.3%	79.2%	2,315,310
Post-Pre	2.0%	4.5%	2.6%	
Total births	1,744,618	1,583,246	1,230,213	4,558,077

To account for determinants of the choice of C-section, I estimate the following regression:

$$\boldsymbol{es_{iht}} = \propto + \boldsymbol{\beta}\mathbf{Post}_{\boldsymbol{t}} + \boldsymbol{\rho}\mathbf{Post}_{\boldsymbol{t}} * \boldsymbol{Public_t} + \boldsymbol{\mu}\mathbf{Post}_{\boldsymbol{t}} * \boldsymbol{Contract_t} + \boldsymbol{\gamma x_{iht}} + \boldsymbol{\delta_t} + \boldsymbol{\theta}_{\mathbf{h}} + \boldsymbol{\epsilon_{iht}} \tag{13}$$

where ces_{iht} is a dummy variable indicating that patient *i* had a C-section in hospital h in time *t*, $Post_t$ is a dummy indicating the period after the fee change (2008-2009), $Public_t$ is an indicator of whether the hospital belongs to the public system, $\mathrm{Contract_t}$ is an indicator of contracted hospitals, i.e. private hospital affiliated with SUS, x_{iht} is a vector including maternal demographics, pregnancy characteristics and infant characteristics. δ_t is a vector of year dummies.

Table XV shows the OLS estimates of the determinants of C-section for the three groups of hospitals considered confirm the conclusions drawn from Table XIV. The coefficient of $Post_t$ indicates that the policy change had a significant effect on the proportion of C-sections. In particular, a larger effect is found on the CONTRACT group, in which the proportion of C-sections increased 1.8% more than the other groups.

I further investigate the effect of the policy change on other special types of hospitals, such as university, philanthropic, and baby-friendly hospitals. Such hospitals have more unique characteristics compared to other facilities. University hospitals are facilities in which, in principle, there is greater awareness of the medical indicators for C-sections. Philanthropic institutions are private institutions that treat relatively more public patients; they must provide at least 60% of their hospital bed capacity to SUS patients. Finally, baby-friendly hospitals are institutions that promote policies in support of breast feeding.

The results from Table XV, Column II indicate that the proportion of C-sections decreased only for university and baby-friendly hospitals. The goal of the policy, which was to stimulate natural births, was not achieved in the overall CONTRACT group. This group responded to the fee change with an increase in the number of C-sections.

As discussed in the model in Chapter 4, physicians consider gains, relative to time, when deciding among birth choices. The SUS policy, though it increased natural births nominally, in real time terms it actually ended up increasing the reimbursement rate for C-sections relatively higher and thus, determined the positive response observed in the hospitals. For some special types of hospitals (university and baby-friendly), in which disutility from deviating from the clinical rate of C-section is higher, the policy decreased the likelihood of C-section.

TABLE XV – FEE CHANGE

VARIABLES	I ces	II ces
post	0.011***	0.011***
	(0.000)	(0.000)
post*public	0.002	0.008**
	(0.489)	(0.025)
post*contract	0.018***	0.021***
	(0.000)	(0.000)
post*baby_friendly		-0.010**
		(0.040)
post*philanthropic		0.001
		(0.838)
post*university		-0.012**
		(0.027)
age	0.328***	0.328***
	(0.000)	(0.000)
indigenous	-0.060***	-0.060***
	(0.000)	(0.000)
white	0.029***	0.029***
	(0.000)	(0.000)
black	-0.008**	-0.008**
	(0.015)	(0.015)
yellow	-0.045***	-0.045***
	(0.000)	(0.000)
secondary	0.035***	0.035***
	(0.000)	(0.000)
married	0.037***	0.037***
	(0.000)	(0.000)
term_31	0.073***	0.073***
	(0.000)	(0.000)
term_36	-0.055***	-0.055***
	(0.000)	(0.000)
term_41	-0.128***	-0.128***
	(0.000)	(0.000)
term_42plus	-0.027*	-0.027**
	(0.050)	(0.049)
care_3	-0.019***	-0.019***
	(0.000)	(0.000)
care_6	0.025***	0.025***
	(0.000)	(0.000)
care_7plus	0.072***	0.072***
	(0.000)	(0.000)
female	-0.011***	-0.011***
	(0.000)	(0.000)
weight	0.234***	0.234***
	(0.000)	(0.000)
anomaly	0.094***	0.095***
	(0.000)	(0.000)
Constant	-2.348***	-2.348***
	(0.000)	(0.000)
Observations	4,558,077	4,558,077
R-squared	0.266	0.266
Firm FE	YES	YES
Year FE	YES	YES
Adj. R-Squared	0.265	0.265

Robust pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

7. CONCLUSION

Brazil has faced excessive rates for C-section for the past forty years. Early government regulations directly concerned with reducing C-section rates in the 1980s and more recent governmental efforts aimed at improving prenatal and labor and delivery care have been unable to reverse the C-sections industry that characterizes Brazil. Recent women's movements have claimed better conditions associated with birth and women's empowerment over childbirth decisions. However, the perception that C-sections are the "default" birth remains strongly entrenched in Brazil's system.

This thesis is the first to employ Brazilian national data representing over ten million births over four years, to investigate economic incentives associated with C-sections in Brazil. This dissertation investigated the reasons behind this choice focusing on three dimensions. First, concerning time efficiencies, C-section scheduling properties are appealing to the overburdened, time constrained physicians in Brazil. I examine the distribution of C-section across different days of the week and times of the day, and document a night and weekend effect, in which C-section births are shifted away from these more desired periods of leisure consumption. I show that in private hospitals this shift occurs to a higher extent, evidence of the large incidence of elective C-sections in the country that are scheduled in advance with day and time defined. I then, explore a traditional festivity in Brazil, Carnival, a long holiday that presumably provides extra incentives for birth inducement activities. I find that even though C-sections are shifted away from the days coinciding with the holiday, physician do not deliberately convert more natural births into C-sections. One explanation for this result is the fact that incentives to schedule C-sections are employed to such high extent that have been already exhausted and Carnival does not provide enough marginal incentive to induce further C-sections.

Interestingly, such convenience advantages associated with C-sections are not reached at a different procedure that the gold standard consumer would pursue. Besides analyzing incentives related to convenience, I investigate patients' preferences in Brazil by comparing birth choices of physicians and non-physician mothers. Being the most informed patients, able to distinguish necessary C-sections from C-section motivated by other private reasons, physicians are in better condition to sidestep not-fully medically justified C-sections and thus are expected to undergo less of this procedure. However, I do not confirm this hypothesis for Brazilian physician mothers. In fact, I find that, contrary to the existing literature in childbirth, physicians are at least or more likely to perform C-section as compared to other women of equivalent socioeconomic status. This finding is worrying given the cultural authority of physicians and the influence they have on patients. The analysis of infant health outcomes such as APGAR scores and infant's weight show a positive association with C-sections, at least in the private sector.

In countries facing perverse incentives, physicians and patients face different dilemmas compared to economic actors in most developed health systems. The thesis develop incorporate the role of time costs and patients preferences into the utility maximizing behavior of the physician. As emphasised, physicians regard income gains relative to time inputs when comparing between birth types and being good agents, derive utility from serving patients preferences when quality associated with natural birth is low.

Using the model developed, I exploit the effect of financial incentives in the system. I take advantage of a government policy that altered birth reimbursement fees in SUS. Using a diff-in-diffs model with three groups of hospitals, I find that the goal of the policy was not attained, with hospitals actually increasing the probability of C-section post-policy change. The intended goal was reached only among baby-friendly and university hospitals, which responded with a decrease in the likelihood of C-section after the policy change.

A supplier-induced demand phase seemed to have taken place in the 1970s, when C-sections were more highly reimbursed that natural births and C-sections became entrenched in the Brazilian culture. To the overburdened, underpaid physician, that centralizes much of the procedures in childbirth and is often required to actively attend the entire birthing process, C-sections offer an efficient alternative allowing the work schedule to move in a predictable pattern, minimizing disruptions.

To the pregnant mother, natural births may often be seen as an inferior option, considering the high degree of pain, the low resources in public hospitals, the overall bad management the procedure through the use of controversial and unnecessary practices and even obstetric violence experienced by many women. C-sections can represent the safe option, the access to a differentiated birth experience and better quality of assistance. The cultural preference for C-section is emphasized in national soap operas, where C-sections are pictured as the option for the rich, whereas natural births are the destiny of the poor, reinforcing the procedure's status among women.

This thesis employs national data from a large health system characterized by a mixed provision. The universal health system coexists with private care. Variations in standards of care, patients profile and physician compensation are used to address the use of C-section under different incentive environments. From a theoretical standpoint, besides offering a setting in which different trade-offs in the physician-patient relationship need to be addressed, Brazil offers a case in which it is possible to analyze the effect of incentives in the period post supplier-induced-demand including the role of opportunity costs and patients preferences. The study is limited in the absence of individual level data at the physician level and being able to analyze direct incentives. Natality data is used, which does not include more detailed information about the patients risk profile, the clinical indications regarding birth and infant post-birth conditions. Future studies should aim to better understand patient's preferences and their impact on birth choices, possibly determining the degree of bargaining power between physicians and patients in Brazil. Also, in the model, the number is considered to be exogenous, a further step would be to considered patients movement across sectors.

Finally, what is pushing Brazil not to push? Besides physicians' high opportunity cost from natural births and the set of incentives that are entrenched in Brazilian culture to favor the consolidation of this procedure, the poor quality associated with natural birth stands out in Brazil. Improving the overall quality associated with natural births in infra-structure and its management dimensions is a first step to reverse the C-section industry in Brazil.

8. CITED LITERATURE

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