Electoral impacts of community-based health expansion: Evidence from Rio de Janeiro*

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Abstract

In this study, I explore Rio de Janeiro's context, the Brazilian city with the highest growth in Primary Health Care coverage between 2008 and 2012, to investigate if the expansion of health care services affected the incumbent mayor's reelection. I use the health facilities' catchment areas design as a source of exogenous variations for voters' exposure to PSF (*Programa Saúde da Família*) services. Using individual voter registration and home address data, I build up a dataset at the polling booth level (*seção eleitoral*). I estimate the model by an OLS linear regression including polling places fixed effects and demographic controls variables in the baseline to absorb specific trends. The preliminary results suggest that PSF coverage variation had significant positive effects on Eduardo Paes' vote share. There is evidence indicating that the PSF expansion through the new units has a more pronounced effect on Eduardo Paes' voting. In contrast, the increase in existing health units' coverage does not affect the electoral outcome. The results also show that the effect in the election year is greater than in the previous years.

Keywords: Political Economy; Elections; Programa Saúde da Família; Public Service delivery; Health

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1 Introduction

Given the increased notoriety of health care issues, politicians and governments are particularly interested in delivering health public policies. Nevertheless, there are few studies investigating electoral outcomes in this field. We still cannot answer the following question: How do healthcare policies impact voting? Do voters reward high-performance politicians when implementing healthcare programs?

To contribute to the literature, I examine whether voters react (or not) to the expansion of primary health care. I explore Rio de Janeiro's context, the Brazilian city with the highest growth in Primary Health Care (PHC) coverage between 2008 and 2012, to investigate if this expansion affected the incumbent mayor's reelection. This study relates to three strands of the literature. First, it relates to feedback theory trying to understand how policy design and its implementation impact citizens and political actors. Secondly, it is also connected with retrospective voting studies, where individuals, based on a politician's performance in office, reward or punish him. Thirdly, it contributes to a growing literature investigating the effect of healthcare policies on voting behavior in developing countries.

Eduardo Paes was elected Rio de Janeiro's mayor in 2008 in the second round, with 50.83% of votes. From 2009, the newly elected government adopted the federal program Family Health Program (PSF, for *Programa Saúde da Família*) to reformulate the city health care model. The local government increased the number of PSF health teams in existing units; however, its biggest move was the new health units' construction, the Family Health Clinics. The PSF coverage, which was around 7% in 2008, reached roughly 38% of the city's population in 2012. I investigate if PSF expansion affected Eduardo Paes' votes in 2012 when he was reelected mayor in the first round with 64.6% of the votes.

The causality between primary health care provision and electoral outcomes is challenging. In order to circumvent confounder variables that may be potentially correlated with both the treatment variable and the outcome, I use the health facilities' catchment areas design as a source of exogenous variations for the exposure of voters to primary health care services.

Using individual voter registration and home address data, I build up a dataset at the polling booth level (*seção eleitoral*), which is the smallest level of electoral data available in Brazil (described in Section 4). The electoral outcome is Eduardo Paes' vote share variation between the 2008 and 2012 elections, both in the first round. The treatment variable is the variation of PSF coverage the between 2008 and 2012 in each polling booths. I estimate this model by an OLS linear regression including polling places fixed effects and demographic controls variables in the baseline as a way to absorb specific trends.

The results suggest that PSF coverage variation between 2008 and 2012 had significant positive effects on Eduardo Paes' vote share between the two elections. There is evidence indicating that the PSF expansion through the new units has a more pronounced effect on Eduardo Paes' voting. In contrast, the increase in existing health units' coverage does not affect the electoral outcome. These effects may indicate that voters tend to react with the health service quality provided and not just with the program's expansion. The results also show that the effect in the year of the election is greater than in the previous years.

The remainder of the project is organized as follows. The next section presents a literature review. Section 3 describes the institutional background of the public healthcare services in Brazil and in Rio de Janeiro, as well as the political system and the municipal elections in Brazil. Section 4 presents datasets. Section 5 describes the empirical strategy. Section 6 shows the preliminary results. Section 7 concludes.

2 Literature Review

The idea that public policies can influence behaviors, interests, beliefs, and, consequently, shape the political environment is not new. *Feedback theory* aims to explain how policy design and its implementation affect the citizens and political actors. As described by Campbell (2012), political elites have been the focus of the feedback literature because they (1) have much more information, (2) have defined goals, and (3) are directly affected by policies. Thus, at the elite level, policies can allocate resources to particular interest groups, impose budget constraints, and affect institutional capacities. However, some years later, authors have turned to analyze how policies affect individuals' attitudes and beliefs about the government and how they can enhance or undermine political participation (Campbell, 2012).

Pierson (1993) presented two potential mechanisms in which policies can affect political participation. The "*resource effects*" influence political behavior by redistributing resources (such as money, free time, and skills) and incentives among interest groups, government elites, and individuals. The "*interpretative effects*" change people's perception of politics and their relationship with political institutions, modifying their cognitive process.

Campbell (2012) resumes several policy characteristics to show their impact on individuals' attitudes, such as: (1) the size of benefits, (2) the visibility of government's role, (3) how concentrated or diffused the beneficiaries are, (4) the benefits' duration, and, finally, (5) how programs are administrated. These characteristics affect the intensity of both resources and interpretative effects. The author also sheds light on methodological difficulties in finding causal effects in these studies.

By and large, since voters can reward or punish politicians according to their performance, government evaluation in elections plays a crucial role in understanding democratic accountability. According to the Michigan School, voters are not capable of evaluating and acting on their perceptions of the government's performance, since they lack enough knowledge about political and ideological issues (Healy and Malhotra, 2013). However, this idea has been cast on doubt. Individuals, even possessing a basic understanding of politics and making mistakes, can implement effective accountability based on simple metrics and using cues and shortcuts. As reviewed by Healy and Malhotra (2013), modern approaches have been on the middle ground, where voters, sometimes, make mistakes, shedding light on psychological biases that influence citizens' decisions.

In sum, the relationship between the government's performance and its electoral outcomes have been analyzed by three types of models. The first is a reward-punishment model, where voters (principals) incentivize good behavior on government administration, rewarding high-performance politicians (agents), or punishing the low-performance ones. In the second model, citizens select politicians whom they think will perform better after

being elected. Lastly, the third model incorporates individuals' cognitive and emotional biases.

One pattern observed in all models is that cognitive biases may jeopardize vertical accountability. For instance, the voter is disproportionately influenced by recent facts and can be guided by emotions. As pointed out by Healy and Malhotra (2013), scholars have been discussing the significant impact of the election-year economy on electoral results versus little or null effects in other years. Other circumstances beyond the incumbent's control, such as natural disasters, floods, and droughts, are systematically considered by people when voting.

In Brazil, scholars have also found evidence of voter responsiveness in different areas. Firpo et al. (2017) and Dias and Ferraz (2019) both found a positive relationship between school quality and the incumbent's vote share. Bueno et al. (2018) and Dias and Junior (2015), analyzing one of the largest housing programs in the world, "*Minha Casa Minha Vida*", found a program's negative effect on incumbent's performance. Cavalcante (2015) observed that mayors' fiscal performance increases their reelections chances. The largest CCT program in the world, *Bolsa Família*, has also been the focus of several studies (Zucco Jr, 2013, 2015; Pinho Neto, 2018). A positive relationship between BF and incumbent's performance in presidential elections in 2002 and 2010 has been observed by Zucco Jr (2013), regardless of party identification in 2014 (Zucco Jr, 2015). According to Pinho Neto (2018), in presidential elections, BF is positively related to the incumbent's party support, while this relationship seems to be negative in municipal elections. BF also increases political participation enhancing voting in environments with higher proportion of volunteer voters.

Voters not only react to the incumbent's performance but also can make better choices by receiving information about government's transparency. Ferraz and Finan (2008), using a natural experiment that randomly audit municipalities, found that voters when informed before the election, punish incumbents' corrupt practices. In contrast, mayors with no irregularities are rewarded. These effects are more significant in municipalities where the local radio diffuses the information. Political leaders also appear to respond to voter responsiveness. Ferraz and Finan (2011), examining municipalities in Brazil, show that corruption levels are lower when politicians face reelection.

In the healthcare realm, Novaes and Mattos (2010) show that healthcare expenditures increase in municipalities where incumbents are running for reelection. Fujiwara (2015), using a quasi-experimental study, shows that the introduction of electronic voting enfranchised poorer and less educated population, increasing the demand of health services. He finds an increase in the number of prenatal visits and a reduction of the prevalence of low-weight births in less-educated women. Karim (2017), using a regression discontinuity design, shows that health expenditures increased in municipalities eligible for the Brazil's 2007 voter's re-registration reform. He also finds an increase in prenatal visits, a decrease in low birthweight, and infant mortality rates. Bobonis et al. (2017), using a randomized control trial by the construction of residential water cisterns in Northeast Brazil, demonstrate that citizens are less likely to participate in clientelist practices after getting access to water. The authors show that demanding less private benefits negatively affected incumbent's electoral performance. They also explain that when rainfall decreases and requests increase, the mayor fulfills roughly half of all claims, and politicians are more responsive to water and health care demands.

This literature suggests that the increase of public goods, especially in healthcare, is both (1) a shift in citizens' political attitudes away from patronage practices toward demands for health and education services, and (2) a government answer to fulfill these demands. Thus, increases in health expenditures seem to be a response by politicians to maximize their election probabilities and fulfill public goods for the poorest.

In the United States, the literature of healthcare programs impact on electoral outcomes is marked by Medicaid studies (Baicker and Finkelstein, 2019; Clinton and Sances, 2018; Haselswerdt, 2017).[1] Baicker and Finkelstein (2019), using a randomized design of a lottery in Oregon, find a significant effect of Medicaid expansion on voter turnout, with results concentrated in men and in Democratic counties. Haselswerdt (2017) finds that the Medicaid expansion generated an increase in voter turnout in the 2014 Congressional elections. Clinton and Sances (2018) estimate that Medicaid increased voter registration in 2014 and 2016, and a temporary impact on turnout in 2014.[2]

Imai et al. (2020), using a randomized social experiment, find that the Mexican program *Seguro Popular de Salud* (SPS), government-subsidized healthcare insurance for the population without social security, does not affect voter support for incumbents. However, it is worth stating that the authors do not mention several essential factors that could potentially explain their results.[3] Fried and Venkataramani (2017) examine a clean water program in Mexico, *Programa Agua Limpia*, and found that it increased support for the incumbent party, suggesting that the incumbent party's improvement is associated with a decrease in mortality rate due to diarrheal disease.

Croke (2017) find a positive relationship between a universal program of bed net distribution in Tanzania and political leaders' support (village chairmen, ward councilors, ward executive officers, and MPs). These effects are more significant in malaria-endemic areas and last up to six months. Boas and Hidalgo (2019) show that informing individuals about mayor's decision in using federal funds to combat dengue, Zika and chikungunya do not affect the intention to vote for the mayor's reelection. However, citizens who know someone affected by microcephaly (Zika virus) tend to punish the incumbent.

In this specific context, PSF literature focuses mainly on health outcomes. There are robust shreds of evidence indicating that the program reduces maternal, fetal, neonatal, and post-neonatal (Bhalotra et al., 2019), infant (Macinko et al., 2006; Aquino et al., 2009), and mortality rates (Rocha and Soares, 2010). Besides the impact on health outcomes, PSF seems to decrease fertility rates (Rocha and Soares, 2010; Bhalotra et al., 2019), increase labor supply for adults, and improve school enrollment (Rocha and Soares, 2010). The authors also suggest that PSF is an efficient tool to improve health in impoverished areas, contributing to reduce health inequalities. However, few studies are analyzing the causality between PSF and electoral outcomes. Ribeiro Braga (2020),

[1] Medicaid is a partnership between state and federal governments to provide public healthcare services to low-income individuals.

[2] It is worth mentioning that this effect may be a consequence of the 1993 National Voter Registration Act that requires public assistant office to offer citizens voter registration forms.

[3] Krasniak et al. (2020) provide some examples: (1) families should pay an annual fee to adhere the SPS, (2) health expenses lower than 30% of family income are paid separately by the family, (3) while social security covers 14,900 different procedures, the SPS covers only 1,556, (4) scholars argue that there is no difference in the use of services among the population without coverage and SPS members, as well as there is no impact on their health, and the like.

using a regression discontinuity design, provides evidence that PSF investments affected the mayor's electoral support. The author shows that a 50% increase in PSF transfers corresponds to an increment of 9 percentage points on incumbent's vote share.

In summary, the literature on voter responsiveness to direct government provision of public goods is mixed. In developing countries, studies have mainly focused on CCT programs in understanding clientelist patterns, looking at resources distributed towards co-ethnics or co-partisans.

3 Institutional background

3.1 Public Healthcare Services in Brazil

Since the 1988 Constitution, health became a citizen right and, consequently, a State obligation. The Unified Health System of Brazil (SUS, for *Sistema Único de Saúde*) was then created on five basic principles: universality, integrality, equity, decentralization, and social participation.

From that moment on, a deep reformulation of the health system logic was observed, from a hospital-centered perspective, concentrated in large urban centers, to an arrangement based on decentralization and health services rationalization. The constitutional principles aimed to promote a new health system focusing on prevention and extension of primary health care (PHC). However, this change was only initiated in 1994 when the federal government designed the Family Health Program (PSF, for *Programa Saúde da Família*).

Currently, the PSF is the largest basic health care program in the world, reaching enormous penetration in the Brazilian territory, especially in remote areas, through the presence of health care teams directly interacting with local communities. The program's health teams are usually formed by one family doctor, one nurse, one assistant nurse, and six health community agents. However, other health professionals, such as dentists, assistant dentists, dental surgeons, and dental hygiene technicians, may join them, according to the location needs and the health unit characteristics. Each PSF team is in charge of a given number of families, according to a pre-established territorial area assigned. Roughly, they are responsible for 3,000 to 4,500 individuals. These health teams are distributed (1) within existing health units, (2) or in new units, built accordingly to the municipal program in areas that do not have any health equipment, and lastly, (4) in households. By following families through continuous assistance, health teams provide health counseling and are able to detect early symptoms that may require special care.

After three decades, the PSF is considered the most important basic health care program in Brazil, with its presence in all 5,570 Brazilian municipalities. By having 43.508 teams, it is estimated to cover more than 133 million people, which represents 64.2% of the total Brazilian population.[4]

Like other national programs, the PSF is a federal program implemented at the municipal level throughout the voluntary adhesion of the municipalities, preferably with the support of the state government. Thus, the

[4]Source: Histórico de Cobertura da Atenção Primária. https://egestorab.saude.gov.br/paginas/acessoPublico/ relatorios/relHistoricoCoberturaConsolidado.xhtml. Last checked on September 16, 2020.

municipal administration project how the PSF teams will work in their basic health units, adapting to their realities, however, always considering the fundamental elements of the program (Brazilian Ministry of Health, 1997). The prompt expansion of the PSF from 1998 was a result of the federal government's strong influence, which was based on the issuing of ordinances and financial regulations (Castro and Machado, 2010; Silva and Andrade, 2014; Costa, 2016).[5] These ordinances induced programs and policies linked to financial incentive mechanisms.

3.2 Public Healthcare Services in Rio de Janeiro

According to the 2010 Census, Rio de Janeiro is the second-most populous municipality in Brazil, with 6.32 million inhabitants. Its 763 favelas cover roughly 1.39 million people, which represents 22.03% of its population, making Rio de Janeiro the Brazilian city with the largest population living in subnormal agglomerations.

Even before the 1988 Constitution and the SUS formulation, the city of Rio de Janeiro experienced some changes in the public health area, but without success. After the Alma-Ata's declaration in 1978, which advocate the urgent action by all governments to promote "Health for All" underlying the importance of the primary health care (PHC), the Municipal Health Secretary (SMS, for *Secretaria Municipal de Saúde*) launched some programs and initiatives to expand the PHC coverage in the city. Nevertheless, the private sector and social security coverage were still dominant. Between 2005 and 2008 there was an effort to expand the number of PSF teams; however, the health care coverage was still low and restricted to some areas (Campos et al., 2016).

Until 2009 the city of Rio de Janeiro faced a chaotic health context due to several factors: (1) high rates of tuberculosis, congenital syphilis, infant, and maternal mortality, dengue epidemic; (2) the lowest municipal funding among Brazilian capitals; (3) health municipal budget extensively allocated to large hospitals; (4) an insufficient number of specialists in family medicine and lack of training; and (5) low capacity to mobilize and decide on the resources available in the health network (hospitals beds, procedures, specialized appointment) (Campos et al., 2016; Coelho Neto et al., 2019; Lapão et al., 2017; Soranz et al., 2016). Despite the federal effort to increase PHC coverage, in December 2008, the city had only 126 PSF teams, covering 7.13% of the population. The PHC coverage in Rio de Janeiro was the second-worst coverage of all capitals in the country, behind only Brasília, which had an estimated coverage of 5.3%.[6] At that time, in São Paulo the PSF coverage was 27.38%, in Belo Horizonte it was 71.63%, in Porto Alegre it was 23.07%, and in Curitiba, it was of 31.86%. Figure 1 shows the PSF coverage in all Brazilian capitals in December 2008 and September 2012.

The new local government, inspired by national and international successful experiences and pressured by

[5] Due to Brazilian federalism characteristics, the post-1994 period is known by the central government's initiative to coordinate health and education policies through norms that distribute responsibilities among federal entities and establish financial incentives to promote the adhesion of subnational governments (Abrucio and Franzese, 2007; Farah, 2013). To federalism see also: Franzese and Abrucio (2009),Licio et al. (2011),Gomes (2009),Abrucio et al. (2013).

[6] Source: https://egestorab.saude.gov.br/paginas/acessoPublico/relatorios/relHistoricoCoberturaAB.xhtml. Some studies estimate that, at that time, only 68 PSF teams had physicians, and they estimate that the PSF coverage in Rio was of only 3.5%. See Harzheim et al. (2016) and Soranz et al. (2016)

the National Primary Care Policy of 2006 (PNAB, for *Política Nacional de Atenção Básica*), leaned on the PHC in order to reformulate the health care model in the city. A few years later, Rio de Janeiro would receive the FIFA World Cup (2014) and the Summer Olympics (2016). After visiting other Olympic cities, such as London, Montreal, Barcelona, and Sidney, the government proposed a new governance and health management model inspired by reforms seen in Portugal and England (Campos et al., 2016; Soranz, 2014).

In this context, the local government implemented the Primary Health Care Reform (RCAPS, for *Reforma dos Cuidados em Atenção Primária em Saúde*) based on three pillars: administrative, organizational model, and health care model reforms.

The SMS turned to a horizontal organizational structure, and the PHC was defined as the main guideline for the health network in Rio. The budget was divided between the health care levels, which made it possible to plan expenses according to service provision characteristics at each level. Besides that, the City Council approved an increase in the municipal health budget from 15% to 20% and sanctioned legal rules to allow the new organizational model based on the outsourced management of Social Health Organizations (OSS, for *Organização Social de Saúde*).[7]

At first, the SMS, to expand the PSF coverage, improved the existing health unit's infrastructure and increased the number of teams in these clinics. However, the SMS's biggest move came through the idealization and construction of new health units, called the Family Health Clinics (CF, for *Clínica da Família*), that started to be built already in 2009, the first year of the new administration. The SMS's goal was not only to increase the PSF coverage, but it was also qualitative in its aim to improve the health services quality (Harzheim et al., 2009).

The CF structure was designed to guarantee the ambiance, comfort, sustainability, and the resolution capacity of the health care units (Harzheim et al., 2009; Campos et al., 2016). Its physical structure was an important requirement that differentiates itself from existing units. The new administration was keen on ensuring that people could differentiate the new units from existing clinics. Because of this, they published in 2010 the document "*Guidelines for the expansion of Family Health Clinics in the City of Rio de Janeiro*" to ensure the CF quality standard as well as the list of services offered.[8] Essentially, the CF units became a strong political flagship for the new government.

The CF changed the concept of PHC in Brazil by building large health units that could allocate 5 or more PSF teams. The list of equipment and services in the CF associated with the incorporation of new technologies enables greater resolution for physicians and, at the same time, greater comfort for patients, such as an offer for the collection of laboratory tests (clinical analysis), X-ray, electrocardiogram, ultrasound, mother-baby care

[7] Some authors defend that this new model enabled better efficiency in the purchase of materials and hiring of personnel; however, it is worth mentioning that no studies are confirming such statements. See Soranz (2014).

[8] The document ranges from hiring family health professionals guidelines to the physical standard established by the SMS for CF. In this second aspect, the document is extremely extensive and clear in describing the colors, furniture, equipment, and visual programming for each type of existing room (reception, restroom, vaccination, collection, oral health, mother-baby, child's room). Such guidelines were valid for new units and the old units renovated and transformed into CF.

after discharge from the maternity hospital, screening for cervical cancer (preventive) and breast cancer, among others (Harzheim et al., 2009).

Another way found by the SMS to guarantee this differentiation between the health units was redefining the PHC establishments' classification. Previously, there were at least 8 different nomenclatures.[9] After the reformulation, only two categories were adopted: Municipal Health Centers (CMS, for *Centro Municipal de Saúde*) and Family Health Clinics (CF, for *Clínica da Família*) (Harzheim et al., 2016).[10] Between 2010 and 2011, the SMS standardized the services and actions offered in each of these units. Thus, the secretariat also adopted a new typology to differentiate the units that operate the PHC only associated with the PSF and those that perform with one or two teams or those units that had no PSF teams.[11]

Between 2008 and 2012, Rio de Janeiro was the Brazilian capital that had the highest growth of the population covered by the PSF, reaching approximately 38% of its population. In September 2012, CF covered roughly 1.3 million, which represents 53% of the total PSF coverage.

3.3 Political System and Municipal elections in Brazil

Voting is compulsory in Brazil for all inhabitants between 18 and 70 years old, and literate citizens. Brazil is the world's fourth-largest democracy, with roughly 148 million voters, which represents around 70% of all citizens.[12] The city of Rio de Janeiro has the second largest electoral district in Brazil, with about 4.9 million registered voters.[13]

Municipalities are the smallest administrative units in the Brazilian Federative Structure, where the mayor is the executive officer chief, and the city council has the legislative power. The Brazilian federalism makes the mayor an extremely important figure in the political scene since the municipality is also recognized as a federative entity as well as states and the Union. Scholars have been pointing out both the mayor's influence in presidential elections and national policy influence in local elections.

The mayor has high administrative autonomy, receiving large amounts of resources every year from the state and the federal governments to provide basic public services such as health care and primary education. However, the mayor is the agenda setter, so he or she is responsible for proposing the city's budget to the City Council each year. The council analyzes it and eventually propose vetoes to it.[14] This executive-legislative relation shows that not only the executive branch is responsible for presenting policies, but also the legislative branch plays at least some role in this game by proposing changes into the original bills (Freitas, 2016).

[9] UCP (for *Unidade de Cuidados Prolongados*), PACS (for *Programa de Agentes Comunitários de Saúde*), PAM (for *Pronto Atendimento Municipal*), PS (for *Posto de Saúde*), *Unidades Mistas*, and CMS (for, *Municipal Health Centers*).

[10] From here on I will use the CMS nomenclature to refer to the old existing units in contrast to the new clinics, CF.

[11] Type A units are health units where the PSF teams cover the full territory; type B units are traditional health units, incorporating one or more PSF teams, that partially cover the territory; and type C units are traditional basic health units, without the presence of PSF teams (Harzheim et al., 2016; Campos et al., 2016).

[12] http://www.tse.jus.br/imprensa/noticias-tse/2020/Agosto/brasil-tem-147-9-milhoes-de-eleitores-aptos-a-votar-nas-eleicoes-2020. Last checked on September 21, 2020.

[13] http://www.tse.jus.br/eleitor/estatisticas-de-eleitorado/consulta-quantitativo. Last checked on September 21, 2020

[14] See Ferraz and Finan (2011) for a detailed description of Brazil's local politics

In Brazil, electors vote simultaneously for municipal mayor and local council every 4 years. The elections are held across the country at the end of the year, usually in October, and the new government begins in January of the following year. In municipalities with less than 200,000 electors, mayors are elected through simple plurality, which represents 98.5% of all Brazilian municipalities. In municipalities with more than 200,000 voters, mayors must be elected with at least 50% of the votes, or a second round is held. Since 1997 mayors can be reelected once. Thus, if a mayor desire to run again, he or she may leave the office for, at least, one term. However, as highlighted by Ferraz and Finan (2011), few mayors return to office after its second term.[15]

Given the strength of Brazilian subnational governments', the municipality proved to be an appealing destination for politicians (Titiunik, 2011). However, the success rate of candidates for reelection has fallen recently. In the 2000 and 2004 elections, the reelection rate was around 58%; in 2008, it reached 66%; in 2012 it was of 55%, and in the last municipal elections, 2016, it declined to 47%. The literature on incumbency advantage focuses both on personal and party advantages. The incumbency effect has been shown to be positive in the United States; meanwhile, in developing countries, it seems to be negative.[16]

3.4 Eduardo Paes Political Biography

Between 1993 and 1996, Eduardo Paes served as Rio de Janeiro's west zone sub-mayor. In 1996, he was elected councilor with the highest vote obtained in that year's election, 83,418 votes. Even before the end of his councilor term, in 1998, he was elected federal deputy with 117,164 votes. In 2002 he was reelected for the National Chamber of Deputies. Later, Paes served as Rio de Janeiro's Municipal Secretary of Environment and Rio de Janeiro State's Secretary of Tourism, Sport, and Leisure, between 2007 and 2008. In 2008, Eduardo Paes received 31.9% of votes in the first round and, in the second round, was elected Rio de Janeiro's mayor with 50.8% of votes, with a difference of only 60,000 votes for the second-placed candidate, Fernando Gabeira.

On the eve of the 2012 elections, Eduardo Paes' administration was approved by 45% of the electorate, 38% considered the government regular, and only 15% considered to be a poor or very bad administration.[17] In 2012, Paes was reelected mayor with 64.6% of votes in the first round, with 2.1 million votes, the most expressive vote share of the municipal elections in Rio de Janeiro's recent history.

[15] According to the authors, among the mayors that were in the second term between 2001-2004, only 12% were reelected in 2008, and only 9% run for higher offices (i.e., state or national congress, senate, or governor).

[16] See Titiunik (2011) Brambor and Ceneviva (2012) for more details.

[17] http://datafolha.folha.uol.com.br/opiniaopublica/2012/07/1130490-eduardo-paes-pmdb-lidera-disputa-com-54.shtml Last checked on September 14, 2020

4 Data

To evaluate the effects of health care expansion on electoral outcomes, I exploit administrative data from various sources. This section describes the datasets and presents some descriptive statistics.

4.1 Electoral Data

Electoral data are obtained from the Brazilian Electoral Superior Court (TSE, for *Tribunal Superior Eleitoral*), which is the official government office responsible for organizing the elections and its statistics in Brazil.

TSE defines delimited geographic areas within a state, called polling districts (*Zona Eleitoral*), which are responsible for centralizing and coordinating the voter registration of citizens living in this particular region. Depending on the population size, a municipality may contain one or more polling districts. In the city of Rio de Janeiro, there are 97 polling districts. TSE selects polling places (*Locais de votação*) within districts to hold elections. Usually, polling places are schools or public service centers. Voter machines (*urna eletrônica*) are located inside of polling places' rooms, called polling booth (*Seção Eleitoral*). In most cases, each polling booth corresponds to one voter machine. Only in extraordinary cases, there is more than one voter machine in each room. Nevertheless, electoral data is aggregated at the polling booth level. In the 2012 election in Rio de Janeiro, there were approximately 11,000 polling booths.

Citizens are registered to vote geographically close to their home address. The proof of residence defines the polling place to vote. Inside each polling place, voters are sequentially assigned within polling booths, always keeping the number of voters roughly the same between the polling booths.

From TSE, I collected voting data for the 2008 and 2012 municipal elections. In TSE's website, it is possible to gather full information on election results.[18] In this dataset, I was able to access data on the number of eligible voters, absentee, turnout, invalid votes (null and blank), and votes for each candidate at the polling booth level. The second piece of data collected in the TSE's platform relies on the characteristics of the electorate at the polling booth level, which consist of age, educational level, and gender.[19] Figure 2 presents Eduardo Paes' vote share distribution by polling district in both municipal elections 2008 and 2012, both in the first round.[20]

4.2 Health Data

4.2.1 CNES

I explore health unit data from the official national register of health establishments in Brazil (CNES, for *Cadastro Nacional de Estabelecimentos de Saúde*). CNES database, created and organized by the Ministry of Health, is available for all three spheres of government, and its registration serves as the basis for other vital

[18] http://www.tse.jus.br/eleicoes/estatisticas/repositorio-de-dados-eleitorais-1/repositorio-de-dados-eleitorais Accessed on July 17, 2020

[19] http://www.tse.jus.br/eleicoes/estatisticas/repositorio-de-dados-eleitorais-1/repositorio-de-dados-eleitorais

[20] Polling district's shapefiles data are available on http://inloco.mprj.mp.br/

systems.[21] The CNES platform provides a panel at the month-year level with a collection of establishments information such as installed physical capacity and infrastructure, the number of hospital beds, health services, professionals, PSF, and PHC teams. I used CNES to identify the number of PSF by month-year per health unit.

4.2.2 *DataRio*

I use Rio de Janeiro's municipal system of urban information, *DataRio*, to access specific health information. DataRio contains detailed information of the city coordinated by the local government, systematizing data in health, education, urbanism, culture, sports, sanitation, transport, and the like.[22] From this website, I had access to information about all the municipal health units: identification code, type of municipal health unit (hospitals, UPA, CMS, CF, and others), opening date, address, latitude, and longitude.

Using the identification health unit code, I match CNES with DataRio. Using the number of PSF teams by month-year (CNES) and the type of each health unit (Datario), it was possible to construct the evolution of PSF coverage in the city, visualizing the share of CF units over the years. Thus, Figure 3 shows the number of PSF teams segregating by CMS and CF units, and by year.

I also use DataRio to identify the health units' exact location and opening date. Thus, I was able to identify where and when each CMS and CF unit was launched in the city.

4.2.3 Health units' catchment area

To expand the PSF coverage, the Municipal Health Secretary (SMS) created one catchment area for each health unit. The catchment areas were designed according to the number of people it was able to follow. This measure was based on the number of PSF teams within each health unit multiplied by 3,450, which was the Ministry of Health estimate at that time. The population beneath one catchment area was under the responsibility of a specific health unit. It is a geographical area around the health facility that includes the covered population that accesses its services. There is no overlap between the health unit's catchment areas. Citizens are registered to health units close to their home address. There are exceptional cases where people request to be registered at a health unit close to their workplace. Citizens who also do not belong to a specific health clinic's catchment area are also assisted in an emergency or urgency demands. However, after the medical appointment, they are sent to the unit for specific treatment (usually to a UPA or a hospital).

As new health teams were allocated within existing units (CMS), the shapefiles were extended. Likewise, as new units were launched (CF), the SMS designed new catchment areas, also expanding the health care coverage. In both cases, these regions' expansion was guided by the city's zip codes' shapefiles. Each zip code in the city contains an approximate number of inhabitants. As the health unit's service capacity increased, it could attend a new zip code, and so on. Matching the health unit's locations and opening date (from DataRio) and

[21] Such as the National System of Information on Ambulatory Care (SIA, for *Sistema de Informação Ambulatorial*) and National System of Information on Hospitalizations (SIH, *for Sistema de Informação Hospitalar*).

[22] https://www.data.rio/

its shapefile (from SMS), I could plot this information on a map. Figure 4 shows the health unit's catchment area in September 2012.

4.3 *Cadastro Único*

Cadastro Único, the Single Registry for Social Programs, contains a set of socioeconomic information about Brazilian families in poverty and extreme poverty situation.[23] This information is used by the federal government, the states, and the municipalities to implement public policies. Several federal government programs and social benefits use *Cadastro Único* as a basis for selecting families for public policies, such as *Bolsa Família* and *Programa Minha Casa, Minha Vida*.[24] *Cadastro Único* provides data on voter registration, such as polling district, polling place, and polling booth, as well as the home address for each person.

An important caveat is that this database does not contain the entire Rio de Janeiro's population. Although the database only includes people who have received or are still receiving any government benefits, it is possible to argue that it consists of people that actually use SUS (or public health services). As discussed by Fujiwara (2015), due to a free health care system's coexistence with a private health insurance system, wealthier people prefer to pay for per-service fees or private insurance premiums and end up hardly using SUS. Therefore, it is reasonable to consider that people enrolled in *Cadastro Único* are the population that uses public health services, and they represent the target population from these public policies.

Since I have the home address of the population enrolled in *Cadastro Único* in 2012, I match this information with the health unit's shapefiles (from SMS). Thus, it was possible to identify if the individual lives inside or outside of a health unit's catchment area and the type of health unit (CMS or CF) responsible for each person. I consider a voter as treated the individual that lives inside of a health unit catchment area. As *Cadastro Único* also provides individual voting data, using the previous step, it was possible to identify in which polling booth each treated individual votes.

This procedure has two main ideas. First and foremost, identify individuals impacted by the PSF program using their home address, since they are registered in health units according to it. Secondly, evaluate PSF's electoral impact, using individual voting data to identify precisely where treated individuals vote.

Since TSE provides voting data at the polling booth level, I aggregated the total number of individuals affected by the health units at the polling booth level. Finally, as TSE provides the total number of voters in each polling booth, it was possible to calculate the proportion of treated voters in each polling booth, the variable of interest.

There is another essential caveat regarding *Cadastro Único*. Even though it is necessary to present documents to fill in family or individuals data when registering in *Cadastro Único*, there are some inconsistencies in the

[23] Families with up to half of minimum wage per person and with up to 3 minimum wages of total monthly income must be registered.

[24] This dataset was organized by the Ministry for Social Development (MDS, for Ministério de Desenvolvimento Social), which was responsible for national policies for social development, food, and nutrition security, social assistance and citizenship income in the country. In 2019, the MDS was merged into the Ministry of Citizenship, alongside with the Ministry of Sport and Culture.

data. The main concern is that the number of people in some polling booths reports by *Cadastro Único* exceeded the total number of voters that the TSE reported. Thus, to avoid polling booths with more than 100% of voters treated, these observations were removed from the database. Thus, it is reasonable to consider that the preliminary effects found may be underestimated.

Tables 1 and 2 present some descriptive statistics at the polling booth level.[25]

5 Empirical Strategy

Ideally, I intend to identify the population treated by PSF and how they voted. Since voting and health data at the individual level are not available, I used aggregated data at the polling booth level. I estimate the PSF effect on electoral outcomes through an OLS linear regression model including pooling places fixed effects as follow:

$$\Delta votes_{pb} = \alpha_p + \beta \Delta PSF_{pb} + X'_{pb}\gamma + \epsilon_{pb} \tag{1}$$

where the subscript 'p' indicates polling places (*Locais de votação*) and 'b' the polling booths (*Seção eleitoral*).

The outcome of interest is Eduardo Paes' vote share variation represented by $\Delta votes_{pb}$. This variable, defined as $\Delta votes_{pb} = votes^{12}_{pb}$ - $votes^{08}_{pb}$, is the difference between Eduardo Paes' vote share in 2012 and its vote share in 2008 in each polling booth, both computed at the first round. The treatment variable ΔPSF_{pb} is the variation of voters covered by the PSF between 2008 and 2012. Similarly, $\Delta PSF_{pb} = PSF^{12}_{pb}$ - PSF^{08}_{pb}. As described in Section 4, since this variable was constructed using individual data from *Cadastro Único*, it was possible to measure this ratio in each polling booth. I calculated this rate as the difference between the proportion of voters covered by PSF teams in December 2008 and the proportion of voters treated in September 2012 (the election month). X'_{pb} represents the controls variable at the polling booth level (from TSE) in the baseline (2008), such as: groups of age (percentage of 16, 17, 18-20, 21-24, 25-34, 35-44, 45-59, 60-69, 70-79 and 79 years of age or older); educational level (percentage of illiterate, knows how to read and write but without formal education, primary incomplete, primary completed, secondary education incomplete, secondary education completed, college incomplete and college completed) and gender (percentage of women and men).

Since the model regresses the first difference in PSF coverage variation, conditional on polling places fixed effects and including controls in the baseline, this specification is equivalent to a difference-in-differences approach. Thus, the identification of PSF causal effect, $\beta = [votes^{12}_{pb} - votes^{08}_{pb}|p, b] = [\Delta votes_{pb}|p, b]$, holds on the typical hypothesis of a dif-in-dif model.[26]

Although this design already controls for non-time-varying confounders, several omitted variables are potentially correlated with the outcome and the treatment assignment. The relationship between Eduardo Paes'

[25] Although in the 2012 election, there are over 11,000 polling booths in the city of Rio de Janeiro, as both variable treatment and the electoral outcome are analyzed in variation, I selected only those polling booths that exist in the two years (2008 and 2012) and those that have not changed addresses. Thus, the total number of base observations is 9,765 polling stations.

[26] (1) Parallel pre-treatment trends between treated and control observations; (2) No compound treatment; (3) No spillovers (SUTVA); and (4) Group membership is stable (no migration from control to treatment)

reelection and the PSF expansion may be endogenous. For instance, if the mayor intentionally allocated new health clinics in areas where he already had increasing (reducing) approval, the estimates are biased downward (or upward). To overcome this empirical issue, I exploit exogenous variation in PSF design to identify how the program coverage affects electoral outcomes.

As described in Section 3, the new clinics' implementation was driven by a health assistance vacuum in the city. However, the exact addresses where the CF units implemented were defined according to the local government's land availability. There is extensive literature pointing out the importance of health care facilities' location in the territory. Since the primary health care is the first contact with the population, health facilities' addresses also represent accessibility to health services. Thus, geographical concerns have been taken into account in health reform debates (Allan, 2014).

To better understand how the Secretariat determined where to allocate the new health facilities, qualitative interviews were conducted with policymakers involved in its plan and implementation. In Rio de Janeiro, no specific factors were taken into account at improving the population's accessibility when choosing the location to build the health clinics. In this specific case, neither the transport modes were taken into account. The local government preferred to created new bus lines instead of choosing places with better accessibility. Thus, even if a region had less PSF coverage or did not have any health services nearby, the government prioritized the implementation in environments where the government could already start building the new clinics as soon as possible.

The definition of health facilities' catchment areas also plays a vital role in health care systems. They are essential to improve public health, weaken health disparities, and minimize disease risks (Wan et al., 2012). Several factors have been recognized as crucial in defining theses regions. The most common is the straight-line distance from the facility and travel time to the facility. However, mean distance measures may overestimate or underestimate health care service areas (Allan, 2014; Pan et al., 2018). Studies have proposed service provision-to-population and physician-to-population ratios, which consider both health supply and demand within a fixed geographic zone. More sophisticated methods develop a floating catchment area, incorporating the level of utilization of health services, health outcomes for specific disease groups, and observed health behavior patterns (Langford et al., 2012; Wan et al., 2012; Allan, 2014).

In Rio de Janeiro's context, none of these factors were considered when planning and implementing health facilities' catchment areas. This empirical strategy's identification hypothesis relies on how these catchment areas were designed and how they have been expanding over time in the territory. Not even the health demand of each region was considered, as well as the existing health conditions of each neighborhood. No study was carried out to verify which regions were most in need or vulnerable in health. Given that clinic locations were defined by land availability, which is greatly determined by fixed geographical factors, the only element used was the pre-existing supply of health facilities. However, this expansion did not have a correct or determined direction.

As the catchment area's idealization and its expansion did not follow any defined thresholds based on income,

social vulnerability, or even the population's health profile, it is reasonable to consider that its design is as good as random in the territory, conditional upon fixed-effects, which are absorbed in the first-difference specification. For that reason, controlling for demographic characteristics makes the treatment assignment mechanism greatly exogenous.

6 Results

In this Section, I present the results analyzing Eduardo Paes' vote share as the main outcome. I also organize the findings in two main parts: (1) I analyze the total effect of PSF expansion and (2) I split the program expansion into the health facility's type: CMS and CF.

6.1 PSF expansion: Total effect

6.1.1 Total effect of PSF expansion on incumbent vote share

Column (1) of Table 3 shows the results from model 1 without controls and fixed effects. The relationship between PSF coverage variation and Eduardo Paes' vote share variation is positive and statistically significant. In column (2), including polling places fixed effects, the estimate is slightly lower than the previous specification. Column (3) presents the estimate including both controls and polling places fixed effects, which is the main specification. The estimated point is lower than the first two specifications, but the coefficient remains positive and statistically significant. Since both outcome and treatment variables are measured in percentage variation, the estimates must be interpreted considering this change in the variables. The PSF coverage between 2008 and 2012 varied from 7.1% to 38.2%, representing an increase of 31.1 percentage points. Thus, to evaluate its impact on Eduardo Paes' vote share, it is necessary to multiply the estimated coefficient by this variation. In other words, considering column (3), the program coverage variation increased by 0.016 (0.053*0.311) percentage points the mayor's vote share variation. Since Eduardo Paes' vote share ranged from 32.6% to 64.6% between 2008 and 2012, a variation of 32.6 percentage points, this impact of 0.016 from PSF coverage represents an increase of roughly 5.06% (0.016/0.326) in mayor's vote share.

6.1.2 Total effect of PSF expansion: by years

Due to the staggered implementation of the program by year throughout 2009 and 2012, I split the treatment variable into years: 1) PSF^{09}, which is the fraction of people treated by the PSF during the first year of the program expansion (I calculate this rate as the difference between the proportion of individuals covered by PSF teams in December 2009 and the proportion of citizens treated by PSF teams in December 2008); 2) PSF^{10}, which is the ratio of people covered by the PSF teams during the second year of the program expansion (I compute this variable as the difference between PSF coverage in December 2010 and the PSF proportion in December 2009); 3) PSF^{11}, which represents the rate of people treated by the PSF during the third year of the program; and lastly, 4) PSF^{12}, which denotes the population covered by the PSF in the last year of Eduardo

Paes' term (in this case, since the election is held in October 2012, I calculate this variable as the difference between PSF coverage on September 2012 and PSF coverage on December 2011).

I estimate the model replacing PSF as below:

$$\Delta votes_{pb} = \alpha_p + \beta_{09}\Delta PSF_{pb}^{09} + \beta_{10}\Delta PSF_{pb}^{10} + \beta_{11}\Delta PSF_{pb}^{11} + \beta_{12}\Delta PSF_{pb}^{12} + X'_{pb}\gamma + \epsilon_{pb} \quad (2)$$

Column (4) of Table 3 suggests a positive and statistically significant impact of PSF coverage on mayor's vote share variation in all years except for the government's first year.

Since the PSF coverage variation in the second year is 6.04 percentage points, varying from 9.6% in 2009 to 15.7% in 2010, the PSF expansion effect is roughly 0.003 (0.054*0.0604) percentage points on Eduardo Paes' vote share variation. As the mayor's percentage votes increased by 32.6 percentage points between the two elections, this impact of 0.003 percentage points represents approximately 1.00% (0.003/0.326) increase in its vote share variation.

Analyzing the government's third year, the PSF coverage changed from 15.7% in 2010 to 31.8% in 2011. This increase of 16.2 percentage points represents an impact of 0.006 (0.038*0.167) percentage points on Eduardo Paes' vote share variation. This impact is approximately 1.88% (0.006/0.326) of Eduardo Paes' vote share variation in the period.

In the last year, the PSF coverage increasing 0.064 percentage points, ranging from 31.8% in 2011 to 38.2% in 2012, similar to the PSF second year. Even so, the PSF effect on the electoral outcome this year is similar to the third year, when the city had the greatest growth observed of PSF coverage in the period. The PSF effect between 2011 and 2012 is approximately 0.007 (0.105*0.064) percentage points on Eduardo Paes' vote share variation. This impact represents a 2.07% increase in the mayor's vote share variation between 2008 and 2012.

This effect of PSF coverage growing over the years and reaching its greatest impact on the election-year is similar to what the retrospective voting literature has found. Voters intend to evaluate the overall politician's performance; however, election-year facts are more easily available than searching information of previous years (Healy and Malhotra, 2013). Even with a small expansion of the program in the government's last year (6.4 percentage points), its impact corresponds to a variation in coverage roughly to 16 percentage points, highlighting the election year's importance.

6.2 PSF expansion by health unit type: CMS and CF

6.2.1 Effect of PSF expansion by health unit type on incumbent's vote share

In this subsection, I explore some heterogeneities on the health units' type. The CF, which were idealized and built from 2009, differs from existing units due to its architectural structure and the health services offered as discribed in Section 3. I decompose the PSF coverage into two fractions: (1) CMS, the portion of voters covered by a CMS unit; and (2) CF, the fraction of people covered by a CF unit. Since there are not overlap between the health facilities' catchment areas, I estimate the model replacing the treatment variable as follow:

$$\Delta votes_{pb} = \alpha_p + \beta_{CMS}\Delta CMS_{pb} + \beta_{CF}\Delta CF_{pb} + X'_{pb}\gamma + \epsilon_{pb} \tag{3}$$

Column (1) of Table 4 reports the estimates of model 3 without control variables and fixed effects. Both CMS and CF coverage variation seems to impact the mayor's vote share variation, with a more pronounced effect on CF facilities. Column (2) presents the results including polling places fixed effects. The findings are roughly the same from the previous specification. Column (3) reports the estimates of model 3 with both control variables and polling places fixed effects. The results suggest a positive and statically significant effect of PSF expansion concentrated in CF units. Simultaneously, CMS coverage does not seem to be related to Eduardo Paes' vote share difference. The CF coverage varied from 0% to 19.9% between 2008 and 2012, representing 19.9 percentage points of increase. The effect of CF coverage variation is roughy 0.013 (0.065*0.199) percentage points on electoral outcomes. Since the mayor's vote share increased by 32.6 percentage points, this impact can be interpreted as a 3.96% increase in Eduardo Paes' vote share.

These results allows us to speculate on how voters react to the service's quality and not only to its expansion itself. The effect found in column 3 of Table 3 seems to come from the new units built (CF) in the period and not from the existing clinics (CMS).

6.2.2 Effect of PSF expansion by health unit type: by years

Similarly to 2, I split the treatment variables in model 3 into years. Thus, I estimate the following specification:

$$\begin{aligned}\Delta votes_{pb} = \alpha_p + \beta^{09}_{CMS}\Delta CMS^{09}_{pb} + \beta^{10}_{CMS}\Delta CMS^{10}_{pb} + \beta^{11}_{CMS}\Delta CMS^{11}_{pb} + \beta^{12}_{CMS}\Delta CMS^{12}_{pb} + \\ \beta^{09}_{CF}\Delta CF^{09}_{pb} + \beta^{10}_{CF}\Delta CF^{10}_{pb} + \beta^{11}_{CF}\Delta CF^{11}_{pb} + \beta^{12}_{CF}\Delta CF^{12}_{pb} + X'_{pb}\gamma + \epsilon_{pb}\end{aligned} \tag{4}$$

Column (4) of Table 4 show the results from model 4 including control variables and polling places fixed effects. Even so, the overall CMS coverage variation impacts electoral outcome (Table 3); when splitting its coverage into years, there is a strong effect during the first year. CMS coverage ranged from 7.1% in 2008 to 9.2% in 2012, representing 2.00 percentage points of growth. Since the estimated coefficient is 0.712, the impact of the health facility's type during the government's first year is 0.015 (0.712*0.02) percentage points on the electoral outcome. This impact is roughly 4.47% (0.015/0.326) of Eduardo Paes' vote share variation in the period.

The government strategy can explain this effect in the PSF expansion. The newly elected government had already decided to invest in expanding primary health care in the city of Rio de Janeiro. Its strategy was to build health units that could be recognized by the population as a product of the new administration. However, while the first units were being built, the Municipal Health (SMS) increased the number of PSF teams in existing units (CMS). Thus, as the new units (CF) were ready, health teams were transferred to the CF, as described in Section 3.

Analyzing the CF coefficients in column (4) of Table 4, the results suggest an increasing and statistically significant impact of CF coverage from 2010. The CF coverage varied from 0.4% in 2009 to 5.8% in 2010, an increase of 5.4 percentage points. Since the estimated coefficient is 0.054, the CF effect corresponds to 0.003 (0.054*0.054) percentage points on the mayor's vote share variation. This impact can be translated as an increment of 0.89% of Eduardo Paes' percentage votes.

In the government's third year, CF coverage ranged from 5.8% in 2010 to 14.7% in 2011. The growth of 8.9 percentage points in its coverage in the city represents an increase in Eduardo Paes' vote share variation by 0.005 percentage points.

In the following year, the CF effect is slightly higher than the previous one. Similarly to CMS, the CF coverage pattern variation in the last year is similar to the second and lower than the third government's year. Between 2011 and 2012, CF coverage varied from 14.68% to 19.87%. These 5.2 percentage points variation represents an increase in mayor's vote share variation by 0.005 percentage points, representing virtually a 1.65% (0.005/0.326) increase of Eduardo Paes' vote share between the two elections.

6.3 HHi index

6.4 Descriptive analysis

To understand the impact of PSF expansion in the legislative branch, I explore data on councilor vote data in the city. In order to do this, I use the HHi (Herfindahl–Hirschman Index) index, which measures the concentration ratio of firms in industries. Since I am analyzing councilors' votes, I am considering them as my unit of analysis. HHi is defined as the sum of the squares of the councilors' vote share within the City Council.

In this preliminary study, I produce a more exploratory analysis on the distribution of seats by parties in the City Council in 2008 and 2012. Table 5 presents each party's proportion in the legislative branch and its HHi index in both years. In general, HHi varied from 0.07 to 0.10 in 2012. It may seem that party concentration increased; however, this growth is driven by the significant increase of PMDB participation (the mayor's party). PMDB participation in the number of chairs varies from 10% to 25%, the highest growth observed in the period. Although, calculating the index without the PMDB party, HHi decreased from 0.06 in 2008 to 0.04 in 2012. This variation represents a decrease in the same proportion of the growth of PMDB HHi (roughly 41%).

To investigate this index spatially, I analyze HHi by political party and polling districts. I compute the index as follows:

$$HHi = \sum_{d=1}^{n} (\frac{V_{pd}}{V_p})^2 \tag{5}$$

where V_{pd} represents the total votes of the p party in the d polling districts and V_p is the total votes of the p party in the municipality.

The last column of Table 6 shows each party's HHi by electoral zone weighted by the total votes received in 2008. Out of 27 parties, 16 of them (59%) had a drop in HHi by zone between 2008 and 2012. The parties that

had the greatest negative variation were: PT do B, PSDC, and PMDB. The parties that had a positive variation in the index lost or maintained their presence in the chamber. The PSDB and DEM, for instance, were the two parties that had the greatest negative variation in the number of seats in the chamber between 2008 and 2012 (Table 5). Thus, although the PMDB has increased its participation in the City Council, the party's councilors' votes in 2012 appear to be less concentrated in the territory than in 2008. In order to better visualize, I present (1) the party with the most significant drop of the index, PT do B, in Figure 5, (2) the mayor's party, PMDB in Figure 6, and (3) the party with the highest growth of HHi in the period, DEM, in Figure 7.

From these two descriptive and preliminary analyses, two hypotheses arise. First, it seems that the incumbent's benefits have spillovers over the legislative branch. Secondly, it appears that health care public policies may break the power of councilors to fill private demands from the poorest, as presented by the literature.

6.5 HHi: Preliminary Results

In order to estimate how PSF expansion impact the concentration of councilors vote share, I propose the following models:

$$\Delta HHi_{pb} = \alpha_p + \beta \Delta PSF_{pb} + X'_{pb}\gamma + \epsilon_{pb} \tag{6}$$

$$\Delta HHi_{pb} = \alpha_p + \beta_{CMS} \Delta CMS_{pb} + \beta_{CF} \Delta CF_{pb} + X'_{pb}\gamma + \epsilon_{pb} \tag{7}$$

where ΔHHi_{pb} is defined as 5 however at the polling booth level.

From column (1) of Table 7, it seems that overall, the expansion of PSF coverage does not affect the HHi index. However, splitting the treatment variable by health facility's type, the results show there is a negative impact of CMS coverage expansion in HHi index variation. Even though, in general, the expansion in new units does not seem to have an impact on the index, when we analyze it by year, some effects appear. In the first year and the second year of government, the results suggest a positive effect on HHi, the concentration of councilors' vote. However, in the election year, this achievement seems to be negative, although small.

7 Conclusion

The evaluation of the incumbent administration is a crucial question in democracies. The literature has been examining whether voters react or not to public policies and if they reward high-performance politicians. Since the increased notoriety of healthcare issues, scholars have shown that political leaders also respond to voter responsiveness, providing healthcare services. This project contributes to the *feedback theory* literature and *retrospective voting* studies, providing some new evidence about the effect of increasing healthcare services on voting behavior in developing countries.

In order to do this, I have explored Rio de Janeiro's context, which faced a significant increase in primary health care coverage between 2008 and 2012. Thus, I investigate if voters reacted to this expansion when reelecting the mayor.

Using data both at the polling booth level, I found that the program's expansion increased the mayor's vote share between the two elections. There is evidence that voters tend to react more to new health units built in this period. At the same time, infrastructure reforms and an increase in the number of PSF teams in existing units did not appear to influence voters. The results also show that election-year has greater impact on Eduardo Paes' vote share variation.

I also tried to investigate the relationship between health care services and the legislative branch. The literature has pointed out that increases in these provisions may break clientelistic patterns. The preliminary analyses suggest a negative impact of the program expansion through existing units in the concentration councilors' votes variation. However, in-depth analyses are needed.

More work is still needed to reach reliable conclusions and find causal relationships between the PSF program and voter behavior. I presented a set of preliminary results; however, this project is still in progress.

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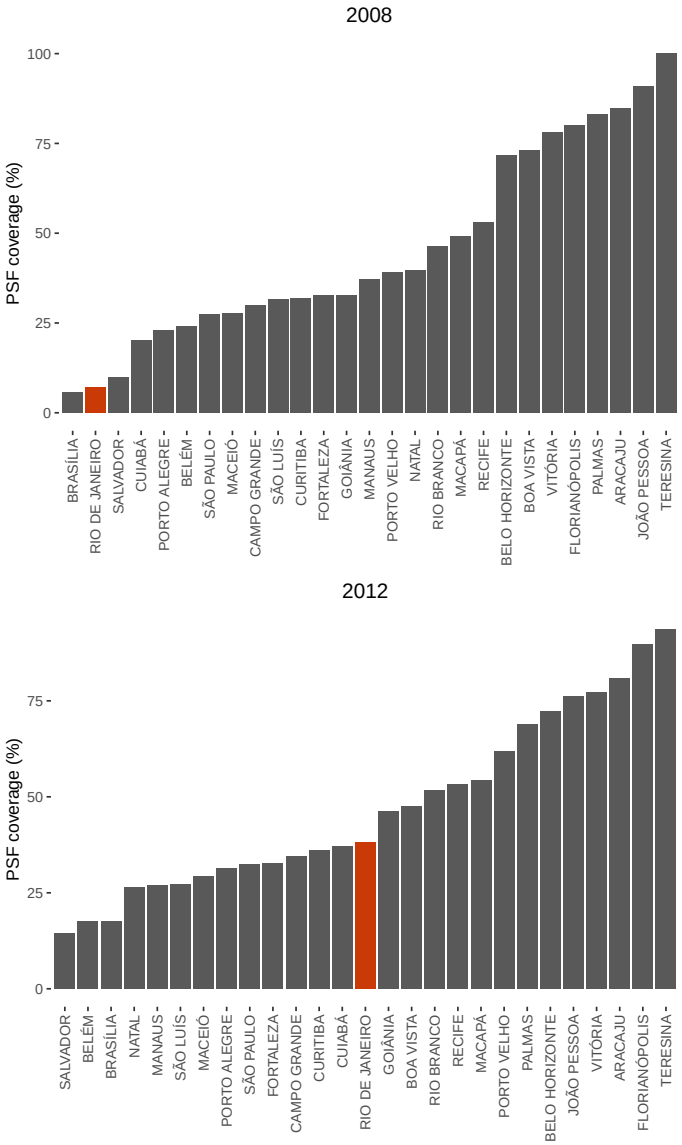
8 Appendix

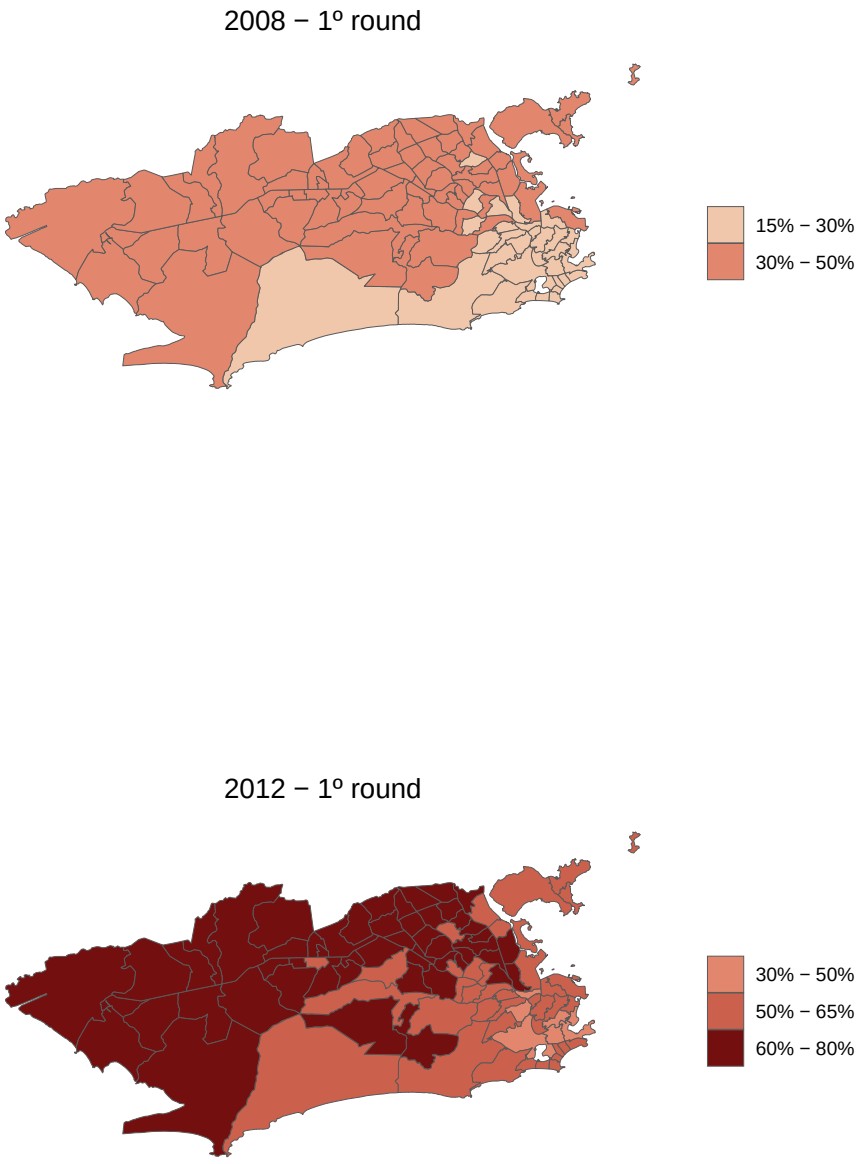
8.1 Maps and graphics

Figure 1: PSF coverage in all Brazilian capitals in December 2008 and September 2012



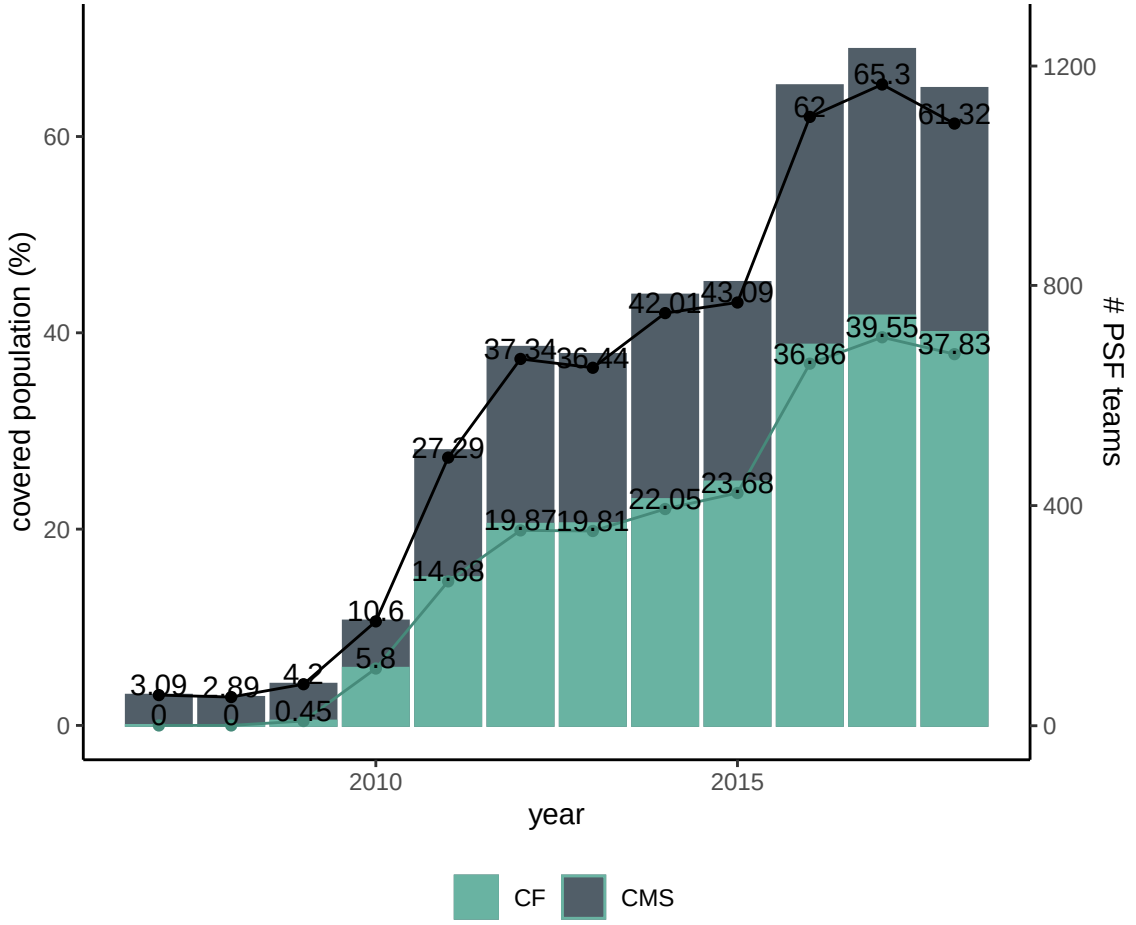
Source: Brazilian Ministry of Health, SAS/Dept de Atenção Básica – DAB

Figure 2: Eduardo Paes' vote share distribution by polling districts in 2008 and 2012



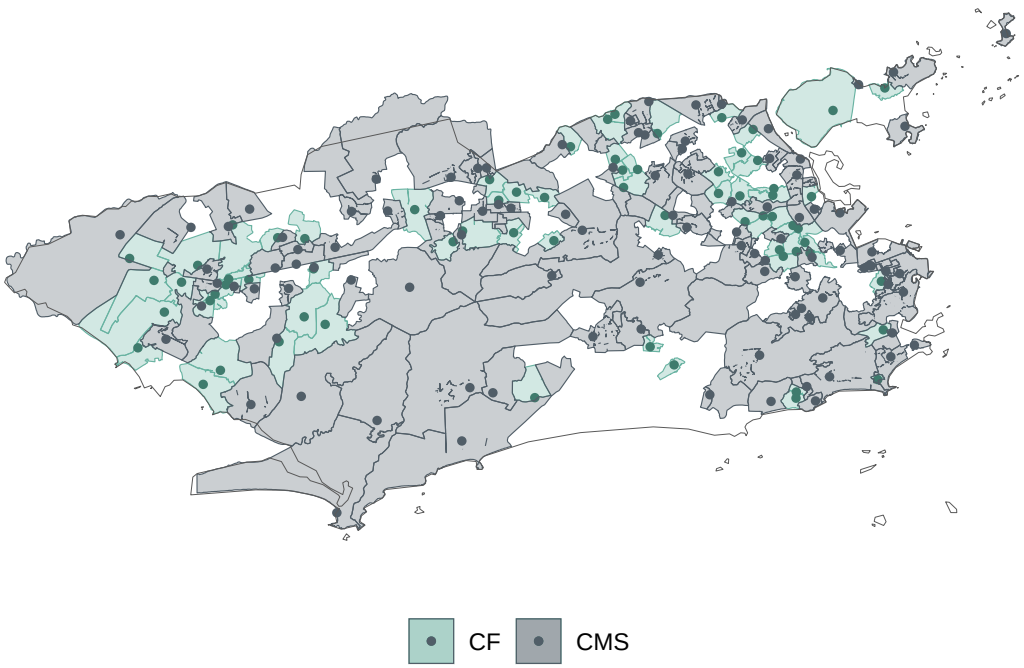
Source: Brazilian Electoral Superior Court - *Tribunal Superior Eleitoral* – TSE

Figure 3: Number of PSF teams and population coverage segregating by CMS and CF and by year



Source: CNES (*Cadastro Nacional de Estabelecimentos de Saúde*) and DataRio

Figure 4: Health units' catchment areas in 2012



Source: SMS (Municipal Health Secretary) and DataRio

8.2 Descriptive statistics

Table 1:

Statistic	N	Mean	St. Dev.	Min	Max
Electoral outcomes					
Eduardo Paes' vote share - 2008	9,765	0.320	0.066	0.094	0.538
Eduardo Paes' vote share - 2012	9,765	0.644	0.101	0.316	0.899
Δ Eduardo Paes' vote share	9,765	0.324	0.073	0.052	0.601
Treatment variables					
PSF					
Δ % PSF - 2009	9,765	0.002	0.011	0.000	0.413
Δ % PSF - 2010	9,765	0.020	0.067	-0.625	0.830
Δ % PSF - 2011	9,765	0.027	0.079	0.000	0.953
Δ % PSF - 2012	9,765	0.009	0.042	0.000	0.986
Δ % PSF - 2009 - 2012	9,765	0.057	0.114	-0.625	0.986
CMS					
Δ % CMS - 2009	9,765	0.001	0.004	0.000	0.131
Δ % PSF - 2010	9,765	0.001	0.016	-0.625	0.189
Δ % PSF - 2011	9,765	0.008	0.048	0.000	0.886
Δ % PSF - 2012	9,765	0.001	0.006	0	0
Δ % PSF - 2009 - 2012	9,765	0.010	0.051	-0.625	0.883
CF					
Δ % CF - 2009	9,765	0.001	0.010	0	0
Δ % CF - 2010	9,765	0.019	0.064	-0	1
Δ % CF - 2011	9,765	0.019	0.061	0.000	0.918
Δ % CF - 2012	9,765	0.008	0.041	0.000	0.986
Δ % CF - 2009 - 2012	9,765	0.047	0.099	0.000	0.986

Table 2:

Statistic	N	Mean	St. Dev.	Min	Max
Control variables - 2008 (baseline)					
% of 16 years old	9,765	0.001	0.004	0	0
% of 17 years old	9,765	0.005	0.011	0.000	0.156
% of 18 - 20 years old	9,765	0.049	0.067	0.000	0.617
% of 25 - 34 years old	9,765	0.204	0.195	0.000	0.908
% of 35 - 44 years old	9,765	0.190	0.120	0.024	0.872
% of 45 - 59 years old	9,765	0.263	0.112	0.015	0.581
% of 60 - 69 years old	9,765	0.101	0.051	0.000	0.266
% of 70 - 79 years old	9,765	0.068	0.044	0.000	0.249
% of 79 years old or older	9,765	0.044	0.037	0.000	0.234
% of female	9,765	0.544	0.090	0.054	0.942
% of male	9,765	0.454	0.090	0.058	0.946
% of illiterate	9,765	0.015	0.014	0.000	0.276
% of knows how to read and write, but without formal education	9,765	0.081	0.060	0.000	0.413
% of primary incomplete	9,765	0.237	0.110	0.007	0.649
% of primary complete	9,765	0.128	0.051	0.000	0.396
% of secondary education incomplete	9,765	0.205	0.082	0.035	0.572
% of secondary education complete	9,765	0.185	0.055	0.017	0.414
% of college incomplete	9,765	0.055	0.043	0.000	0.299
% of college complete	9,765	0.091	0.104	0.000	0.593

8.3 Regressions Tables

Table 3: Total effect of PSF expansion on incumbent's vote share

	Dependent variable:			
	Δ Eduardo Paes' vote share			
	OLS		*panel linear*	
	(1)	(2)	(3)	(4)
Δ % PSF	0.154***	0.144***	0.053***	
	(0.006)	(0.006)	(0.005)	
Δ % PSF - 2009				0.005
				(0.060)
Δ % PSF - 2010				0.054***
				(0.009)
Δ % PSF - 2011				0.038***
				(0.007)
Δ % PSF - 2012				0.105***
				(0.014)
Polling places fixed effects	No	Yes	Yes	Yes
Controls (baseline)	No	No	Yes	Yes
Observations	9,765	9,765	9,765	9,765
Residual Std. Error	0.071 (df = 9763)			

Standard errors in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Note: The control variables in the baseline (2008) included: groups of age (percentage of 16, 17, 18-20, 21-24, 25-34, 35-44, 45-59, 60-69, 70-79 and 79 years of age or older); educational level (percentage of illiterate, knows how to read and write but without formal education, primary incomplete, primary completed, secondary education incomplete, secondary education completed, college incomplete and college completed) and gender (percentage of women and men).

Table 4: PSF expansion by health unit type: CMS and CF

	Dependent variable:			
	Δ Eduardo Paes' vote share			
	OLS		*panel linear*	
	(1)	(2)	(3)	(4)
Δ % CMS	0.080***	0.080***	0.016	
	(0.014)	(0.014)	(0.011)	
Δ % CF	0.176***	0.163***	0.065***	
	(0.007)	(0.007)	(0.006)	
Δ % CMS - 2009				0.712***
				(0.254)
Δ % CMS - 2010				0.055
				(0.037)
Δ % CMS - 2011				0.009
				(0.012)
Δ % CMS - 2012				0.151
				(0.092)
Δ % CF - 2009				−0.030
				(0.061)
Δ % CF - 2010				0.054***
				(0.009)
Δ % CF - 2011				0.058***
				(0.009)
Δ % CF - 2012				0.104***
				(0.014)
Polling places fixed effects	No	Yes	Yes	Yes
Controls (baseline)	No	No	Yes	Yes
Observations	9,765	9,765	9,765	9,765
Residual Std. Error	0.071 (df = 9762)			

Standard errors in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Note: The control variables in the baseline (2008) included: groups of age (percentage of 16, 17, 18-20, 21-24, 25-34, 35-44, 45-59, 60-69, 70-79 and 79 years of age or older); educational level (percentage of illiterate, knows how to read and write but without formal education, primary incomplete, primary completed, secondary education incomplete, secondary education completed, college incomplete and college completed) and gender (percentage of women and men).

8.4 HHi: Preliminary analyses

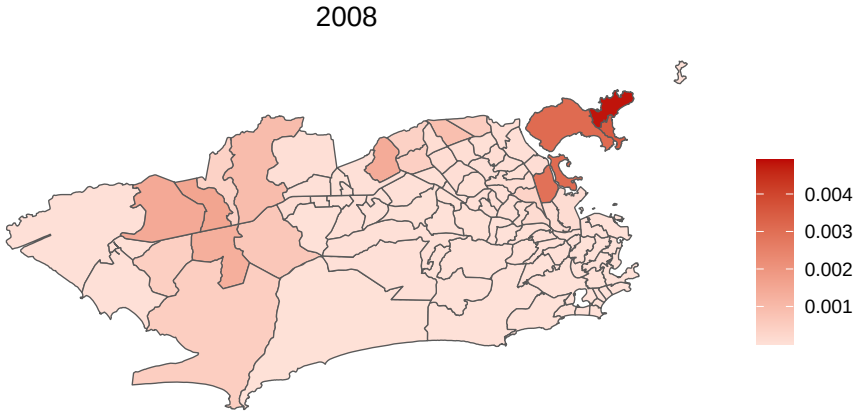
Table 5: Distribution of seats in the city council by party

	Political Party	Seats-2008	Seats-2012	(%) 2008	(%) 2012	Δ%	HHi 2008	HHi 2012
1	PMDB	5.00	13.00	9.80	25.49	0.16	0.01	0.06
2	PSOL	1.00	4.00	1.96	7.84	0.06	0.00	0.01
3	PSDC	1.00	3.00	1.96	5.88	0.04	0.00	0.00
4	PT	3.00	4.00	5.88	7.84	0.02	0.00	0.01
5	PTB	1.00	2.00	1.96	3.92	0.02	0.00	0.00
6	PSD	0.00	1.00	0.00	1.96	0.02	0.00	0.00
7	PSL	0.00	1.00	0.00	1.96	0.02	0.00	0.00
8	PTN	0.00	1.00	0.00	1.96	0.02	0.00	0.00
9	PHS	1.00	1.00	1.96	1.96	0.00	0.00	0.00
10	PP	3.00	3.00	5.88	5.88	0.00	0.00	0.00
11	PR	2.00	2.00	3.92	3.92	0.00	0.00	0.00
12	PRB	2.00	2.00	3.92	3.92	0.00	0.00	0.00
13	PRTB	1.00	1.00	1.96	1.96	0.00	0.00	0.00
14	PSB	2.00	2.00	3.92	3.92	0.00	0.00	0.00
15	PSC	2.00	2.00	3.92	3.92	0.00	0.00	0.00
16	PTC	1.00	1.00	1.96	1.96	0.00	0.00	0.00
17	PC do B	1.00	0.00	1.96	0.00	-0.02	0.00	0.00
18	PDT	3.00	2.00	5.88	3.92	-0.02	0.00	0.00
19	PMN	1.00	0.00	1.96	0.00	-0.02	0.00	0.00
20	PPS	2.00	0.00	3.92	0.00	-0.04	0.00	0.00
21	PV	3.00	1.00	5.88	1.96	-0.04	0.00	0.00
22	PSDB	5.00	2.00	9.80	3.92	-0.06	0.01	0.00
23	PT do B	3.00	0.00	5.88	0.00	-0.06	0.00	0.00
24	DEM	8.00	3.00	15.69	5.88	-0.10	0.02	0.00

Table 6: HHi at the polling districts level by party

	Political Party	HHi 2008	HHi 2012	ΔHHi	Toal votes - 2008	weighed ΔHHi
1	PT do B	0.03	0.02	-0.01	166425	-1181.43
2	PSDC	0.03	0.02	-0.01	82713	-781.77
3	PMDB	0.02	0.01	-0.00	312649	-777.20
4	PTC	0.03	0.03	-0.01	72215	-560.84
5	PTB	0.02	0.02	-0.00	85982	-400.62
6	PMN	0.05	0.03	-0.01	34639	-399.22
7	PP	0.02	0.02	-0.00	140446	-288.03
8	PR	0.02	0.01	-0.00	135335	-238.23
9	PV	0.02	0.02	-0.00	198737	-161.23
10	PTN	0.04	0.03	-0.01	15620	-95.81
11	PCO	0.07	0.00	-0.07	1023	-76.26
12	PRTB	0.03	0.03	-0.00	25667	-70.60
13	PSTU	0.02	0.01	-0.00	11493	-50.30
14	PSOL	0.01	0.01	-0.00	63595	-12.70
15	PSL	0.02	0.02	-0.00	24674	-10.00
16	PCB	0.01	0.01	-0.00	5332	-4.18
17	PPS	0.01	0.01	0.00	113239	18.86
18	PHS	0.02	0.02	0.00	50008	35.51
19	PRP	0.03	0.03	0.01	7568	60.25
20	PC do B	0.01	0.01	0.00	109433	62.08
21	PDT	0.01	0.01	0.00	174220	88.21
22	PSB	0.02	0.02	0.00	100892	145.54
23	PRB	0.01	0.01	0.00	151224	162.52
24	PT	0.01	0.01	0.00	200038	242.94
25	PSDB	0.02	0.02	0.00	266993	530.41
26	PSC	0.02	0.02	0.01	144842	849.00
27	DEM	0.01	0.02	0.00	476788	1116.71

Figure 5: PT do B - HHi distribuition



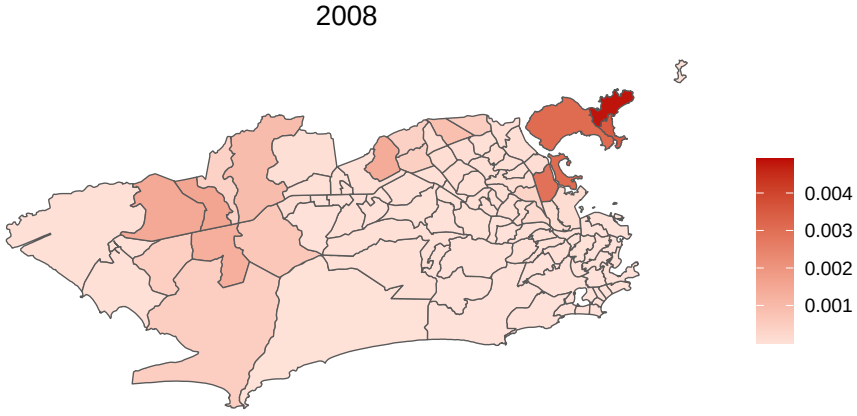


Figure 6: PMDB - HHi distribuition

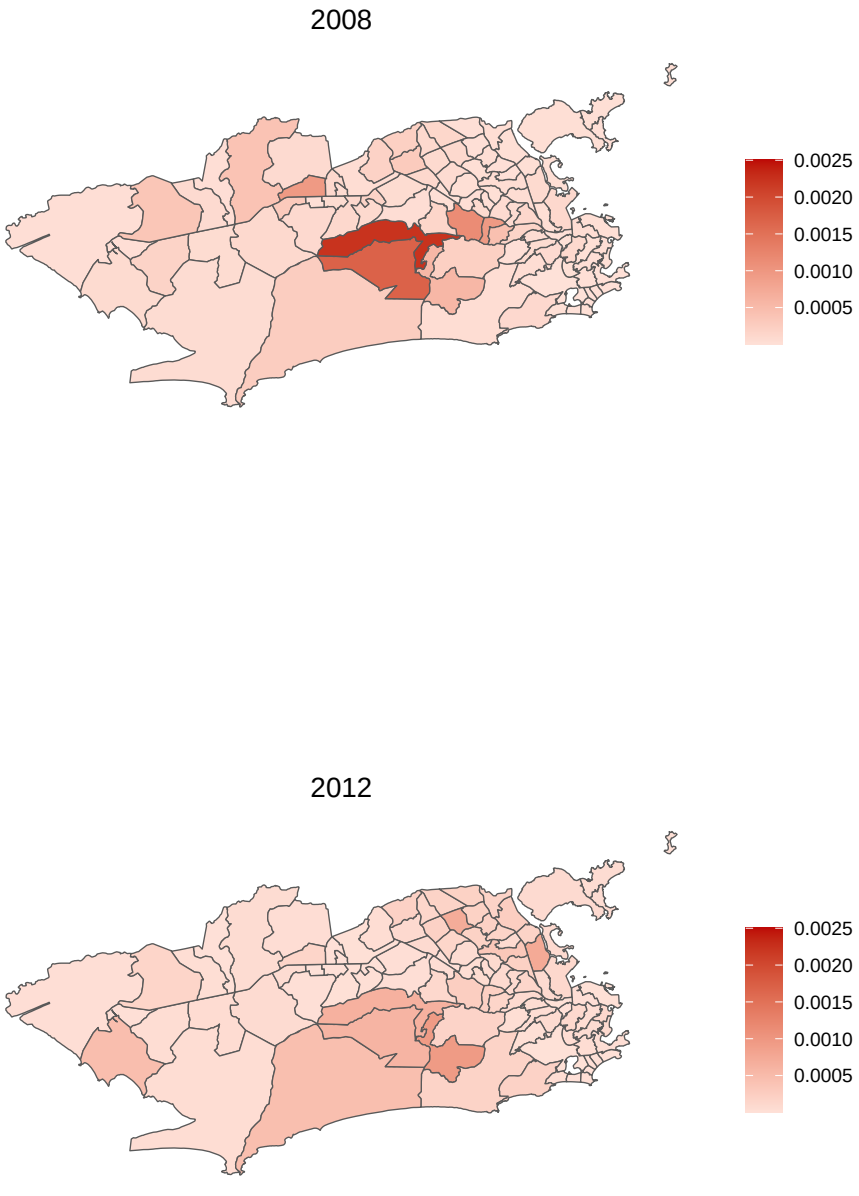


Figure 7: DEM - HHi distribuition

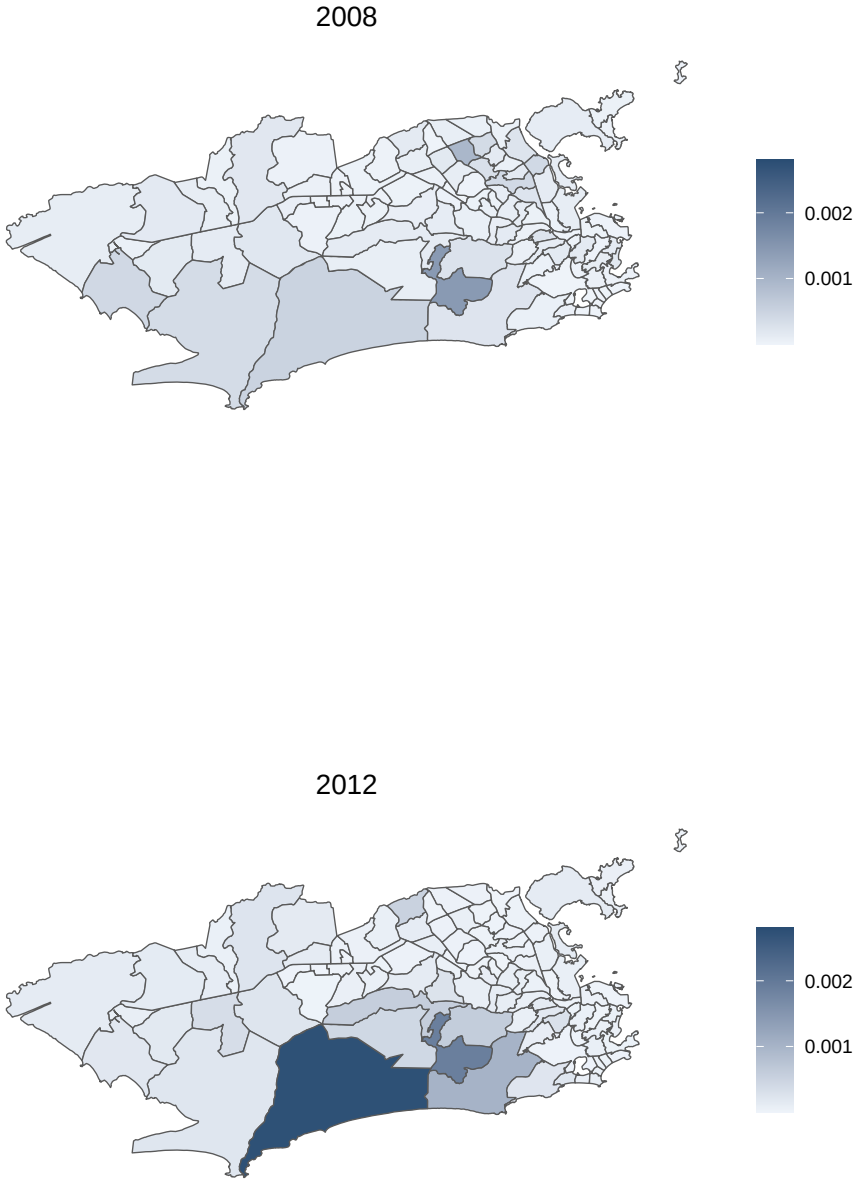


Table 7: Total effect of PSF expansion on HHi index

	Dependent variable:		
	Δ HHi		
	(1)	(2)	(3)
Δ % PSF	−0.002		
	(0.001)		
Δ % CMS		−0.012***	
		(0.003)	
Δ % CF		0.002	
		(0.002)	
Δ % CMS - 2009			−0.356***
			(0.066)
Δ % CMS - 2010			−0.037***
			(0.010)
Δ % CMS - 2011			−0.008***
			(0.003)
Δ % CMS - 2012			0.054**
			(0.024)
Δ % CF - 2009			0.245***
			(0.016)
Δ % CF - 2010			0.006**
			(0.002)
Δ % CF - 2011			−0.002
			(0.002)
Δ % CF - 2012			−0.007**
			(0.004)
Polling places fixed effects	Yes	Yes	Yes
Controls - 2008	Yes	Yes	Yes
Observations	9,765	9,765	9,765
R^2	0.026	0.027	0.056
Adjusted R^2	0.012	0.014	0.042

Standard errors in parenthesis. *p<0.1; **p<0.05; ***p<0.01

Note: The control variables in the baseline (2008) included: groups of age (percentage of 16, 17, 18-20, 21-24, 25-34, 35-44, 45-59, 60-69, 70-79 and 79 years of age or older); educational level (percentage of illiterate, knows how to read and write but without formal education, primary incomplete, primary completed, secondary education incomplete, secondary education completed, college incomplete and college completed) and gender (percentage of women and men).