The Real Effects of Capital Requirements on the Brazilian Healthcare Industry*

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Abstract

In this paper, I show that the introduction of the solvency margin, a capital requirement aimed at limiting Brazilian healthcare insurance firms from excessive risk-taking, has led to adverse effects on firms' growth prospects, affecting firms' fundamentals, and ultimately increasing market concentration. By exploring firms' *ex-ante* exposure to the capital requirement rule and variation across multiple local markets, I use a *differences-in-differences* approach to show that more exposed firms grew their customer base 12% less, on average, than their counterparts, and that this effect persists even after three years of the solvency margin implementation. When it comes to firm-level prospects, I show that this higher exposure also affects firms' future financial fundamentals, firms' likelihood of being delisted, and is negatively correlated with changes in the median price levels for customer healthcare plans. Finally, to the extent that this differential growth trend is capable of shifting aggregate industry fundamentals, I show that states with a higher portion of exposed firms saw their market concentration surge 22% more than their counterparts. The baseline results continue to hold even after performing several robustness checks and employing alternative specifications. Overall, this study enhances the understanding of the trade-offs involved with the implementation of capital requirement rules outside of the financial sector.

Keywords: Capital Requirements; Brazilian healthcare system, Corporate Finance.

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1 Introduction

The private healthcare system is central to guaranteeing access to healthcare in Brazil, being responsible for the healthcare assistance of almost a quarter of the population. Along with the creation, in 1988, of the *Sistema Único de Saúde* (SUS), access to public health was ensured for all Brazilian citizens. However, despite the consolidation of Brazilian healthcare as a public good, the precariousness of the public healthcare services prompted a massive entry of private players (Pinheiro et al., 2015). Over time, the development of the private healthcare industry in Brazil initiated a growing concern regarding the proper functioning of the industry, which made the ground for the beginning of the Brazilian healthcare insurance industry regulation. As a consequence, Law nº 9,656[1] was enacted in an attempt to reduce the industry's distortions, minimize resource expropriation, enhance the transparency of public and private players, and define mechanisms that ensure a proper financial equilibrium between healthcare insurance firms and consumers.

All in all, such historical developments made the ground for the establishment of the country's regulatory health insurance agency, *Agência Nacional de Saúde Suplementar* (ANS), created through the Law nº 9,961[2], in 2000. As an autarchy linked to the Brazilian Ministry of Health, ANS seeks to promote the defense of the public interest regarding healthcare services, regulate the relationship between private players and its consumers, and foster actions aimed at the development of the country's healthcare system. However, despite the massive growth of the healthcare industry, concerns about the solvency of healthcare insurance firms called the attention of policymakers and regulators.

The country's dependency on private healthcare assistance, however, became clear only after the liquidation of one of the country's largest healthcare plan, *UNIMED Paulistana*, in 2015, leaving more than 740,000 customers without healthcare assistance[3]. The company's net debt, which grew more than four times between 2007 and 2009, over more than R$ 2.5 bi, culminated in a series of managerial hurdles that were transmitted over to healthcare suppliers and customers that rely on private healthcare insurance. Ultimately, these issues led to the company's liquidation by the regulatory agency, in 2015, where *UNIMED Paulistana* had to transfer all of its customer base to other healthcare insurance firms.

Since its creation, several measures were put in place by *ANS* seeking to promote its

[1] *Lei dos Planos de Saúde*

[2] *Lei nº 9.961, de 28 de janeiro de 2000*

[3] See the article *"Detalhes exclusivos sobre a quebra da Unimed Paulistana"*, published in 2015 in a Brazilian national newspaper, for a detailed discussion.

mission of the public interest regarding healthcare services, which special attention to several resolutions related to the *Rol de Procedimentos em Saúda*, the main reference regarding minimum coverage from healthcare insurance providers as well as resolutions aimed at enforcing the the accounting recognition of technical provisions related to healthcare insurance activity. Within this context, among the several measures seeking to ensure adequate financial sustainability standards within the industry and safeguard customers from the risk of insolvency by health insurance firms[4], the regulatory agency has introduced capital requirements rules – that is, financial policies aimed at mitigating insolvency risks – through a series of technical and financial provisions and warrants, with the introduction of the Solvency Margin, in 2012, as its most profound regulatory action.

Through such regulation, Brazilian healthcare insurance firms were obliged to gradually constitute financial buffers based on their historical operational costs and/or revenues, being susceptible to regulatory action in case of non-compliance. In such situations, penalties such as the impossibility of launching new healthcare plans, and eventually the regulatory intervention for liquidation could be put in place by the regulatory agency.

As a result, the industry's financial assets, defined as Cash, Cash Equivalents, and Short-Term Investments, saw a surge of almost 4 (four) times the level previous to the enactment of the solvency margin, from R$ 5.9 bi to more than R$ 23 bi. On the one hand, if establishing capital requirements as an indirect control over firms' leverage decisions act as benefiting stakeholders by potentially reducing firms' insolvency risk, on the other hand, however, it is not clear if such action may have adverse welfare consequences. In this sense, since such requirements force firms to adjust their capital structure either by raising equity or directing resources towards less risky assets, such as high-liquidity financial instruments and cash, they may have a direct effect on the availability of financial resources for firms' operating business activities, which in turn can impact future investment decisions.

To that point, although regulatory action may act towards protecting the ultimate customers' interests, it also can generate second-order adverse effects. Anecdotal evidence[5] indicates that as the solvency margin formulation takes the form of a *"one-size-fits-all"* approach, by requiring a fixed percentage of capital retention applicable to firms' operations, it may have disincentivized future investments by health insurance firms in expanding their customer base, as a correspondent increase in the equity level is needed to comply

[4]See *Resoluções Normativas ANS* for a detailed description of all regulations created by the Brazilian regulatory agency.

[5]ANS has new rule for provisions. Valor Econômico, 2019.

with the capital requirement rule. In this sense, the higher the size of firms' healthcare operations, the more warranties are required, thereby dampening the returns from growth prospects in face of positive investment opportunities. Furthermore, firms may also be unwilling to invest in verticalization strategies, such as the construction of hospitals and healthcenters, as it would decrease the availability of internal funds that could be used to fund such growth opportunities.

Even though the effects of the introduction of capital requirements have been widely studied in the banking sector, especially after the 2008 crisis (Hanson et al., 2011; Admati et al., 2013), there is still little evidence of its real implications outside of the financial sector. In addition to that, from a practitioner standpoint, despite the prominence of the private healthcare insurance industry in Brazil, there is still no empirical assessment of the introduction of the Solvency Margin in the sector.

Given all the above, in this paper, I analyze the real implications of the introduction of the Solvency Margin in the Brazilian healthcare insurance industry. Specifically, I investigate whether the decrease in the availability of internal funds due to the enforcement of the capital requirement rule affects firms' investments in tangible assets and growth in their customer base, as well as assess its potential spillover effects on market structure, competition, and service quality.

By means of a *differences-in-differences* approach, this paper uses an extensive database that links healthcare firm's financial and operational data from between 2009 and 2019 to customer data at the firm-month-state level to compare the growth in the customer base of healthcare firms that were *ex-ante* more exposed to the capital requirement rule – *i.e,* the ones which had more financial leverage prior to the rule – against those where the capital requirement rule was not binding – *i.e,* firms with high capital buffers previously to the enactment of the solvency margin.

To be able to tease out the effect of the solvency margin rule, the sufficiency of solvency margin – *i.e,* how much equity firm would need to integralize in order to comply the capital requirement rule – is calculated for each firm in the sample. Based on firms' financials two years *before* the actual enactment of the rule, this measure of exposure takes into account firms would have been considered constrained as if the capital requirement rule was in place in that year, thereby alleviating some endogeneity concerns due to firms adjusting their actual equity levels. Moreover, as adjustments in capital structure are costly, firms may be unable to freely scale up to the desired equity levels *ex-post* the solvency margin implementation.

In line with the capital requirement rule having second-order adverse effects, results show that even though more exposed firms tend to have higher growth in their customer base, on average, there is a negative and statistically significant effect of the exposure to the capital requirement rule after it took place: exposed firms – *i.e,* those where the sufficiency of solvency margin relative to total equity is higher than the median – grew, on average, approximately 12% less than their counterparts during the period post implementation of the solvency margin, which is both statistically and economically significant. This effect is robust to different specifications and to the inclusion of a wide set of covariates and controls, both time-invariant, such as firm fixed effects, as well as time-varying controls, such as state-year fixed effects.

With the solvency margin designed to be implemented gradually over time, one would expect that, if any, the stringency of the effect should increase over time. By analyzing the dynamics of the solvency margin rule over time, it is possible to confirm this pattern: at the end of the first year when the solvency margin was put in place, there was no difference in growth levels between treated and control firms. However, between 2013 and 2017, treated firms grew monotonically less than their counterparts, with the effects being marginally significant in 2018, strengthening to the argument that the introduction of the solvency margin led to effects that do not dissipate over a short period of time.

If firms could tap into new resources frictionlessly, as in a (Modigliani and Miller, 1959) framework, then there is no reason to believe that solvency needs could affect their growth prospects – *i.e,* faced with a positive NPV opportunity, a firm could issue equity at market value and fund the project. Why, then, do we observe differential trends over time for some firms? With firms facing different costs of issuing equity due to asymmetric information, some firms may be willing to foregone profitable growth opportunities anticipating difficulties in issuing equity in the realization of a bad state. The aforementioned results suggest that lower levels of solvency margin sufficiency are related to lower growth levels in the customer base. However, these results implicitly assume that the cost of issuing equity is homogeneous across firms, which is unlikely to hold in a scenario with more than 1,200 active firms. In special, the presence of *UNIMED*, the largest active health cooperative group of its kind, with organizational characteristics that are strikingly different from limited-liability-companies (LLC), may indicate that even with the group of more exposed firms, the effects can be heterogeneous across several dimensions.

In line with the latter discussion, by employing the baseline specification in a subsample that excludes health cooperatives, I show that the differential growth trend that affects the solvency margin rule is entirely driven by this sub-group of non-health cooperatives. In terms of magnitude, I observe an effect of approximately two times the magnitude of the baseline effect, from 12% to 24%, with results that are statistically significant in all specifications and after employing several robustness checks. Interestingly, I do not find statistically significant effects for health-cooperatives, where non-limited-liability is present.

Even though these results may indicate that this subset of firms trades off positive growth opportunities against complying with mandatory equity levels due to the capital requirement rule, several endogeneity concerns could harm the interpretation of these results as induced by the solvency margin implementation. In special, as managers observe the state and choose the equity levels to maximize value, those that issue more equity to comply with the solvency margin rule may be exactly the ones potentially more affected by a liquidity shock. In such a situation, higher equity levels are positively correlated with the degree of (unobserved) investment opportunities, which if not controlled, may bias the previous estimates upwards.

To provide even further evidence of the previous results, I exploit the fact that not only do more than 80% of operational revenues come from *employee-sponsored* contracts but also that markets tend to be *locally* concentrated to analyze what happens when treated firms get hit by a positive employment shock versus a negative shock. As such, if the previous results are due to the fact that some firms are willing to foregone positive growth opportunities to comply with the solvency margin, one would expect these results to be concentrated within the realization of "good" states of the economy - *i.e,* positive employment shocks in the region that the firm concentrates its operations, which are plausibly correlated with the firms' investment opportunities. By splitting the sample according to the employment growth levels at the state level), however, it becomes clear that more exposed firms located in states with positive employment growth are the ones driving the results.

More specifically, looking only at the sub-sample of state-year pairs that had positive employment growth in a given period ("good realizations"), there is a negative and statistically significant effect of -17.3% in the growth of more exposed firms, with effects being indistinguishable from zero for the sub-sample of state-year pairs with negative employment growth in the period ("bad realizations"). In other words, even though more exposed firms are sensitive to positive demand shocks induced by positive employment growth in their regions, negative demand shocks (as proxied by negative employment growth in a given state-year pair) do not seem to be driving adjustments in these firms' customer base. This asymmetric response to different employment shocks helps overcoming alternative narratives for why these firms are growing less year-over-year.

What do these results tell about firms' adjustments due to the changing nature of market conditions? Seeking to understand how firms adapt to the changes induced by the introduction of the solvency margin, I test whether such exposure is also capable of affecting several firms' outcomes. More specifically, the results show that changes in investments and revenues are fully driven by reductions in operational, and not financial, activity. Furthermore, more exposed firms saw their delisting probability increase by approximately 7.6% relative to the overall delisting probability. Finally, using information regarding reference prices for all commercialized healthcare plans, results show that healthcare firms that were negatively hit by higher capital standards presented price adjustments that were 5.8% lower relative to their competitors within the same region.

All in all, these results provide evidence that, when faced with a positive employment shock in their regions, not only firms more exposed to the capital requirement rule benefit less from such market growth relative to their counterparts but also firms less exposed to the solvency requirement were able to adjust prices in a more pronounced manner. However, are these changes capable of shifting market concentration? In a final set of results, I aggregate the data at the state level to show that states that have been more exposed to the capital requirement rule (by having a higher concentration of customers from more exposed firms) saw their market concentration (as measured by the *Herfindahl-Hirschman Index - HHI*) increase by 21.7%, although there hasn't been any statistically significant spillovers in health-outcomes, such as the number of complaints filed by private healthcare customers and/or increases in public healthcare service provision.

This paper contributes to the growing literature on capital requirements in several ways. First and foremost, it adds relevant contributions to the understanding of the economics of life insurance markets, which have implications for the economy as a whole due to its relevance. In the United States, for example, the healthcare sector constitutes almost a fifth of the US economy, making clear that the functioning of this industry has a tremendous impact on the welfare and well-being of the population - even if consumers are heavily insured - due to losses in consumer surplus (Gaynor et al., 2015). For example, employers may tunnel higher healthcare costs to workers through reduced wages and/or reducing benefits, as well as reducing or dropping insurance coverage entirely. Moreover, the competitive environment of this industry may affect the quality of care, which in turn may have substantial effects on several health outcomes.

Moreover, this paper also contributes to the study of capital regulation in insurance markets. In recent years, the study of the effects of capital regulation has focused on analyzing changes induced by the implementation of several financial stability mechanisms aimed at mitigating risks of widespread distress within the banking industry. For that matter, the gradual implementation of Basel I, II, and III, for example, has set grounds for the recent empirical research aimed at understanding the consequences of such changes in the financial regulatory agenda (Demir et al., 2017; Gropp et al., 2019). Consequently, the bulk of the empirical results in the literature lies in analyzing the responses due to credit supply shortfalls induced within the financial industry, which in turn can generate spillovers to the real economy (Kashyap et al., 1993; Kashyap and Stein, 2000; Paravisini, 2008; Peek and Rosengren, 1997).

On the other hand, for the healthcare industry, understanding the role of capital requirements in improving welfare for the economy as well as empirical evidence on the real economic effects of such regulations is much less prevalent (Lorent, 2008). Although such regulations are generally aimed at controlling risk-taking, reducing the insolvency risk, and insulating policyholders, it is not clear whether such regulations emerge as a welfare-improving policy within the insurance industry, since they may also alter the structure of the market, constrain firms' and consumers' choice sets, and induce additional costs on firms (Gaganis et al., 2015). For example, capital regulations may be relevant given the high social costs related to healthcare provider failures when suddenly a significant mass of *ex-ante* insured individuals are no longer insured for health-related claims. However, understanding the potential side effects of such regulations in the industry remains an open question.

In this sense, what are the mechanisms by which the introduction of capital requirements in the healthcare industry can improve welfare? Relatedly, how do firms respond – *i.e,* if anything, how managers adjust their decisions? Answers to this question are still limited in the capital requirements literature. In light of that, the richness of the data allows for a deep understanding of key managerial implications in the presence of leverage regulation. Therefore, this paper sheds light on novel mechanisms by which firms respond to liquidity shocks within the real economy, such as competition, investments, asset composition, and service quality, paralleling previous studies that focused on the study of leverage regulation and credit markets (Benetton, 2018; Benetton et al., 2020).

Furthermore, the results from this paper also have key contributions in terms of practical relevance for at least three motives. First and foremost, health insurance is, in recent years, among one of the country's most fast-growing industries, presenting an annualized growth rate of 2.3% in the customer base and 13.47% in revenues over the last two decades, reaching roughly one-quarter of the overall Brazilian population. Not only the expectancy of a higher demand for healthcare services due to the country's population aging trend but also a shortage in supply of public healthcare by *SUS*, the country's universal healthcare access system, contribute to the upswing in the investment level within the health insurance industry. Despite the favorable institutional framework, concerns about financing constraints – namely due to leverage regulations – may play a key role in determining whether healthcare firms can effectively be able to benefit from such investment opportunities.

Additionally, within the last two decades, healthcare assistance costs are rising sharply: from 2001 to 2019, healthcare firms' operating margin fell, on average, 5.3 percentage points, a substantial drop of approximately 25% from 2001 levels, from 21% to 15.6%. While threatening the financial sustainability of the industry, increasing operating costs also have indirect effects on the capital requirement amount, which in turn may dampen investments aimed at mitigating risks of financial distress – *e.g*, internalizing healthcare support services, such as hospitals and health centers.

Finally, concerns regarding the stringency of the solvency margin by practitioners and representative entities were a common reason to question the regulatory issues concerning industry's financial sustainability. Of special interest for this research, the adoption of a risk-based approach that is arguably better suited to provide enough incentives for investments has been intensely debated in the *ANS*'s bulletins. To that matter, anticipating a need for capital resources during the COVID-19 pandemic, the regulatory agency anticipated the firms' decision for adopting the risk-based capital rules, which otherwise would have been put into practice only in 2023. All things considered, such evidence reinforces the need for a careful investigation of the adverse effects of the solvency margin implementation on the development of the Brazilian health insurance industry.

All in all, tracing the impact of such capital requirement rules not only enhances the understanding of the real economic effects of such policies but also provides a framework for practitioners to understand how to effectively design financial regulation rules that accurately trade off benefits and costs. More importantly, from an academic perspective, by teasing out the effects of capital regulation rules, this paper contributes to the growing literature on healthcare markets by filling a gap in understanding the industry's welfare effects and the role of policy interventions.

The rest of this paper is organized as follows. Section 2 provides a high-level overview of the Brazilian healthcare industry during 2000-2019. Sections 3 and 4 describe the data, the descriptive statistics of the sample considered in the analysis, while solvency margin implementation, while Section 5 provides a detailed discussion on the implementation of the solvency margin. Section 6 discusses the empirical strategy adopted in the study.

Sections 7 and 8 discuss the results. Finally, Section 9 concludes and provides directions for future research.

2 Empirical Context

When assessing the potential adverse effects of the solvency margin, two key contemporary facts highlight the relevance of the analysis. First, even though there is a massive growth in the number of health insurance users within the last two decades, the number of active healthcare firms fell dramatically (ANS, 2020). Excluding exclusively dental coverage, while the number of healthcare customers increased almost 51% from 2000 to 2019, reaching almost 47 million individual customers, health insurance firms tumbled by almost 54% during the same period, from 1,970 to 920 active firms.

Furthermore, there is a notable increase in concentration towards medium and large players. During the decade, medium (50,000-500,000 clients) and large-sized firms (up to 500,000 clients) market shares increased more than 5.2 percentage points, from 78% to 83.3% of the total market. Concurrently, small to mid-sized firms (1-50.000 clients) saw their participation shrink from 22.06% to 16.64%. As such, understanding these points is also of practical importance for regulatory policy, as market concentration can lead to higher insurance premiums and consumer welfare losses, as presented in Ho and Lee (2017) when analyzing the United States private healthcare industry.

Importantly, it is also not clear whether the capital requirement regulation brought by the rule disproportionally affected the returns from small firms, which account for approximately 17% of the overall Brazilian health insurance market as of 2020. As it is expected that is more costly for small firms to issue equity due to informational frictions, such leverage regulation could potentially affect them to a greater extent through a higher cost of capital. When considering liquidity shortages induced by leverage regulation, such change can lead to large real effects if firms are unable to withstand such shortfalls by tapping into internal cash reserves or issuing equity.

Finally, despite the importance of the private healthcare industry on a national basis, there is no empirical evidence regarding the potential adverse effects of the Solvency Margin within the industry and, ultimately, on the consumer side. On the one hand, ultimate customers can benefit from a decrease in the likelihood of default, a situation that could potentially undermine their access to health assistance. On the other hand, however, not only due to market concentration towards larger and fewer health insurance firms but also from the change in firms' investment prospects, such regulation can produce spillover effects in terms of consumer service quality given the increase in firms' market power. As such, the net benefit of the regulation for ultimate customers is non-trivial.

To that matter, the empirical literature on healthcare markets has focused on the different interactions between firms affecting variables that are directly related to consumers' welfare, such as prices, quality, treatment decisions, and insurer premiums. As such, a multistage approach, proposed in Gaynor et al. (2015), highlights the main steps related to the determination of welfare in healthcare markets: **I)** first, healthcare providers and workers decide on their quality; **II)** given their quality levels, these providers negotiate with insurers to determine the insurers' networks and set the prices paid for the services; **III)** with that, insurers choose their premiums to maximize the objective function, taking into account their characteristics as well as those from their competitors; **IV)** consumers observe each insurers' provider networks, premiums, and other characteristics, optimally selecting their insurers; and **V)** some consumers get sick and effectively use the insurers' network.

In empirical terms, very few papers try to assess more than two stages, with the healthcare markets (stages I-II) gaining most of the attention from the literature. Our work specifically adds to the international literature on healthcare markets by providing empirical evidence on multiple stages by analyzing not only healthcare-insurer networks but also insurer-employer and insurer-individual (directly) relationships. For example, identifying the effect of capital regulation on insurers' outcomes can lead to adverse effects in competition, thereby directly affecting insurers' price setting decisions (stage III), but also changing their choice for network quality (II) and affecting consumers' choices (stage IV). To that matter, our work adds to the earlier literature on the effects of competition on insurers' premiums (Dafny, 2010; Dafny et al., 2012; Dranove et al., 2003) by shedding light on the potential unintended consequences of policy-making that lead to changes in the functioning of healthcare markets.

As expected, identifying the effect of capital requirements on firms' outcomes is not straightforward, as it is likely that firms' behavior can simultaneously react to demand-side shocks induced by a reduction in the degree of investment opportunities. For that, our identification strategy will benefit from a unique setting in the Brazilian health insurance industry that enables us to partly control for demand-side effects. On average, 80% of health insurance customers is originated from employer-sponsored contracts (ANS, 2020), where individuals have access to health insurance plans through their employer, which in turn negotiates the terms of the contract and bears the majority of the insurance costs generated from her pool of employees. Furthermore, aside from large health insurance conglomerates, the vast majority of health insurance players' operations and commercial activities is locally concentrated: firms have most of their health insurance customers concentrated in a few, neighboring municipalities. As a consequence, variations in health insurance firms' investment opportunities are plausibly correlated with the local unemployment level where the firm concentrates its operating activities. This distinctive setting allows one to use measures of unemployment levels in the neighboring regions that each firm operates as plausible controls for investment opportunities.

Altogether, to disentangle the leverage regulation effect from possible investment opportunities shocks, the empirical design adopted in this study will use exogenous exposure to the solvency margin in a *differences-in-differences* (D-D) approach, seeking to pin down the size of the frictions caused by the enforcement of the rule while controlling for time-varying demand factors that are likely to affect firms' willingness to invest. As such, the results discussed in the next sections contribute to the growing literature on the effects of capital requirements and the health insurance industry in several ways.

3 Data

A distinctive feature of studying the Brazilian healthcare industry is the availability of publicly available granular data through Brazilian's national open-access initiative, *Programa de Dados Abertos*. With the several pieces of open-data contained in this program, I construct an extensive dataset of firm-state-year observations that comprises, on average, 87% of all Brazilian healthcare insurance firms (in terms of the number of customers) between 2010 and 2020. More specifically, I collect information regarding health insurance firms' financials, market, service quality, and local economic conditions. Table 1 provides a detailed description of the available data and how the design of the final database to used in the empirical analysis.

I start by collecting information on healthcare firms' financials during the study period. *ANS* provides detailed income statement and balance sheet information for all active healthcare firms in Brazil on a quarterly basis, following its customized accounting standards - for more details, see *Plano de Contas da ANS*. Due to changes in accounting standards throughout the study period, information regarding the financials for the income statement and balance sheet was hard-coded following its respective accounting identification names.

To ensure that financial information is consistent over time, for every firm in the sample, I map the changes in accounting standards for all relevant variables of the study and match them accordingly by imposing a unique internal identification number [6]. I then collect end-of-year financial information between 2009 and 2019 and map all relevant accounts to a common identifier to ensure that all financial variables are defined the same way throughout the sample period. At the end of this process, it is possible to fully reconstruct firms' general balance sheet and income statement information for all years of the sample, yielding an unbalanced panel of 1,655 unique firms.

Additionally, since the study aims to investigate the effects of capital requirement rules mainly on the basis of firms' future investments in healthcare operations, I drop all observations where firms are classified as *Administratora de Benefícios*, *Autogestão* and *Seguradora de Saúde*, as these firms have notable distinct business operations than other healthcare firms and, in its vast majority, do not invest in healthcare operational assets. Additionally, I also drop all observations where the firm is focused in dentistry healthcare (*Cooperativa Odontológica* and *Odontologia de Grupo*)[7]. Finally, I also exclude all healthcare cooperative firms characterized as federations ("*Federações*"), since these entities are mainly established for operating commercial alliances and do not constitute a clear operating healthcare insurance firm.

Additionally, a potential caveat when considering firms whose incorporation date occurs after the promulgation of the *Solvency Margin* is that these firms were not *ex-ante* exposed to the rule. For that reason, I drop all firms where the date of incorporation occurs after the implementation of the rule. Finally, I consider only firms whose assets in place in the first year of the sample (2010) were greater than or equal to R$ 1*MM*.

At the end of this process, I am able to reach a total of 479 unique healthcare firms throughout the study period, with 3,085 firm-year observations over the study period. Relative to the overall market of healthcare firms within the considered categories, however, this sample represents, on average, 87% of the total number of customers, providing clear evidence of the informativeness of our results to the broader market. Considering this final sample, I winsorize all the numeric variables at the 1^{st} and 99^{th} percentiles.

Next, considering this sample of firms, I use *ANS*'s unique identifier (*Registro ANS*) to collect information on the number of customers for each firm over the study period. More specifically, for each firm, *ANS* provides the number of customers across several

[6]Specific accounting standards applicable to Brazilian healthcare firms were enacted in 2000 through *Resolução da Diretoria Colegiada – RDC N° 38*, establishing how these firms should provide accounting information for reporting and fiscal matters. Notwithstanding, seeking to accommodate the changing nature and better reflect the their financial and accounting conditions of these firms, several amendments were put in place in the subsequent years of its enactment, with direct effects on the industry's accounting standards

[7]For more information on the distinct types of healthcare firms in Brazil, see *Resolução da Diretoria Colegiada 39*.

characteristics, such as gender, age, whether the plan is employee-sponsored or not, and healthcare coverage characteristics, among others, at the *city-month* level. As such, I am able to construct a panel of *year* $\times$ *firm* $\times$ *city* observations that tracks the evolution of market-share at the municipality level.

As such, for a municipality m in period t, I define the market share of a given firm i as the number of customers held by firm i, $Cust_{i,m,t}$ relative to the total number of customers in municipality m and period t:

$$Share_{i,m,t} = \frac{Cust_{i,m,t}}{\sum_i Cust_{i,m,t}} \tag{1}$$

$Share_{i,m,t}$ is calculated for all firms in my sample throughout the study period, aggregated at the *state* level. Unfortunately, *ANS* does not provide access to customer-detailed data at the municipality level prior to January 2014, which hinders the use of municipality level data prior to the promulgation of the capital requirement rule [8].

Finally, I also merge this data to firms' categorical information, such as the date and state of incorporation, the entity type, the date of dissolution (for delisted firms), as well as information on healthcare service quality from *ANS*'s public servers, which comprises of *ANS*'s performance assessment of each active healthcare firm over time, and measures of customer's complaints over time. More specifically, I collect historical information regarding *ANS*'s periodic evaluation of health insurance firms, *Índice de Desempenho da Saúde Suplementar (IDSS)*, which seeks to evaluate and monitor, at the annual level, the performance of healthcare firms, providing benchmarks in terms of overall quality and reduce information asymmetry on the customer's end. *IDSS* Information regarding financial sustainability, internal processes, compliance, ease of access, and healthcare quality. Data is in *end-of-year* format and spans from 2009 to 2019. In addition to this data, I also collect the yearly number of complaints made by customers regarding several aspects of healthcare firms' operations, such as commercial, contractual, and healthcare-related issues.

[8] On February 25th, a request for proprietary ANS data was made through *Lei de Acesso à Informação* (LAI). This data request seeks to complement the information that is already published as a way to provide further evidence for the results. In the document, *ANS* acknowledges the existence of such information but, as of this study date, there has been no update in *ANS*'s public folders with the requested data.

4 Descriptive Statistics

Figure 2 shows the evolution of the number of active healthcare firms over the study period[9]. As shown in Panel A of Figure 2, the number of active healthcare has been steadily decreasing: beginning in 2000, the number of all active healthcare firms was 1,970. In 2019, however, this number is 920, a decrease of approximately 53% - or 3.92% on a yearly basis.

Conversely, Panel B of Figure 2, shows that the number of delistings - conditional on being considered an active healthcare firm in the previous period - is around 2.5%, being considerably stable over time. Together, these can imply that there is a tendency towards market concentration, where a reduced number of firms operate in the market over time. To shed more light on this finding, Figure 3 shows that the number of active customers in the private healthcare market is steadily growing, which corroborates with the evidence presented before. Panel A shows that the number of active healthcare customers has grown by almost 50% relative to the 2000 levels, or approximately 2.16% on a yearly basis. These numbers, in absolute terms, represent approximately 47 million private healthcare customers in 2019. In other words, this implies that almost a quarter of the Brazilian population relies on private healthcare insurance, which reinforces the relevance and representativeness of this market.

Additionally, the average age of the healthcare customer has also increased: between 2000 and 2019, the average customer became 10% older, with the average age going from 31.91 in 2000 to 35.95 in 2019. Panel B of Figure 3 shows that there is a steadily increasing tendency in the average age across time, which reflects not only the change in demographic characteristics of the Brazilian population but also the sorting of customers and private healthcare plans. A more detailed view of the portfolio distribution of customers by healthcare firms will be given in Section 5.

Given all of the above, it is key to understand how healthcare firms' financials have evolved over time. Figure 4 plots the evolution of the average hazard ratio (1 - Gross Margin) over time for all active healthcare firms. By considering only revenues and costs that are related to healthcare operations, it is possible to have a view of the operational nature of the healthcare business, letting aside any effects from financial decisions such as interest expenses, non-operational revenues/costs, and accruals. As the figure makes clear, healthcare firms' operational costs are rising sharply: while in 2001 this ratio was

[9] Active healthcare firms are those that are allowed by *ANS* to operate as healthcare firms in the Brazilian territory and are thereby authorized to sell healthcare plans. To be considered an active healthcare firm, these firms must comply with a series of financial and operational established by *ANS*, reviewed on a quarterly basis.

approximately 77.5%, it has since been increasing on an yearly basis, reaching approximately 82% in 2019, an increase of 4.5 percentage points. In other words, it means that, after covering all the costs related to providing healthcare assistance to its customers, the average healthcare firm in 2019 has a margin of approximately 17.5% left to cover all costs that are not directly hazard-related, such as administrative expenses, interest expenses, non-operational expenses, among others.

All in all, consistent increases in the healthcare customer's average age, together with reductions in operational margins and a reduced number of active healthcare firms may create a more challenging competitive environment, which hinders less-efficient firms to operate in this market. To get a better understanding of how the industry concentration behaved during the same period, define HHI_t as the Herfindahl-Hirschman Index (HHI) of market concentration for the period t as:

$$HHI_t = \sum_i Share_{i,t}^2, \tag{2}$$

where $Share_{i,t}$ defined as before. Figure 5 plots the evolution of the aggregate HHI considering only both the overall healthcare industry market, and the market considered in the sample. As clearly highlighted in the figure, concentration across the whole healthcare market has increased substantially between 2011 and 2019, with an average increase of approximately 45% in the HHI. Notably, the period with a markedly higher increase in market concentration - between 2011 and 2013 - coincides with the period where the solvency margin was effectively put in place.

To the extent that the industry-wide changes previously shown are related to the introduction of stricter capital requirement rules, the introduction of the solvency margin may have created additional difficulties for more exposed firms to increase their participation in the markets that they operate. Before showing further evidence of this relationship, the next section provides a detailed description of the *Solvency Margin*, the capital requirement rule introduced by *ANS* that has established minimum equity levels for healthcare firms to operate in the Brazilian healthcare industry.

5 The introduction of the solvency margin

Motivated both by the dependence of the Brazilian healthcare system upon private sector services and the growing concern regarding the risks of financial distress in the industry, the solvency margin was established in 2009, effectively being put into practice at the beginning of 2013 through the *RN 209/2009*. In practical terms, the solvency margin is defined as the mandatory amount of equity (adjusted for economic purposes) to cover the maximum of:

$$SM_{i,t} = \max \left\{ \begin{array}{l} 20\% \times \left[\dfrac{\left(\sum_{i=j}^{12} 100\% \times Premium_{Pre} + 50\% \times Premium_{Post} \right)}{12} \right], \\ 33\% \times \left[\dfrac{\left(\sum_{i=j}^{36} 100\% \times OpCost_{Pre} + 50\% \times OpCost_{Post} \right)}{36} \times 12 \right] \end{array} \right\}, \tag{3}$$

where $Premium_{Pre}$ refers to the monthly premium received in pre-established health plans, and $Premium_{Post}$ refers to the monthly premium received in post-established health plans. While pre-established premiums are the pecuniary costs incurred by customers calculated before the usage of the healthcare insurance assistance, post-established premiums are those calculated after the assistance costs have been effectively incurred. Relatedly, $Op.Cost_{Pre}$ and $Op.Cost_{Post}$ are the costs incurred for health assistance in Pre/Post contracts for the last j months, respectively. From the latter, the required solvency margin that health insurance firm i must attain in each period t follows:

$$RequiredSolvencyMargin_{i,t} = Adj.Equity_{i,t} - K_t \times SM_{i,t}, \tag{4}$$

where $Adj.Equity_{i,t}$ is the firms' equity adjusted for economic purposes: book equity minus non-current intangible assets, tax credits from losses, ownership interest in regulated entities, deferred sales expenses, and prepaid expenses. Importantly, the Solvency Margin was structured in such a way that firms' capital requirement ratio grows linearly by a factor K_t. More specifically, at the end of 2013, the first period when the rule is effective, $K_{2013} = 0.35$, growing proportionally each month until December 2022, when the solvency margin coefficient is fully applicable – *i.e*, $K_{2022} = 1$.

On a monthly basis, health insurance firms must assess and disclose the sufficiency of the solvency margin following ANS proceedings to the regulatory agency. When in deficit – *i.e*, $RequiredSolvencyMargin_{i,t} < 0$ –, firms are obliged to raise equity to comply with the minimum equity postulated by ANS, where non-compliance with the required procedures can ultimately lead to liquidation.

Seeking to understand the potential effects of the introduction of a capital requirement rule in the industry, Figure 6 shows the evolution of healthcare firms' operational leverage before and after the solvency margin was in place. As Panel A makes clear, after the introduction of the solvency margin, firms' operational leverage has steadily decreased. To get a better understanding of the motives behind the decrease in leverage, Panel B shows that the period after the solvency margin was in place was marked by a substantial increase in firms' financial buffers: while before the solvency margin was in place, the average amount of short-term financial assets was about 35% of Total Assets, this number has grown to almost 55% in 2019. In other words, this means that more than half of firms' resources in 2019 were allocated to financial, and not operational, assets.

To get a better sense of the overall magnitude of these financial buffers on an industry-wide level, Figure 7 shows the evolution of financial assets before and after the introduction of the solvency margin by aggregating all active firms' financial assets year over year. As the figure shows, the overall financial buffer held by healthcare firms in 2019 was approximately R$ 23 billion, an increase of almost four times relative to the 2010 levels.

As a consequence, firms' assets devoted to operational activities have decreased over the period substantially. Importantly, according to the solvency margin rule, a firm that increases its customer base by 10% must also increase the amount of financial buffers proportionally to the increase in premiums or costs, according to the solvency margin rule calculation. If this shift was not uniform across firms, which may indicate that some firms are relatively less capable of funding growth opportunities, a potential explanation for the increase in the market's overall concentration is that firms more exposed to the solvency margin had a higher marginal cost for investing in operational assets, while firms less exposed to the capital requirement rules.

Notwithstanding, identifying a causal relationship between the introduction of the solvency margin and the increase in the market concentration has several caveats. As such, it is not clear, only from these results, that the introduction of the solvency margin had a direct effect on the market's concentration. To provide an empirically convenient way to understand the effects of the introduction of the solvency margin in this industry, the next section provides a deep dive through the identification strategy employed in Section 7.

6 Identification and Empirical Design

As in most of the empirical corporate finance and financial intermediation literature, assessing the effect of capital requirements on firms' market performance is not straightforward, as there is a variety of unobservable confounding factors that are likely to be related to both dependent and independent variables. For example, a lack of investment opportunities may drive firms into a situation where future market performance is poor, but at the same time may harm firms' financial conditions, which in turn determines its exposure to the solvency margin rule. If this is the case, a naïve ordinary least squares (OLS) regression of the growth in market share on the exposure to the capital requirement rule would yield biased estimates of the desired effect due to omitted variable bias.

Of special interest to this study, a common concern is how one can disentangle the effects of the capital requirement rule on future market prospects – *i.e.*, supply-side factors — from those related to unobservable investment opportunities that firms may face – *i.e.*, demand side factors. As such, any study that aims to assess the effect of the introduction of solvency margin on future growth prospects, which is not exonenous to firms' characteristics, should guarantee that any confounding factors are properly controlled for in the regression specification.

One notorious approach to assessing the effects of liquidity shocks in a clean identification strategy is found in Aiyar et al. (2014), which study the transmission of shocks induced by increases in the United Kingdom's (UK) bank-specific capital requirement rules on cross-border credit supply. By analyzing an international sample of multiple loan relationships with UK-resident banks, the authors show that cross-border lending is negatively affected by more stringent capital requirement rules: a 100 basis-point point increase in the capital requirement from a UK-resident bank is associated with a 5.5 percentage points decrease in the growth rate of cross-border credit amount. Furthermore, the effects are heterogeneous conditional on bank and relationship characteristics, as banks tend to favor their "core" country relationships, which are shown to have the smallest decreases in credit supply. Finally, when analyzing separately between bank and non-bank lending - *i.e*, directly to households and firms, respectively -, results shed light on the bank relationship as the main channel of liquidity transmission, as decreases in cross-border non-bank lending are statistically insignificant.

Parallelling Aiyar et al. (2014), Khwaja and Mian (2008) assess the impact of liquidity shocks induced by bank balance sheets on firms' loan amounts. Using a dataset comprised of firm-bank relationships at the loan level, the authors exploit unanticipated nuclear tests in Pakistan as a proxy for liquidity shocks on Pakistani banks' balance sheets. Results show that for the same firm borrowing from two different banks, the loan level from banks that were hit by the liquidity shock drops an additional 0.6 percent for each 1 percent decline. One noteworthy feature of this empirical approach is that as the data is presented at the loan level, one can control for factors that are common for each loan-firm and/or loan-country pair, thereby relieving concerns about endogeneity coming from the demand channel, such as investment opportunities.

In this paper, I use the introduction of the solvency margin in the Brazilian health insurance market as a shock that impacts the marginal cost of equity of healthcare firms in a heterogeneous way. The empirical strategy goes in line with the most recent advances in the capital requirements literature within the financial industry, similar in spirit to Aiyar et al. (2014), who studies the transmission of shocks induced by increases in the United Kingdom's (UK) bank-specific capital requirement rules on cross-border credit supply, and Khwaja and Mian (2008) which assesses the impact of liquidity shocks induced by bank balance-sheets into firms' loan amounts.

Even though the rule was widely enforced across healthcare players, due to the different distribution of equity levels and firms' fundamentals prior to its enactment, some firms were *ex-ante* closer to the threshold for capital requirement margin calls than other firms – *i.e*, more constrained. To the extent that i) such implementation was not anticipated by firms' managerial decisions; ii) the regulation reduces the available supply of internal funds *ex-post* implementation; and ii) adjustment costs on firms' capital structure are present, one can investigate whether if firms more exposed to the rule at the onset of the implementation reduce their future investments and growth prospects.

Still, a potential concern regarding this empirical design is related to omitted variables: investment opportunities, on the one hand, directly affect firms' demand for capital, whereas on the other hand may also be related to firms' financial conditions, which are plausibly correlated with the exposure to the *Solvency Margin* rule. For example, poor investment opportunities may negatively affect firms' financial conditions, whilst also reducing firms' demand for investment. Consequently, omitting investment opportunities is likely to produce biased estimates of the introduction of capital requirement rules .

Seeking to partially insulate the identification strategy from demand-wide factors, the strategy adopted in this paper leans on a specific feature of the Brazilian industry: historically, approximately 80% of all healthcare insurance revenues are *employer-sponsored*, with the vast majority of firms' customers concentrated within *neighboring* regions. Consequently, such setting allows inferring that health insurance firms' investment opportunities are closely related to variations in local employment conditions. Therefore, variations state-level conditions and, in special, local employment conditions – which are arguably exogenous to healthcare firms' decisions – can be used in the regression specification seeking to control for unobserved demand-wide factors such as investment opportunities. As expected, the correlation coefficient between variations in aggregate unemployment growth rates and aggregate health insurance customer growth during 2000-2015 is -0.87, which is in line with the argument that variations in local employment conditions predict customer growth in the health insurance market.

Within this framework, the empirical strategy is designed as follows. Since the solvency Margin rule was announced in December 2009 and enacted in January 2013, I define $DistSolvency_{i,2009}$ as the distance to the mandatory *Solvency Margin* of firm i at the end of 2009 (in percentage terms), assuming $K = 1$ - *i.e*, considering the full extent of equity to be integralized until 2022:

$$DistSolvency_{i,2009} = \frac{Adj.Equity_{i,t} - SM_{i,t}}{SM_{i,t}} \tag{5}$$

Intuitively, $DistSolvency_{i,2009}$ measures the relative stringency of the *Solvency Margin*, which is firm-specific but fixed over time. In this sense, the more negative the distance is, the higher the level of equity to be integralized by the firm until 2022. We divide our sample of firms in quintiles of the distribution of $DistSolvency_{i,2009}$ and define our exposure variable, $Exposure_i$ as 1(0) if $DistSolvency_{i,2009}$ is below (above) the median.

Based on that, the main specification of the empirical design follows a *differences-in-differences* (D-D) approach of the form:

$$\log(Cust_{i,s,t+1}) = \beta_{DD} \times (Rule_t \times Exposure_i) + \Theta' Controls_{i,t} + \alpha_i + \alpha_{s \times t} + \varepsilon_{i,s,t+1}, \tag{6}$$

where $\log(Cust_{i,m,t+1})$ is the (log) number of customers that firm i has in state s in $t+1$, $Rule_t$ is an indicator variable that assigns 1 (one) after the *Solvency Margin* implementation (2012), and zero otherwise. $Controls_{i,t}$ is a vector of firm time-varying characteristics, such as size, profits, and profitability, and α_i, $\alpha_{s \times t}$ refers to firm and state-year fixed effects, respectively. Note that $Exposure_i$ and $Rule_t$ are subsumed by the firm and state-year fixed effects and therefore are omitted from the specification.

As the data is at the firm-state-year level, the inclusion of state-year fixed effects ensures a direct comparison between the growth in market share between similar firms subject to the same state-time trends, thereby alleviating concerns about endogeneity issues induced by unobservable investment opportunities.

Finally, the underlying identifying assumption of the model is that in the absence of the solvency margin, future outcomes for firms more/less exposed to the rule would have evolved in parallel. In other words, conditional on observables (firm, time, and local economic conditions), higher exposure to the rule affects future outcomes only through its direct effect on the availability of internal cash, and not by any other indirect channel that affects the growth in the customer base. Formally, let Γ denote the set of covariates included in the baseline regression. Therefore, it must be that:

$$E[Rule_t \times Exposure_i | \Gamma] = 0 \tag{7}$$

If this condition is satisfied, β_{DD} will measure the differential effect on future outcomes for firms that were more constrained by the Solvency Margin rule. As such, based on the above discussion, it is expected β_{DD} to be *negative*. Along with the main results, several robustness checks will be conducted to rule out possible alternative explanations. Furthermore, we investigate the sensitivity of the results through (i) different measures for growth, such as capital investments and labor; (ii) different levels of past firms' quality assessment; and (iii) the stringency of the solvency margin over the years after the rule was put in practice. Finally, baseline estimates will be used to assess the aggregate change attributable to capital requirements, tracing its contribution to the overall increase in market concentration *ex-post* implementation period. The next section provides a detailed discussion of the main results of the econometric estimation.

7 Firm-level Analysis

7.1 Summary Statistics

Table 1 provides the summary statistics of the sample used throughout the multivariate analysis. As expected, firms more/less exposed to the capital requirement rule are different across a wide set of dimensions: even though more exposed firms present a higher return on Equity, mainly due to leverage - even though not statistically significant -, they present lower levels of operational returns (as shown by lower EBITDA, Net Margins, and Hazard Ratio). These results are expected, as more firms more exposed to the capital requirement rule, by definition, rely more on financial leverage to sustain their operations.

Additionally, lower levels of operational returns not only shed light on the additional riskiness of these exposed firms to the aforementioned industry trends, such as rising healthcare assistance costs but also relate to the dependency of these firms on returns from non-operational activities - *i.e,* returns from financial instruments. To this point, it is worth noting that the *SELIC* rate - *i.e,* the Brazilian federal funds rate, has varied substantially over the study period, reaching its peak in 2016 at approximately 14.25% yearly, and dropping to 5% in 2019, close to the lowest levels for this benchmark since the Brazilian Central Bank started to disclose the SELIC rate for monetary policy related issues, in 1999.

As such, firms relying more on the returns of financial instruments to sustain net margins faced additional difficulties during the period after 2016 to deliver positive accounting profits.

Furthermore, more exposed firms present lower investment in operational assets (as shown by lower Property, Plant, and Equipment levels). Investing in operational assets, - such as hospitals, healthcare centers, etc - has been a key practice in this industry to decrease or sustain the rise in healthcare costs. As Table 1 shows, more exposed firms show lower levels of operational assets relative to less exposed ones, providing another dimension by which this subsample of firms may induce customers to additional insolvency risk.

All in all, it is relevant to consider such differences when estimating the effect of the solvency margin on firms' growth prospects in order to control for confounding factors that may arise due to differences in financial performance, which are plausibly positively correlated with growth prospects. In the next subsections, I provide multivariate results that show that more and less exposed firms had different trends in terms of customer growth after the solvency margin was put in place.

7.2 The effect of higher exposure to capital requirements on future growth

Table 2 provides the estimates of equation (6) considering the full sample of healthcare firms across different states. The coefficient of interest, $Rule \times Exposure$, is negative and statistically negative in all specifications, providing evidence that the introduction of solvency margin has led more exposed firms to show lower growth in their customer base, relative to other firms that were not substantially exposed to the rule. More specifically, Column (1) shows that not only do more exposed firms typically have less growth, the wedge between these firms and less exposed ones in terms of growth terms widens. In columns (2) and (3), the inclusion of year, state, and firm fixed effects shrink the coefficient of $Rule \times Exposure$ by almost 50% of the value presented in column (1), since it is expected that firms more exposed to the capital requirement rule may also grow less than their counterparts, irrespective of the rule being in place. Finally, to rule out any potential confounding factor coming from unobservable trends at the state level, Column (4) adds State $\times$ Time fixed effects to the regression.

In other words, firms that were below the median in terms of sufficiency of solvency margin grew their customer base 11.7% less, on average, relative to other firms less exposed to the capital requirement rule, on an yearly basis. The effects remain statistically significant (at the 5%) level even after controlling for firm-fixed effects and state unobservable trends, indicating that two similar firms, subject to the same state shocks, have a wedge of 11.7% in their annual growth. Furthermore, this effect is attributed to the fact that one of these firms has been more exposed to the capital requirement rule. In all estimates, we also include controls firm-level controls such as Size, defined as the natural logarithm of the firm's Total Assets, the market of firm i in state s for the period t ($Share_{i,s,t}$), the percentage of customers from firm i that are in state t relative to the overall number of customers from firm i, while also controlling for pre/post trends before/after the introduction of the solvency margin rule.

In sum, these results show that the solvency margin rule has affected firms in a heterogeneous way, with some less exposed firms being able to increase their market share at the expense of the more exposed ones having lower customer growth. Intuitively, by showing a higher marginal cost for funding their customer growth, more exposed firms had to bypass potential growth opportunities in such a way that was profitable for less exposed firms to exploit.

Notwithstanding, one can argue whether these results may vary across different types of firms in our sample. For example, there might be situations in which firms, even with very low (or negative) levels of solvency margin sufficiency, are still able to raise equity more efficiently than their counterparts due to other factors unrelated to their exposure to the capital requirement rule. Of special interest to this study, health cooperatives, mostly represented by UNIMED, the world's most widespread health cooperative group and the largest player in private healthcare player in Brazil, which are considered non-limited liability companies (non-LLC) in Brazil, have clear governance regimes than limited liability companies.

Being formally characterized as a health-cooperative group, UNIMED is a decentralized entity, held by health-care professionals, with equal-voting characteristics. Accounting for more than a third of the overall private healthcare market as of 2019, UNIMED raises equity via i) the integralization of current profits; ii) the approval of new health-care professionals inside the cooperative; and (or) iii) through the actual network of healthcare professionals, approved in board meetings.

As such, one would expect that, if anything, health cooperatives should have a different response to the introduction of the solvency margin, relative to other similar firms that operate in a limited liability setting. To get a better understanding of these differences, Tables 3 and 4 provide the results of estimating Equation (6) to different subsamples of non-health cooperatives and health cooperatives only, respectively.

The results from Tables 3 and 4 make clear that the adverse effects of the introduction of the capital rule requirement are coming from the subsample that excludes health-cooperative firms, with the coefficient of interest being negative, statistically significant at the 1% level, and almost twice the magnitude as the one presented in Table 2, Column (4). Column (4) of Table 4 shows that conditional on being an LLC company, more exposed firms have 24% less growth in their customer base relative to similar, less exposed firms. Looking at Table 3, however, it is possible to see that, regardless of the specification used, conditional on being a health cooperative, there is no differential growth trend associated with firms less/more exposed to the capital rule.

7.3 The stringency of the *Solvency Margin* over time

The results from the previous section that not only the capital requirement rule has adverse effects in terms of market growth, but more importantly, these effects are concentrated among the group of limited liability (LLC) firms. After analyzing these effects, I now extend the specification presented in Equation (6) to analyze how the effect presented in Tables 2-4 evolves over time. In other words, does the exposure to the capital requirement rule promote differential growth trends over time?

To shed light on this issue, I estimate the following dynamic *differences-in-differences* equation:

$$\log(Cust_{i,s,t+1}) = \sum_{t'=2010}^{2018} \beta_t \times (1[t = t'] \times Exposure_i) + \Theta' Controls_{i,t} + \alpha_i + \alpha_{s\times t} + \varepsilon_{i,s,t+1}, \tag{8}$$

where $1[t = t']$ is a set of indicator variables that equals one if $t = t'$, with t' is defined between 2010 and 2018, $t' = 2011$, the first year where the capital requirement rule was effectively put in place, as the reference category, and all other variables defined as before. I repeat the specification presented in Equation (8) in three different panels: i) the full regression sample; ii) the subsample of health cooperatives, and iii) the sample excluding health-cooperatives.

The results from these estimations are presented in Figure 8. In line with the results presented in Tables 2-4, the adverse effects of the introduction of the solvency margin are mostly driven by the subsample excluding health cooperatives, presented in Panel B. With regards to timing patterns, even though the effect is not indistinguishable from zero during the first year that the capital requirement rule was put in place, results from Panels

A and B show that the effect becomes negative and statistically significant, with increasing magnitudes over time.

More specifically, for the subsample shown in Panel B (without health cooperatives), the estimated effects range from -13% in 2012 to -55% in 2016, which is in line with the timing pattern regarding the stringency of the solvency margin over time (K_t), described in Section 5. Relevant to this investigation, the differential trends in growth patterns between more/less exposed firms not only seem to increase over time but also show to be persistent throughout the study period.

7.4 Robustness checks

The results from the previous subsection highlight that there is a statistically significant wedge between firms more and less exposed to the solvency margin rule. In other words, firms more exposed to the capital requirement rule presented lower future growth in their customer base. Moreover, these effects seem to be concentrated in the sub-sample of non-health cooperative firms and do not dissipate over time.

To shed further evidence that the estimated effects stem from differences in the exposure to the capital requirement rule, and not due to any other confounding factor, I discuss a series of robustness checks that reinforce the intuition that the channel that explains the wedge between these subsets of firms is the exposure to the solvency margin rule.

7.4.1 Employment Flows and Investment Opportunities

An important concern with the specification presented in Equation (6) relates to investment opportunities and their relationship with firms' growth prospects. As in most empirical corporate finance settings, firms' investment opportunities are plausibly correlated with future outcomes, and failing to account for such variation may induce biased estimates of the desired effects. Relatedly, the inclusion of firm-fixed effects, in general, does not solve the endogeneity issue, as there might have time-varying trends that are plausibly correlated with the dependent variable, but are unobservable to the econometrician. As a consequence, naïve estimates can be capturing demand-side effects related to the available set of investment opportunities that each firm is confronted with, and not supply-side effects related to the availability of capital to invest in operational activities.

In this specific setting, however, industry-specific characteristics play a relevant role in attempting to control for a firm's investment opportunities. As discussed in Section 1, historically, approximately 80% of all healthcare insurance revenues are originated from *employer-sponsored* contracts. As a primary consequence of this fact, firms' unobserved investment opportunities are plausibly correlated with local employment flows, which are exogenous to healthcare insurance firms' characteristics.

That said, one would expect that, if the estimates presented in Tables 2-6 are related to the exposure to the capital requirement rule, and not by other demand-side factors that could explain firms' growth decisions, then it should be the case these effects are stronger in regions that experienced positive employment flows.

To test for this, I use municipal employment flow data from *CAGED* and rerun Equation (6) by subsamples of positive and negative employment flow shocks: for each pair of firm-state-year i, s, t in the sample, I calculate the variation in employment for state s between $\{t-1, t\}$, $EmpFlow_{s,t}$, classifying this observation based on $EmpFlow_{s,t} > 0$.

Tables 5 and 6 consider the subsample of non-health cooperative firms, which seen to drive the majority of the effects, and present the estimates from Equation (6) in subsamples of firm-state-year tuples based on $EmpFlow_{s,t} > 0$ and $EmpFlow_{s,t} \leq 0$. As the results clearly show, the interaction term, $Rule \times Exposure$ is statistically significant only for markets with positive employment shocks during the period.

Assuming that these employment flows are not induced by firms' unobservable characteristics, this evidence further reinforces the claim that the estimates presented before relate to supply, and not demand-wide, effects. Importantly, since the regression sample is at the firm-state-year level, the same firm-year pair can be in both samples. In practical terms, it means that the wedge between more and less exposed firms in terms of customer growth increase only in the regions that, in fact, experienced a potentially higher level of investment opportunities.

7.4.2 Local vs. Distinct Markets

Another concern with the previous results relates to *where* this decrease in customer growth is occurring. Another potential explanation for the results presented herein is the relocation of more exposed firms to some specific markets. As stated below, the Brazilian healthcare industry market is generally seen to be geographically segmented, with health insurance firms concentrating the vast majority of their customers in regions neighboring their headquarters.

As such, an alternative explanation for the decrease in customer growth is that these previous estimates are simply capturing a reallocation between regions that a firm operates seeking to increase operational efficiency. For example, a healthcare insurance firm might be more prone to focus on growing in local markets, where it is easier to adopt cost-reduction strategies than in other markets where such strategies are not value-enhancing[10].

To rule out this alternative explanation, I rerun the dynamic plot presented in Figure 8, Panel B, for subsamples of local/non-local markets. I classify a market for a firm i as $Local_i = 1$ for the state in which the firm historically holds the vast majority of its customers, and zero otherwise. The results, presented in Figure 9, show that this alternative explanation is unlikely to hold since the decrease is mainly driven by local, and not non-local, markets.

7.5 Observable confounders at the firm-level

Lastly, I tackle the issue of the estimates being confounded by time-varying confounders at the firm level. As shown in Table 1, firms more exposed to the solvency margin are different across a wide set of dimensions relative to their less exposed counterparts. If the heterogeneity across these dimensions is not captured by the inclusion of firm fixed effects, then the desired effects may be capturing variation induced by time-varying financial characteristics [11].

To ensure that the estimates are not an ultimate outcome of the heterogeneity observed between more/less exposed firms in terms of financial characteristics, I extend the main specification, presented in Equation (6), adding *PPE*, *ROE*,*Net Margin*, *Leverage*, *Current Ratio*, and the *Hazard Ratio* as controls. The estimates, shown in Table 7, confirm that our results remain statistically significant, even after adding a wide set of time-varying, firm-level controls to the baseline specification.

8 The adverse effects of capital requirements

The results so far provide evidence that firms more exposed to the capital requirement rule did show lower growth in their customer base relative to less exposed firms, especially in markets characterized by having positive investment opportunities. In practice, the

[10]For example, a firm may opt to verticalize costly operations, such as hospitals and specialized health centers, only if a certain number of customer threshold is achieved.

[11]Since these covariates can also be affected by higher exposure to the solvency margin rule - an example of "bad controls", as in Angrist and Pischke (2009) -, I opted not to include this set of covariates in the baseline regressions.

results indicate, on an overall basis, 24% less growth year over year, on average, which is persistent even after three years of the rule introduction.

To this point, how do these estimates translate to potential effects across the industry? Although exposed firms are expected to adjust some of their fundamentals seeking to accommodate the effects of such change, it is still not clear whether these changes have the potential to impact market-wide trends, such as market concentration indices and state-level health outcomes, such as public healthcare service provision and overall private healthcare service quality.

To shed further light on the effects of capital requirements in the Brazilian healthcare industry, this last section explores the adverse effects of the introduction of the capital requirement rule by focusing on firm-level and state-level implications. More specifically, the role of firm-level responses is analyzed by exploring potential spillovers in terms of firms' financial fundamentals, survival probability, and, finally, pricing conditions. Lastly, market-wide trends are by aggregating the data at the state level and investigating whether more states more exposed to the capital requirement rule present different fundamentals *ex-post*.

8.1 Firm-level responses to changes in local market conditions

How do firms more exposed to the capital requirement rule accommodate the changes induced by lower growth levels and constraints on their investment levels? While the results from the previous section provide evidence that these firms are indeed growing less, there is still not clear *how* or *whether* these firms adjust to these market-level changes.

To shed light on the potential firm-level spillovers from the lower growth levels induced by the exposure to the solvency margin, I use a similar version of Equation (6) to investigate whether changes induced by more exposure to the solvency margin are related to changes in firms' fundamentals. More specifically, I run:

$$\mathbf{Y}_{i,t+1} = \beta_{DD} \times (Rule_t \times Exposure_i) + \Theta' Controls_{i,t} + \alpha_i + \alpha_{s \times t} + \varepsilon_{i,s,t+1}, \tag{9}$$

where $\mathbf{Y}_{i,t+1}$ is a vector of firm-level characteristics at $t+1$, such as financial fundamentals and whether the healthcare plan was active or not as of 2021. As firm-level fundamentals are the same irrespective of the market being considered, I aggregate the number of customers of each firm across states s.

8.1.1 Firm-level fundamentals

Table 8 presents the results of the specification presented in Equation (9), focusing on a specific set of firms' financial fundamentals at $t+1$. In line with the argument that more exposed firms had lower incentives to invest in operations *ex-post* the solvency margin implementation, Columns 1-3 show that, while the change (expressed as $\Delta i = \log(i)$) in customers did not drive overall assets differently, the change is fully concentrated in operational assets portion – *i.e,* assets related to promoting healthcare assistance, such as hospital and healthcare centers –, while changes in financial assets, such as short-term, low-risk financial instruments, cash and cash equivalents, did not show to be related to changes in the customer base.

In line with this previous result, Column 4 shows that this effect is also pronounced in terms of Operational Revenues: firms more exposed to the capital requirement rule are decreasing operational revenues – *i.e,* revenues related to healthcare assistance activity. Interestingly, Columns 5-6 show that the adjustment seems to be concentrated in terms of revenue, as more exposed firms did not show to adjust in terms of gross margins (Column 5) and/or EBITDA (Column 6). Interestingly, the non-statistically significant results regarding gross margins and EBITDA may indicate that there were no other adjustments in the firms' operational structure other than the lower activity due to foregone investment opportunities.

8.1.2 Survival probabilities

Are the firms characterized by losing market due to the capital requirement rule riskier than the ones that are being benefited by such policy? While the results from Table 8 may indicate that some firms' financial fundamentals are changing, these are not sufficient evidence to argue that there are different trends in terms of survival probabilities.

In order to shed additional light on such issue, I leverage information from *CADOP – Sistema de Cadastro das Operadoras* – and collect information about all healthcare insurance delistings between 2004 and 2020. Overall, delistings can occur due to i) regulatory enforcement (*Deliberação da Diretoria Colegiada*), cancellation (*Cancelamento)*, incorporations (*Incorporações*), and liquidations (*Liquidações*). The average delisting rate of the sample (# of firms delisted relative to the overall number of firms) is about 11.04%.

Table 9 shows the results of a regression in the likes of Equation (9), where the dependent variable is a dummy variable $Delisted_i$ that assigns 1 (one) if firm i is Delisted during the end of the sample period (2020), and zero otherwise. Column 1 shows that, on average, exposed firms did show a lower survival probability during the sample period. However, when looking at the individual classifications for delistings, results from Columns 2-5 show that the increase in delisting probability has been surging especially due to the Regulatory Agency Enforcements (*RAE*), defined as situations when the regulatory agency decides to intervene and prevent the healthcare plan from performing its operational activities, and *Incorporations*, where the given healthcare plan transfers its customers to another already regulated and established healthcare plan. Interestingly, column (5) shows that the likelihood of a *Liquidation* goes in the opposite direction.

8.2 Pricing outcomes

When confronted with changes in market conditions, do more/less exposed firms react by setting prices differently? Although previous results shown in Table 8 show that firms adjusted operational revenues due to the changes induced by the solvency margin implementation, it is not clear whether such change is driven solely by the change in the customer base, or whether it is in conjunction with changes in prices. Importantly, although changes in the customer base do not necessarily affect the ultimate customer, price adjustments can directly impact customer welfare.

To better investigate this issue, I leverage information from *ANS*'s database on commercial pricing references – *Valor Comercial de Referência*. These values form the basis for the pricing of Brazilian healthcare plans, and must be provided by each firm in a document that justifies price setting for each healthcare customer plan of health plans through actuarial calculations. Values are shown in monthly installments, calculated using nominal current prices. It is important to stress that this reference price of a given healthcare plan may present differences in relation to the commercialization prices in practice. The prices effectively practiced for contracting the products must be within the commercialization limits established in the regulations. More specifically, the upper bound for the effective price is 30% above the reference price, while the lower bound is the maximum value of the estimated assistance cost and 30% below the reference price.

I proceed by collecting, for each year of my sample, all firm $\times$ plan $\times$ age bracket[12] reference prices that are available. Since I cannot observe where a plan is actually commercialized, averaging out the values for each combination can skew the price distribution if there are geographical differences in price setting, which is likely to be the case. In this

[12] *ANS* considers 10 different age brackets for pricing purposes: [0,18], [19,23], [19,23], [24,29], [30,33], [34,38], [39,43], [44,48], [49,53], [54,58], and [59,∞).

sense, I calculate, for each tuple, the median value for the reference price. This price reflects, for a given firm, the median price that forms the basis of its pricing throughout all plans commercialized in a given year and for a given age bracket. I then use a similar strategy as of Table 8 and estimate the following specification:

$$\log Price_{i,a,t+1} = \beta_{DD} \times (Rule_t \times Exposure_i) + \Theta' Controls_{i,t} + \alpha_i + \alpha_{s \times t} + \alpha_a + \varepsilon_{i,s,t+1}, \tag{10}$$

where $\log Price_{i,t+1}$ is the natural logarithm of the reference price for firm i, in period $t+1$, for an age bracket a. As before, for each firm, I use the subsample of state-year observations corresponding to the state where the firm hold the majority of its customers. I include age bracket fixed effects (α_a), and cluster the standard errors at the firm, state, and age bracket levels.

Table 10 presents the results of a panel specification including all age brackets, while Table 11 estimates single equations for each age bracket (removing α_a and clustering the errors at the firm and state levels). As shown in the aforementioned tables, there is a statistically significant and positive relationship between exposure to the solvency margin and the reference price: firms more exposed to the solvency margin adjusted their prices approximately 5.8% less than their counterparts. Interestingly, as shown in Table 11, this result seems to be stronger in magnitude and statistical significance to lower age brackets.

Overall, pricing estimates depict a situation where firms less exposed to the solvency rule – and, as shown previously, able to exploit positive investment opportunities within their markets – are setting prices higher than their counterparts. While outside of the scope of this study, a potential explanation for such change can be related to changes in market power: as less exposed firms gain market-share in detriment of firms that are prevented from exploiting such opportunities, gains in bargaining power can provide firms with the option of setting higher prices.

8.3 Do Capital Requirement exposures pass through local markets?

The estimates presented in the previous section highlight the role of the solvency margin in explaining future growth outcomes in the Brazilian Healthcare Industry. In broader terms, these aforementioned results show that, among other factors, exposure to the capital requirement rule has a negative, statistically, and economically significant effect on the growth of a firm's customer base. More than that, these results also have consequences in terms of firms' fundamentals, such as delisting probability, and seem to be a driver of price setting.

However, taken individually, these results do not shed light on the potential *aggregate* effects of the introduction of the capital requirement rule in the Brazilian healthcare industry. More specifically, it is not clear, from the aforementioned results, if the disproportionate effects of the solvency margin introduction across more and less exposed firms induced changes in market concentration and/or induce changes in health outcomes at the state-level.

To tackle this issue directly, I first focus on understanding the aggregate effects of the introduction of the solvency margin by estimating state-level regressions and testing whether states with high exposure to the capital requirement rule – *i.e*, those were exposed firms concentrate their customer base – show different trends in terms of market concentration.

To test the claim that such changes induced variation in market concentration, I first aggregate the data at the state-year level by taking a weighted average of the solvency margin sufficiency (SSM_i) in 2010 across states, weighted by the size of each firm:

$$SSM_s = \frac{\sum_{i=1}^{N} Size_{i,2010} \times SSM_i}{\sum_{i=1}^{N} Size_{i,2010}} \tag{11}$$

With that, I run triple-differences specification at the state-year level:

$$\begin{aligned} log(1 + HHI_{s,t}) = \beta_1 \times Exposure_s + \beta_2 \times Rule_t + \beta_3 \times EmpFlow_{s,t} \\ +\beta_4 \times (Exposure_s \times Rule_t) + \beta_5 \times (Exposure_s \times EmpFlow_{s,t}) + \beta_6 \times (Rule_t \times EmpFlow_{s,t}) \\ +\beta_7 \times (Rule_t \times Exposure_s \times EmpFlow_{s,t}) + \varepsilon_{s,t}, \end{aligned} \tag{12}$$

where $Exposure_s$ is a dummy variable that assigns the value one if the state s level of solvency margin sufficiency, which is a weighted average of the solvency margin sufficiency of all firms that operate in s, is lower than the median, $Rule_t$ is a dummy variable that assigns one for observations after $t = 2012$. In words, Equation (10) estimates whether states that were more exposed to the capital requirement rules experienced changes in their market concentration levels, and if these changes are occurring in state-year pairs facing positive employment flows during that period.

The results, presented in Table 12, are in line with the argument that the introduction of the solvency margin has increased market concentration. As shown by the double interaction term, $Rule \times Exposure$, and the triple interaction term, $Rule \times EmpFlow \times Exposure$, not only more exposed states are indeed having increases in market concentration after the introduction of the solvency margin was put in place, but this effect is mainly driven during years where these states faced *positive* employment shocks. In this situation, the differential effect for more exposed states is an increase in the market's HHI of 21%, on average, which is statistically and economically significant. All in all, these results show that capital requirement rules pass-through local market conditions, thereby increasing industry's concentration in more affected markets.

Taken together with the results from Tables 10 and 11, these results provide evidence in line with the argument that the solvency margin rule has led to adverse effects in the industry: not only markets became more concentrated, but firms gaining market-share due to the introduction of the solvency margin rule are setting higher prices.

In addition to this point, higher levels of market concentration can also manifest either by firms i) having higher bargain power, thereby dampening service quality and expropriating consumer welfare; or ii) offering better services due to gains stemming from scale efficiencies. Furthermore, of special interest to this study, higher levels of market concentration can also affect public healthcare service provision. Higher price adjustments and lower supply can screen out potential customers from using private healthcare services and, in turn, induce customers to lean on public healthcare assistance. To test these predictions at the state-level, I leverage *DataSUS* open-source based data and collect all information regarding the number of internations and medical procedures held by the Brazilian's public healthcare service at the state-level. I also complement this data with information on customer complaints regarding health insurance plans provided by *ANS*, with information about the location of the complainer and the specific firm that is the object of the complaint.

With that, I run equations similar to Equation (12) to understand whether more exposed states have shown changes in public service provision and private service quality after the introduction of the solvency margin. The results, presented in Table 13, do not show statistically significant changes in any of these health outcomes. Taken together, these results indicate that although market concentration has soared within more exposed states during periods of positive employment shocks after the introduction of the solvency margin, there is no evidence at the state-level that supports the argument of spillovers to public healthcare service provision or the service quality within the private healthcare sector.

9 Conclusions and directions for future research

The Brazilian private healthcare insurance is central to the country's health policy coordination, providing private healthcare assistance for one in each four citizens. Among the several measures taken by the industry's regulatory agency to insulate customers from the risk of insolvency by their healthcare insurance providers, the introduction of the solvency margin, enacted at the end of 2009 and put in place two years after, which enforce firms to gradually constitute capital buffers based on their assistance costs and revenues, imposed a cap in firms' leverage decisions, which in turn may have caused second-order effects in the industry.

Despite its relevance, there is still no empirical assessment of the introduction of the solvency margin in the Brazilian healthcare industry. In this paper, I fill this gap by showing that not only firms more exposed to the capital requirement rule grew their customer base less than their counterparts, but also that this effect is mainly concentrated in the subsample of non health cooperatives, and does not dissipate over a short period of time.

The results presented in this paper show that, conditional on being more exposed by the capital requirement rule, non health cooperative firms grew, on average, 24% less than otherwise similar firms that have not been exposed. This effect is statistically significant even after including a wide set of covariates and fixed effects to control for confounders, and remains significant in all robustness checks performed.

Furthermore, when looking at the second-order effects of such changes, the results show not only that more exposed firms presented higher likelihood of delisting and lower levels of operational assets and revenues, firms that were positively hit by the effects of such policy adjusted prices 5.8% higher, on average, with statistically significant results across the whole sample and within almost all customer's age brackets.

To the extent that more exposed firms grew less than their counterparts after the implementation of the solvency margin, is this sufficient to have aggregate impacts in the industry? By comparing states that concentrate a higher portion of customers from exposed firms, I show that the wedge between more and less exposed firms can explain the surge in the market concentration over time: more exposed states saw market concentrations increase 21%, on average, after the solvency margin implementation. Interestingly, this effect is only present in states with positive local employment flows, which are plausibly correlated with the market's investment opportunities. In addition to that, although there has been a notable increase in market concentration, there is no evidence of state-level changes in health-outcomes, such as influx of patients to the public healthcare service provision and/or changes in the level of complaints filed by users of private healthcare plans.

Notwithstanding, even though these results enhance our understanding of the effects of capital requirements outside of the financial sector, more investigation is still needed to understand the welfare consequences of such adoption. More specifically, even though market concentration has increased as a result of the solvency margin, understanding whether ultimate consumers are better off in welfare terms is still an open question, since market concentration can, on the one hand, can harm customers through increasing market power from the supplier side, but at the same time can have positive effects due to efficiency gains. To that matter, more investigation on such topics can enhance our understanding of the welfare consequences of introducing capital requirements outside of the financial sector.

In 2020, anticipating the difficulty of healthcare insurance firms to comply with the solvency margin rule while maintaining their core businesses amid the onset of the COVID-19 pandemic, *ANS* allowed firms to switch to a risk-based assessment for capital requirements, which otherwise would have been implemented only in 2023. I expect these results to be valuable insights to shed light on the trade-offs associated with implementing capital requirement policies, providing a clear understanding of their short and long-term aggregate consequences.

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10 Figures

Figure 1: Raw Data and Final Dataset Description

This figure provides detailed information on the raw data inputs considered in the study, as well as the final dataset used throughout the multivariate analyses. All information used throughout the study is publicly-available. Detailed information about the consolidation procedures can be obtained upon request.

Source	***Data***
Agência Nacional de Saúde Suplementar (ANS)	*Financials* : Full disclosure of firms' financials (balance-sheet statements, cash-flow statements, and income statements). This data will be essential for understanding firms' financial conditions *ex-ante* the introduction of the solvency rule, as well as to assess possible *ex-post* effects. Data is at the end-of-year format and spans from 2006 to 2019.
	Customer: Detailed information regarding the number of firms' ultimate customers (individuals) over time, by month, and municipality. Data is at the firm-municipality-month level and spans from December 2014 to December 2019.
	Service Quality: Historical information regarding *ANS's* periodic evaluation of health insurance firms, *Índice de Desempenho da Saúde Suplementar (IDSS)* . Information regarding financial sustainability, internal processes and compliance, ease of access, and healthcare quality. Data is in a yearly format and spans from 2009 to 2019.
	Firm Characteristics : Categorical information regarding firms' entity type (non-profit, private for-profit, cooperative), State of incorporation, date of incorporation, date of dissolution.
Cadastro Geral de Empregados e Desempregados (CAGED)	*Net inflow of formal contracts:* Information regarding the net inflow (hires minus dismissals) of formal employment contracts. Data is at the municipality-month level and spans from 2000 to 2019.
Relação Anual de Informações Societárias (RAIS)	*Job characteristics:* Firm-specific information regarding detailed characteristics of each job contract. Data is in yearly format and spans from 2010 to 2019.
Final Dataset	At the end of the merging process, the final database will consist of a unique set of firms' financials, market, service, and employment characteristics, as well as their corresponding exposure to local employment conditions. Data will be aggregated on a firm-year basis and will span from 2006 to 2019.

Figure 2: Number of active private healthcare firms over time

This figure provides detailed information on the number of active healthcare firms in the Brazilian healthcare industry during 2000 and 2019. Panel A plots the number of active healthcare firms for each period presented in the x-axis, whereas Panel B plots the number of delisted firms in each year on the y-axis. Labels presented in the top of the bar chart shows the ratio of delisted firms to the number of total active firms at the beginning of each year.

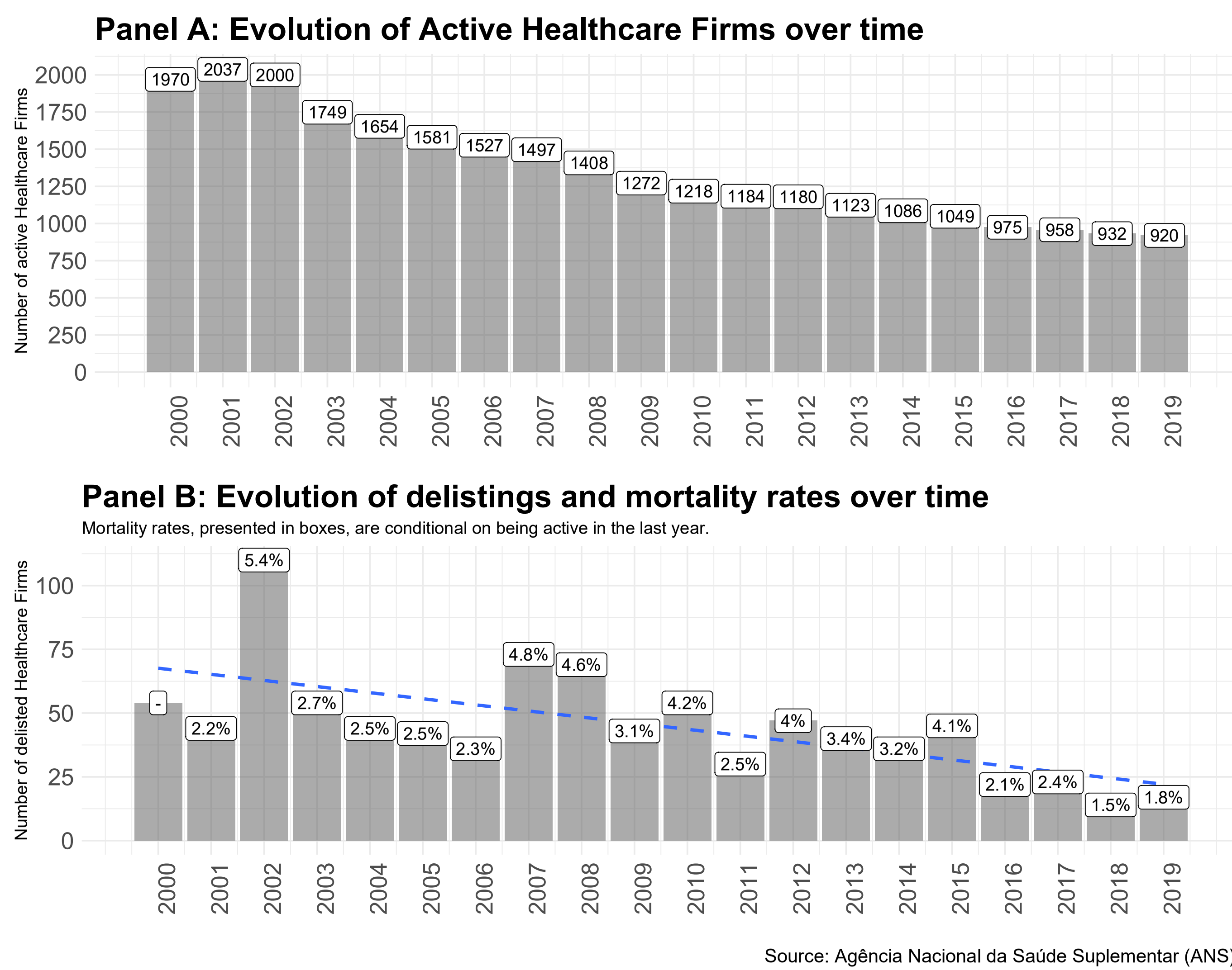


Figure 3: Number of active private healthcare customers and average age over time

This figure provides detailed information on the number of active healthcare customers between 2000 and 2019 and the average customer age throughout the same period. Panel A shows the number of active healthcare customers (in billions) during each period between 2000 and 2019. Panel B plots the average age of active healthcare customers between 2000 and 2019.

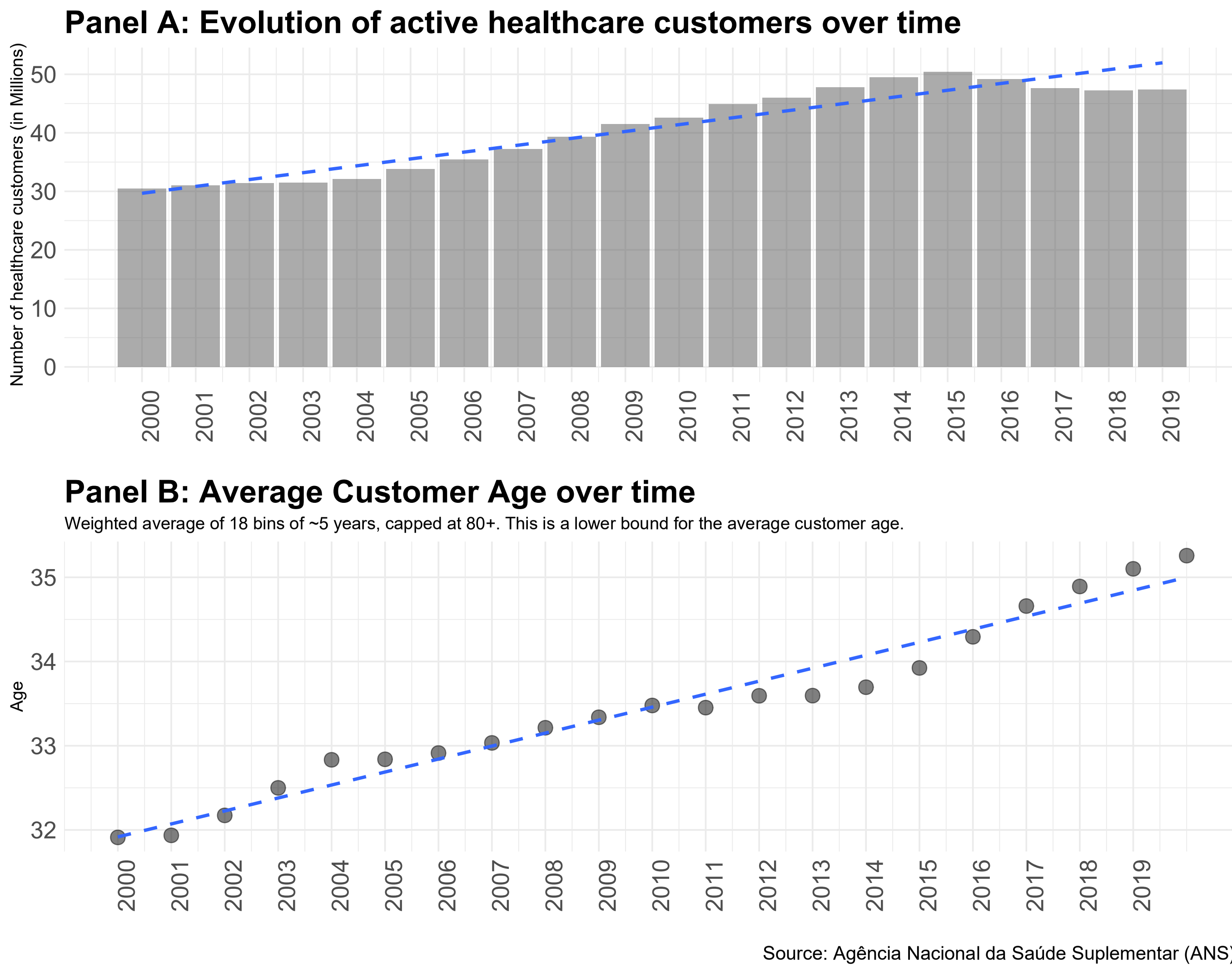


Figure 4: Evolution of private healthcare firms' operational costs over time

This figure plots the evolution of the Hazard Ratio for active healthcare firms between 2001 and 2019. Hazard Ratio is defined as 1 - Gross Margin. Calculations are made according to *ANS*'s accounting standards described in the *Plano de Contas Padrão da ANS* and account for changes in accounting standards occurred throughout the study period.

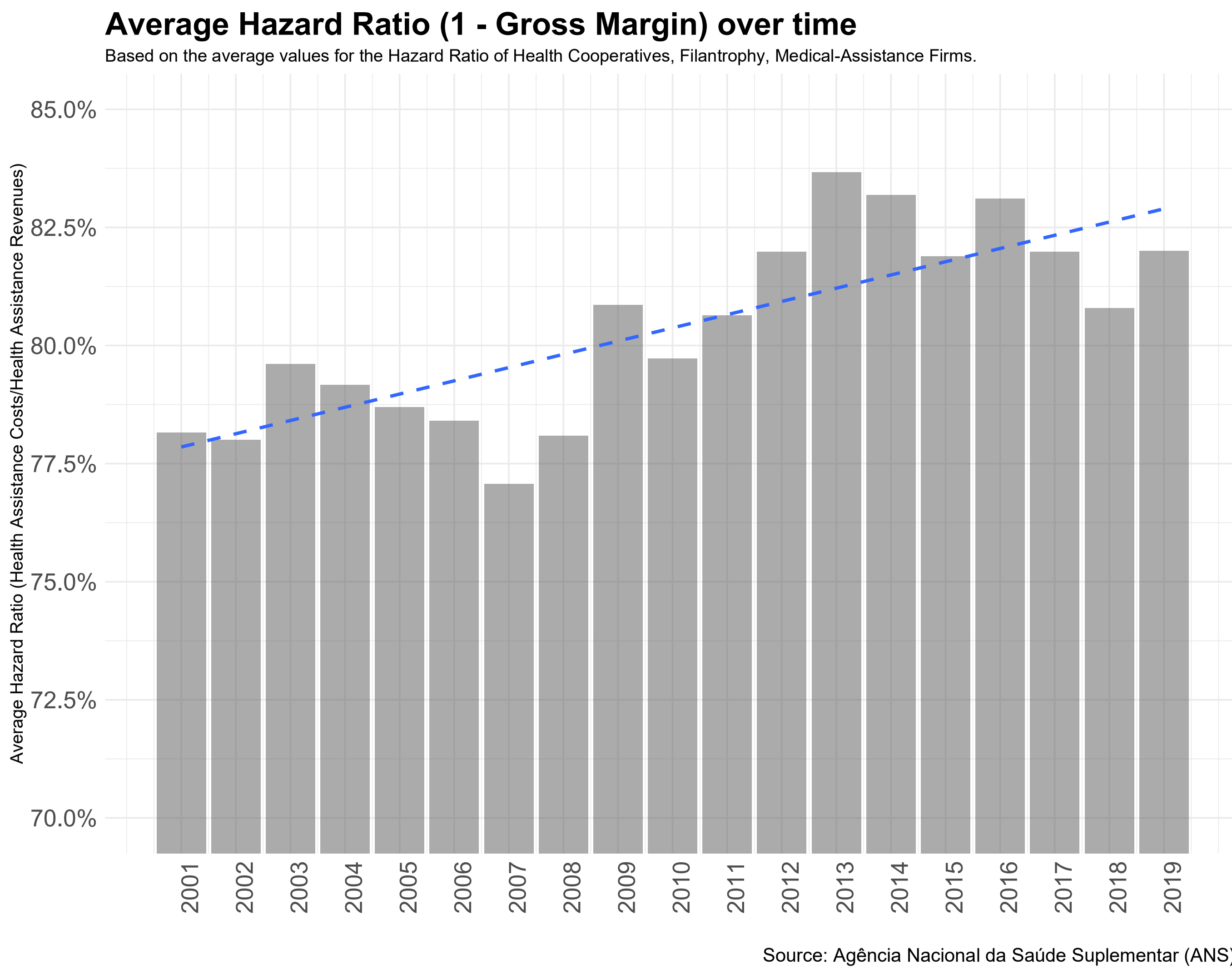


Figure 5: Brazilian private healthcare industry concentration over time

This figure plots the evolution of the Herfindahl-Hirschman-Index (HHI) of the brazilian healthcare industry between the second quarter of 2011 and 2019. HHI is calculated following Equation (2). Gray dots represent the HHI estimate across the whole set of active healthcare firms in each period, whereas black dots represent the HHI estimate considering only the subset of categories included within the regression sample.

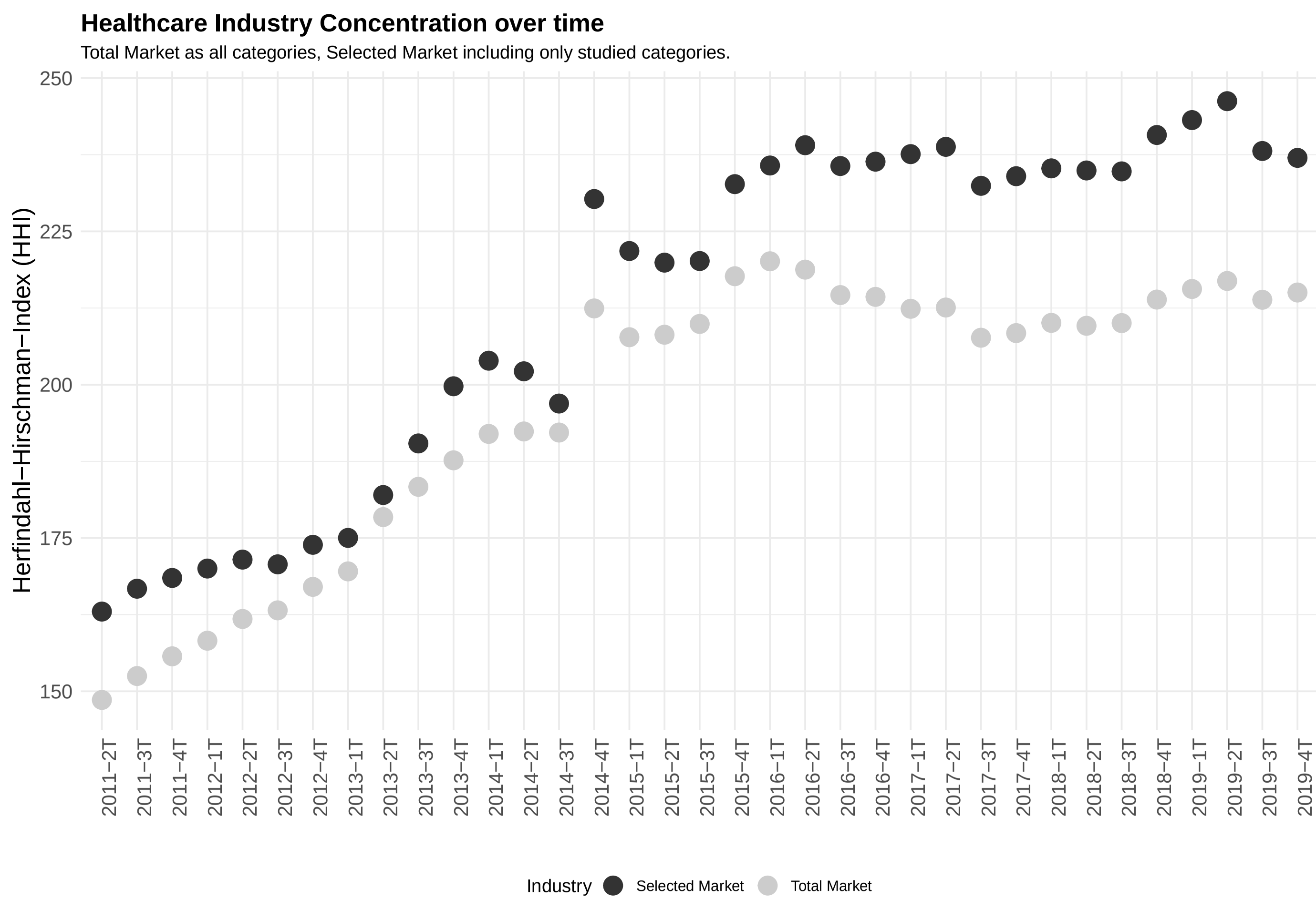


Figure 6: Evolution of private healthcare firms' leverage and financial buffers costs over time

This figure provides information on the evolution of financial buffers held by Brazilian healthcare firms before and after the introduction of the solvency margin. Panel A shows the evolution of the average Leverage ratio of active Brazilian healthcare firms between 2010 and 2019, whereas Panel B shows the evolution of the Financial Assets (in % of Total Assets) held by these firs. Leverage is defined as the ratio of Total Assets to Total Equity. Financial Assets are defined as Cash, Cash Equivalents, and Short-Term Investments, according to *ANS*'s accounting standards described in the *Plano de Contas Padrão da ANS*.

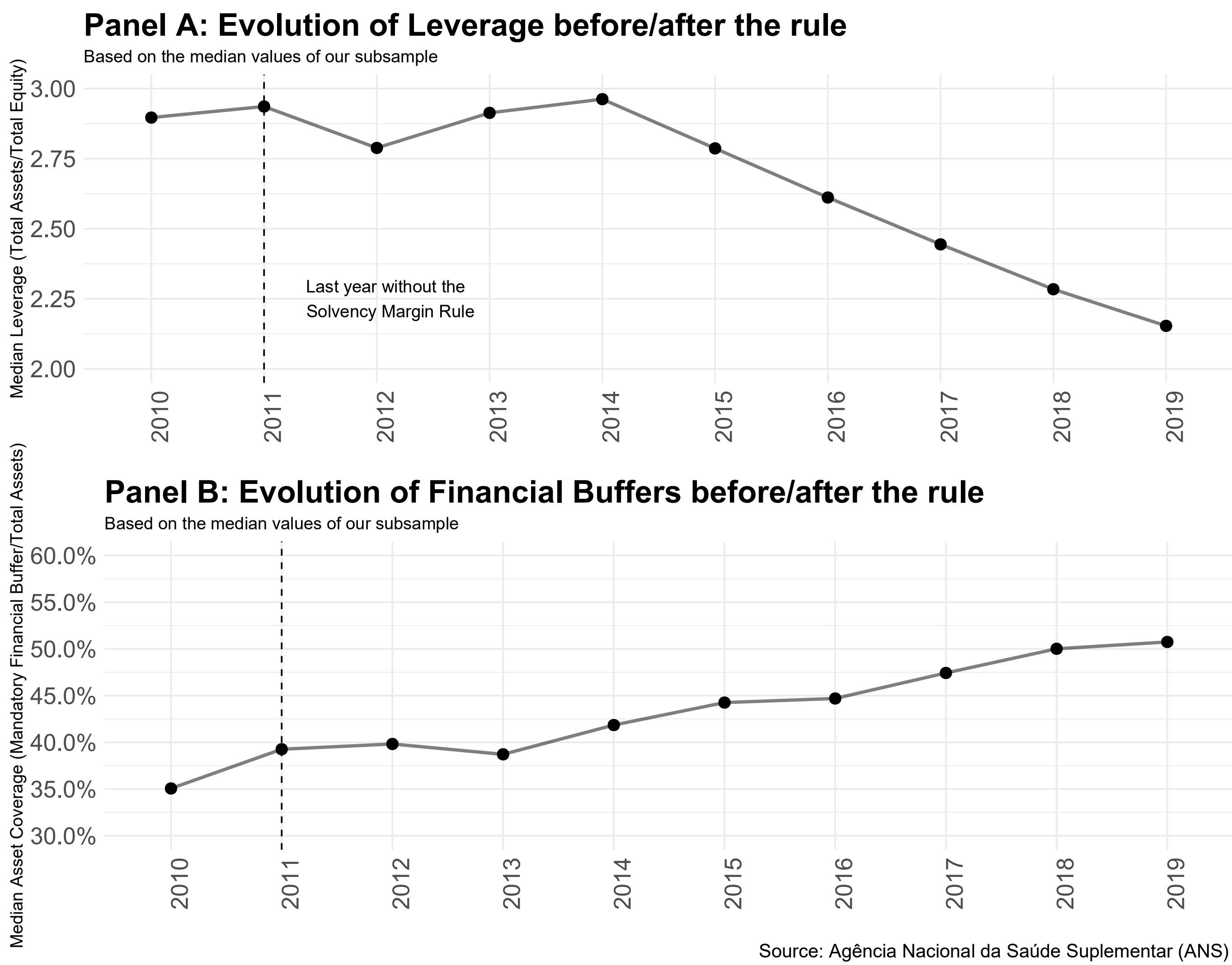


Figure 7: Evolution of private healthcare firms' financial assets before/after the *Solvency Margin* rule

This figure provides information on the evolution of financial assets held by Brazilian healthcare firms before and after the introduction of the solvency margin. Financial Assets are defined as Cash, Cash Equivalents, and Short-Term Investments, according to *ANS*'s accounting standards described in the *Plano de Contas Padrão da ANS*. The y-axis plots the amount (in R$ billion of Financial Assets held by all active healthcare firms between 2010 and 2019.

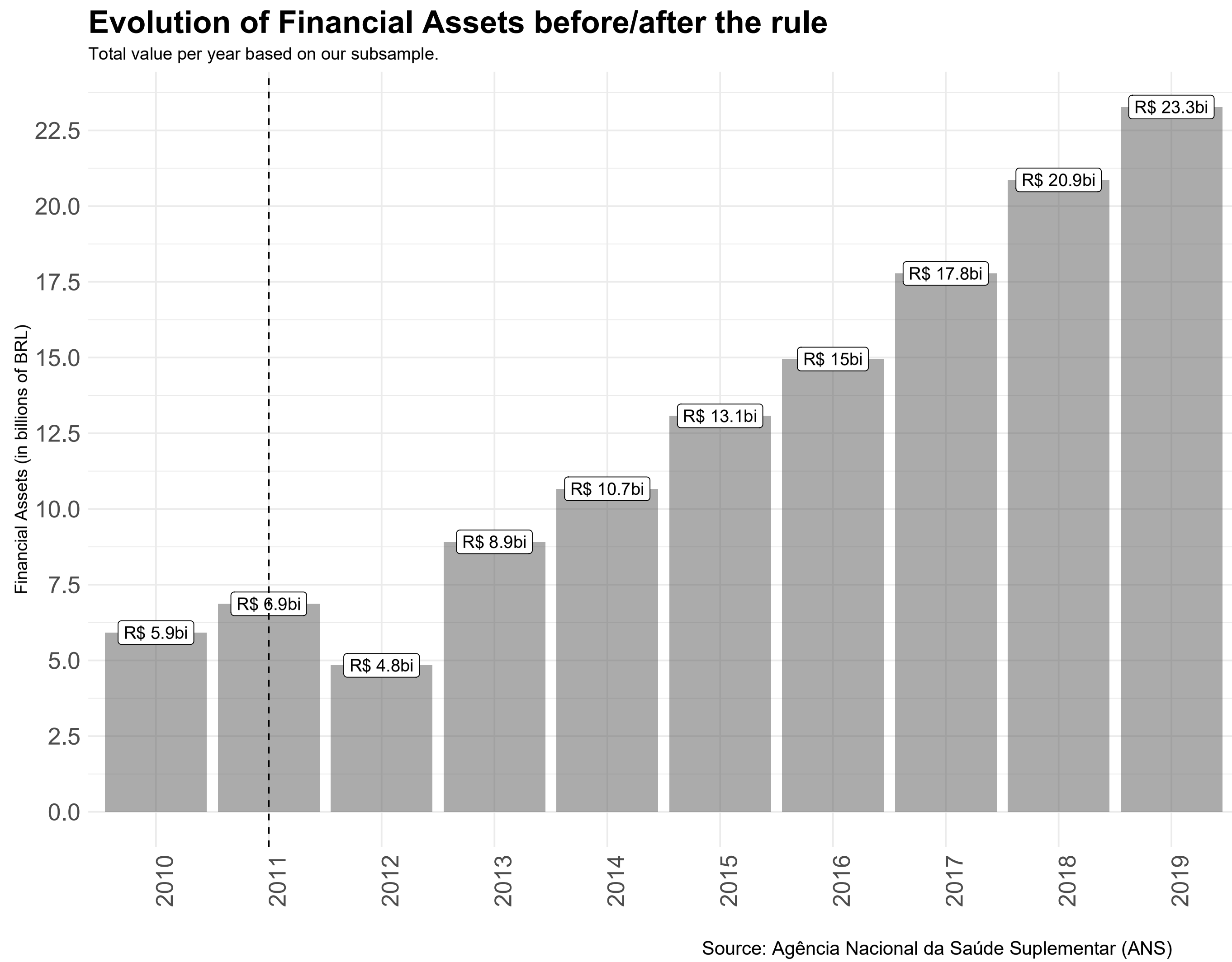


Figure 8: Dynamic *differences-in-differences* for different subsamples of firms.

This Figure presents the estimation results of the dynamic *differences-in-differences* specification, presented in Equation (8) and described in Section 7. Panels A-C plot the point estimate and the 90% confidence interval of β_t on the y-axis, with t varying on the x-axis. The reference category considered in the estimations is $t = 2011$, the first year when the solvency margin was effectively put in place.

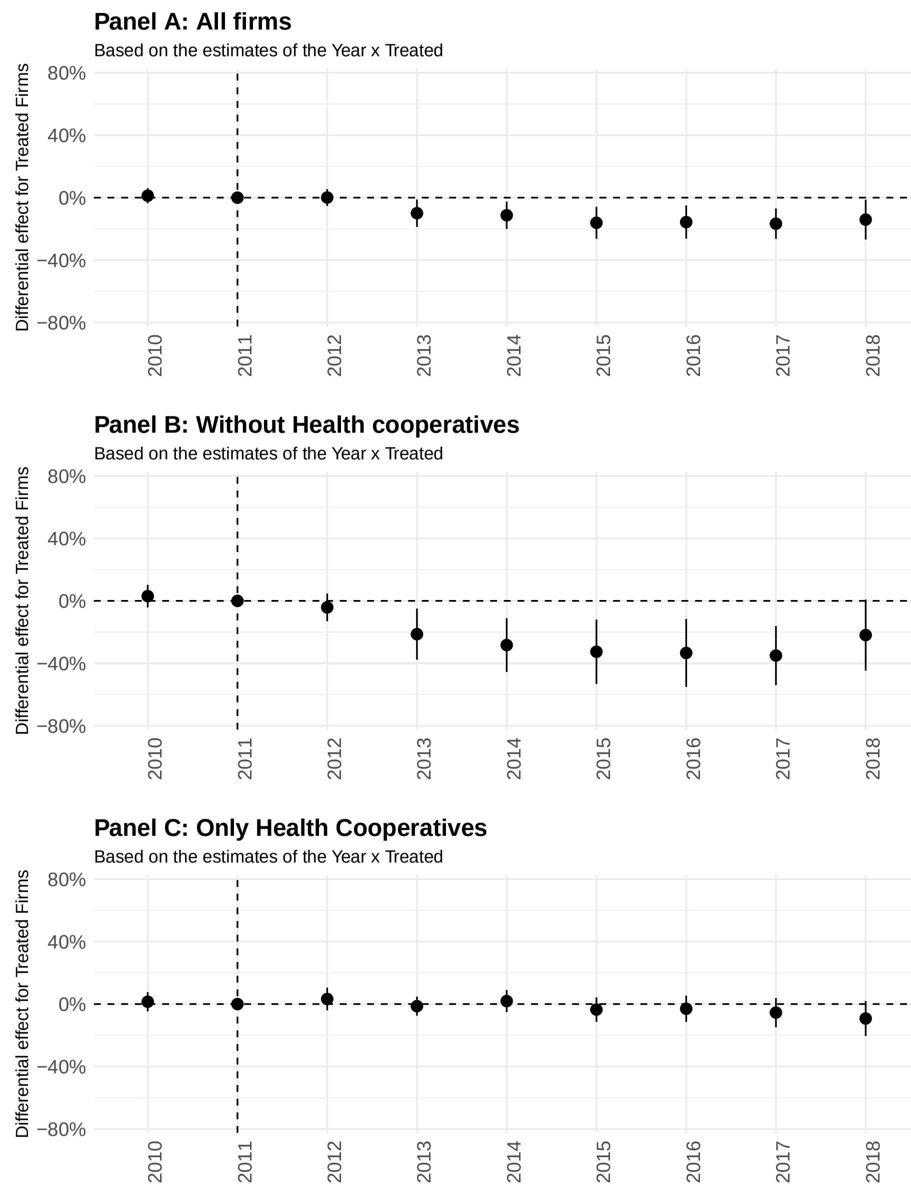
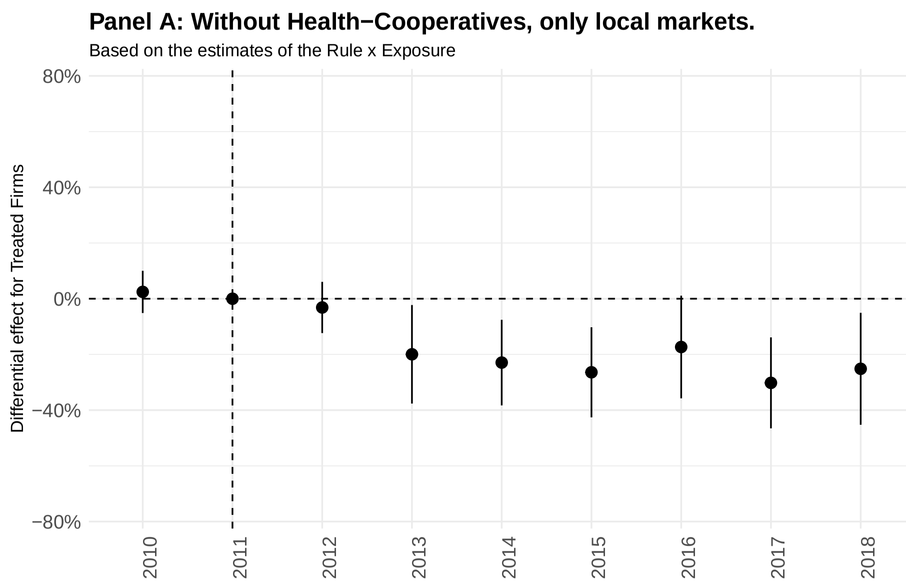


Figure 9: Dynamic *differences-in-differences* for different subsamples of non-healthcare cooperatives, based on local and non-local markets.

This Figure presents the estimation results of the dynamic *differences-in-differences* specification, presented in Equation (8) and described in Section 7. Panel A (B) plots, for the subsample of observations where $Home = 1$ ($Home = 0$), the point estimate and the 90% confidence interval of β_t on the y-axis, with t varying on the x-axis. The reference category considered in the estimations is $t = 2011$, the first year when the solvency margin was effectively put in place.



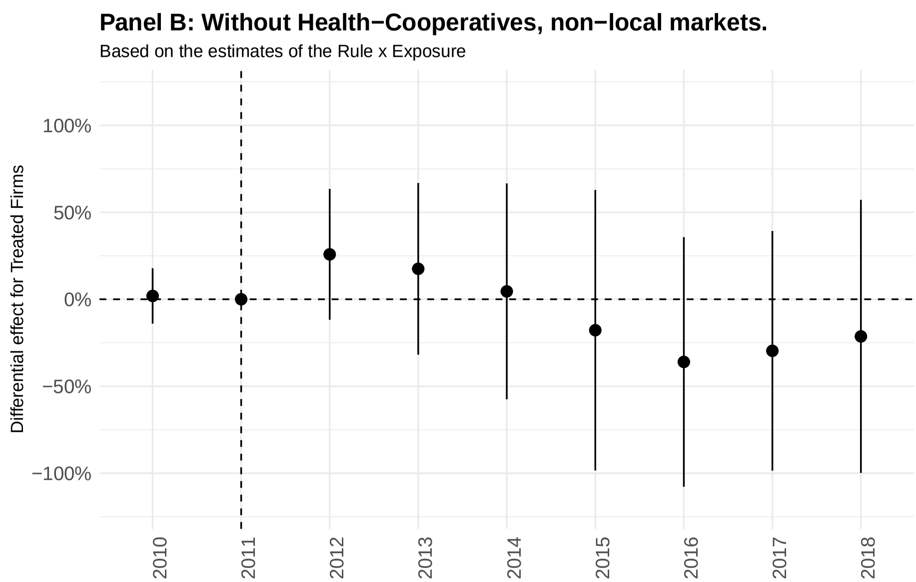


Table 1: Summary Statistics - Regression Sample

This table presents the summary statistics for the sample used throughout the analysis conducted in Section 5. Column 2 shows the average values for firms in which the sufficiency of solvency margin is greater than or equal to the median value (more exposed firms), whereas Column 3 shows the same calculations for the subsample of firms with sufficiency margin above the median. Finally, columns 4 and 5 present the differences between columns 1 and 2 and its corresponding p-values, respectively. EBITDA (%) is calculated as the ratio of net operational income to gross revenues. Net margin is the ratio of profits to gross revenues. PPE (%) is the ratio of Property, Plant and Equipment to Total Assets. State Market Share (%) is the market share of a firm in the state where it hosts the majority of its customers. Hazard Ratio is defined as 1− Gross Margin. Size is defined as the natural logarithm of firms' Total Assets. *DistSolvency* (%) is defined as in Equation (5).

Variable	$DistSolvency <$ **Median**	$DistSolvency \geq$ **Median**	$\Delta(1-2)$	**p-val**
EBITDA (%)	0.013	0.030	0.018	0.012
Net Margin	0.012	0.041	0.029	0.000
PPE (%)	0.193	0.338	0.145	0.000
Return on Equity	0.171	0.117	-0.054	0.416
State Market Share (%)	0.027	0.010	-0.017	0.003
Hazard Ratio	0.781	0.712	-0.069	0.000
Size	16.6	16.3	-0.3	0.093
SSM (%)	-0.924	1.930	2.854	0.000

Table 2: OLS - Growth in Customer Base and Solvency Margin Sufficiency

This table presents the estimation results of the *differences-in-differences* specification, presented in Equation (6) and described in Section 6, for the whole sample of healthcare firms across states. The dependent variable, log(1+$Customers_{i,s,t}$), is the natural logarithm of (1+$Customers_{i,s,t}$), where $Customers_{i,s,t}$ is the number of customers that a health cooperative i has in state s during year t, and zero otherwise. $Rule_t$ is an indicator variable that equals one if the observation relates to periods during or after 2011. $Exposure_i$ is an indicator variable that assigns one if firm i presented a solvency margin sufficiency during 2009 below the median, and zero otherwise. All specifications include clustered standard errors at the firm level, as well as firm-level controls interacted with pre and post trends relative to the first year of the year of the capital requirement rule (*i.e,* 2011). Standard errors are presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable: log(1+$Customers_{i,s,t}$)			
	(1)	(2)	(3)	(4)
Exposure	0.909***	0.909***	-	-
	(0.094)	(0.094)		
Rule	$-$0.911*	-	-	-
	(0.513)			
Exposure × *Rule*	$-$0.219***	$-$0.240***	$-$0.125**	$-$0.117**
	(0.060)	(0.062)	(0.050)	(0.051)
Firm Controls	✓	✓	✓	✓
Firm Controls × Post	✓	✓	✓	✓
Year FE	No	✓	✓	No
State FE	No	No	✓	No
Firm FE	No	No	✓	✓
State-Year FE	No	No	No	✓
Cluster	Firm	Firm	Firm	Firm
Observations	3,085	3,085	3,085	3,085
R^2	0.703	0.716	0.962	0.964
Note:			*p<0.1; **p<0.05; ***p<0.01	

Table 3: OLS - Growth in Customer Base and Solvency Margin Sufficiency - Only Health Cooperatives

This table presents the estimation results of the *differences-in-differences* specification, presented in Equation (6) and described in Section 6, for the subsample of healthcare cooperatives across states. The dependent variable, log(1+$Customers_{i,s,t}$), is the natural logarithm of (1+$Customers_{i,s,t}$), where $Customers_{i,s,t}$ is the number of customers that a health cooperative i has in state s during year t, and zero otherwise. $Rule_t$ is an indicator variable that equals one if the observation relates to periods during or after 2011. $Exposure_i$ is an indicator variable that assigns one if firm i presented a solvency margin sufficiency during 2009 below the median, and zero otherwise. All specifications include clustered standard errors at the firm level, as well as firm-level controls interacted with pre and post trends relative to the first year of the year of the capital requirement rule (*i.e,* 2011). Standard errors are presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable: $\log(1+Customers_{i,s,t})$			
	(1)	(2)	(3)	(4)
Exposure	0.408^{***}	0.408^{***}	-	-
	(0.100)	(0.100)		
Rule	0.009	-	-	-
	(0.675)			
Exposure × *Rule*	0.007	−0.017	−0.037	−0.031
	(0.065)	(0.065)	(0.048)	(0.048)
Firm Controls	✓	✓	✓	✓
Firm Controls × Post	✓	✓	✓	✓
Year FE	No	✓	✓	No
State FE	No	No	✓	No
Firm FE	No	No	✓	✓
State-Year FE	No	No	No	✓
Cluster	Firm	Firm	Firm	Firm
Observations	1,530	1,530	1,530	1,530
R^2	0.776	0.800	0.984	0.987
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 4: OLS - Growth in Customer Base and Solvency Margin Sufficiency - Excluding Health Cooperatives

This table presents the estimation results of the *differences-in-differences* specification, presented in Equation (6) and described in Section 6, for the subsample of healthcare firms excluding health-cooperatives across states. The dependent variable, log(1+$Customers_{i,s,t}$), is the natural logarithm of (1+$Customers_{i,s,t}$), where $Customers_{i,s,t}$ is the number of customers that a health cooperative i has in state s during year t, and zero otherwise. $Rule_t$ is an indicator variable that equals one if the observation relates to periods during or after 2011. $Exposure_i$ is an indicator variable that assigns one if firm i presented a solvency margin sufficiency during 2009 below the median, and zero otherwise. All specifications include clustered standard errors at the firm level, as well as firm-level controls interacted with pre and post trends relative to the first year of the year of the capital requirement rule (*i.e*, 2011). Standard errors are presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable: log(1 +$Customers_{i,s,t}$)			
	(1)	(2)	(3)	(4)
$Exposure$	1.224***	1.224***	-	-
	(0.133)	(0.133)		
$Rule$	-1.158	-	-	-
	(0.707)			
$Exposure \times Rule$	-0.308^{***}	-0.326^{***}	-0.239^{***}	-0.241^{**}
	(0.091)	(0.094)	(0.088)	(0.094)
Firm Controls	✓	✓	✓	✓
Firm Controls × Post	✓	✓	✓	✓
Year FE	No	✓	✓	No
State FE	No	No	✓	No
Firm FE	No	No	✓	✓
State-Year FE	No	No	No	✓
Cluster	Firm	Firm	Firm	Firm
Observations	1,555	1,555	1,555	1,555
R^2	0.694	0.701	0.954	0.959

Note: *p<0.1; **p<0.05; ***p<0.01

Table 5: OLS - Growth in Customer Base and Solvency Margin Sufficiency - Only for state-year pairs with positive employment flows and and excluding health-cooperatives.

This table presents the estimation results of the *differences-in-differences* specification, presented in Equation (6) and described in Section 6, for the subsample of healthcare firms excluding health-cooperatives and state-year pairs with $Employment_{s,t} > 0$. The dependent variable, log(1+$Customers_{i,s,t}$), is the natural logarithm of (1+$Customers_{i,s,t}$), where $Customers_{i,s,t}$ is the number of customers that a health cooperative i has in state s during year t, and zero otherwise. $Rule_t$ is an indicator variable that equals one if the observation relates to periods during or after 2011. $Exposure_i$ is an indicator variable that assigns one if firm i presented a solvency margin sufficiency during 2009 below the median, and zero otherwise. All specifications include clustered standard errors at the firm level, as well as firm-level controls interacted with pre and post trends relative to the first year of the year of the capital requirement rule (*i.e*, 2011). Standard errors are presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable: log(1 +$Customers_{i,s,t}$)			
	(1)	(2)	(3)	(4)
Exposure	1.237***	1.236***	-	-
	(0.140)	(0.140)		
Rule	-0.554	-	-	-
	(0.861)			
Exposure × *Rule*	-0.248^{***}	-0.242^{**}	-0.173^{**}	-0.173^{**}
	(0.094)	(0.097)	(0.085)	(0.086)
Firm Controls	✓	✓	✓	✓
Firm Controls × Post	✓	✓	✓	✓
Year FE	No	✓	✓	✓
State FE	No	No	✓	No
Firm FE	No	No	✓	No
State-Time FE	No	No	No	✓
Cluster	Firm	Firm	Firm	Firm
Observations	681	681	681	681
R^2	0.724	0.730	0.964	0.965
Note:		*p<0.1; **p<0.05; ***p<0.01		

Table 6: OLS - Growth in Customer Base and Solvency Margin Sufficiency - Only for state-year pairs with negative employment flows and excluding health-cooperatives.

This table presents the estimation results of the *differences-in-differences* specification, presented in Equation (6) and described in Section 6, for the subsample of healthcare firms excluding health-cooperatives and state-year pairs with $Employment_{s,t} \leq 0$. The dependent variable, log(1+$Customers_{i,s,t}$), is the natural logarithm of (1+$Customers_{i,s,t}$), where $Customers_{i,s,t}$ is the number of customers that a health cooperative i has in state s during year t, and zero otherwise. $Rule_t$ is an indicator variable that equals one if the observation relates to periods during or after 2011. $Exposure_i$ is an indicator variable that assigns one if firm i presented a solvency margin sufficiency during 2009 below the median, and zero otherwise. All specifications include clustered standard errors at the firm level, as well as firm-level controls interacted with pre and post trends relative to the first year of the year of the capital requirement rule (*i.e,* 2011). Standard errors are presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable: $\log(1 + Customers_{i,s,t})$			
	(1)	(2)	(3)	(4)
Exposure	1.082***	1.063***	-	-
	(0.319)	(0.333)		
Rule	−3.417	-	-	-
	(2.729)			
Exposure × *Rule*	−0.234	−0.240	−0.349*	−0.292
	(0.276)	(0.300)	(0.182)	(0.224)
Firm Controls	✓	✓	✓	✓
Firm Controls × Post	✓	✓	✓	✓
Year FE	No	✓	✓	✓
State FE	No	No	✓	No
Firm FE	No	No	✓	No
State-Time FE	No	No	No	✓
Cluster	Firm	Firm	Firm	Firm
Observations	874	874	874	874
R^2	0.691	0.697	0.964	0.971
Note:		*p<0.1; **p<0.05; ***p<0.01		

Table 7: OLS - Growth in Customer Base and Solvency Margin Sufficiency - Additional controls

This table presents the estimation results of the *differences-in-differences* specification, presented in Equation (6) and described in Section 6, for the whole sample of healthcare firms across states. The dependent variable, log(1+$Customers_{i,s,t}$), is the natural logarithm of (1+$Customers_{i,s,t}$), where $Customers_{i,s,t}$ is the number of customers that a health cooperative i has in state s during year t, and zero otherwise. $Rule_t$ is an indicator variable that equals one if the observation relates to periods during or after 2011. $Exposure_i$ is an indicator variable that assigns one if firm i presented a solvency margin sufficiency during 2009 below the median, and zero otherwise. All specifications include clustered standard errors at the firm level, as well as firm-level controls interacted with pre and post trends relative to the first year of the year of the capital requirement rule (*i.e,* 2011). Standard errors are presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable: $\log(1+Customers_{i,s,t})$			
	(1)	(2)	(3)	(4)
Exposure	0.726^{***}	0.734^{***}	-	-
	(0.111)	(0.110)		
Rule	-1.299^{***}	-	-	-
	(0.484)			
Exposure × *Rule*	-0.183^{***}	-0.205^{***}	-0.120^{**}	-0.108^{**}
	(0.061)	(0.062)	(0.050)	(0.050)
Ext. Firm Controls	✓	✓	✓	✓
Ext. Firm Controls × Post	✓	✓	✓	✓
Year FE	No	✓	✓	✓
State FE	No	No	✓	No
Firm FE	No	No	✓	No
State-Time FE	No	No	No	✓
Cluster	Firm	Firm	Firm	Firm
Observations	3,067	3,067	3,067	3,067
R^2	0.715	0.728	0.963	0.966
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 8: Second-order effects on firms' outcomes - *ex-post* Financial Fundamentals

This table presents the estimation results of the *ex-post* effects specification, presented in Equation (9) and described in Section 7, for each of the firms' financial fundamentals. log(Assets) is the natural logarithm of firms' total assets, while log(Financial Assets) and log(Op. Assets) are the firms' short-term financial securities (financial instruments, cash, and cash equivalents) and assets related to healthcare operations, respectively. log(Operational Revenue) is the natural logarithm of firms' revenue that is accrued to healthcare operations (excludes any gains from financial from financial assets). Hazard Ratio is defined as the firms' gross margin (cost of healthcare assistance for firms' customers divided by the total revenue from customers' healthcare installments). EBITDA is defined as earnings before interest, taxes, depreciation and amortization. *Exposure* and *Rule* are defined as in previous tables. All specifications include clustered standard errors at the firm level, presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable:					
	Δ Assets	Δ Fin. Assets	Δ Op. Assets	Δ Op. Revenue	Hazard Ratio	Δ EBITDA
	(1)	(2)	(3)	(4)	(5)	(6)
Exposure	0.056***	0.249*	0.084	0.586***	0.063***	−0.016
	(0.019)	(0.127)	(0.060)	(0.057)	(0.014)	(0.148)
Rule						
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exposure × *Rule*	−0.032	0.035	−0.132***	−0.242***	−0.027**	−0.061
	(0.020)	(0.100)	(0.042)	(0.049)	(0.012)	(0.153)
Full Firm Controls	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
State-Year FE	✓	✓	✓	✓	✓	✓
Cluster	Firm	Firm	Firm	Firm	Firm	Firm
Observations	2,616	2,616	2,616	2,616	2,614	1,610
R^2	0.984	0.751	0.895	0.912	0.156	0.570
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 9: Second-order effects on firms' *ex-post* outcomes - Delisting Motivations

This table presents the estimation results of the *ex-post* effects specification, presented in Equation (9) and described in Section 7, in terms of delisting status. *Delisted* is a dummy variable that assigns 1 (one) if firm *i* has been delisted throughout the sample period, and zero otherwise. *RAE*, *Cancellation*, *Incorporation*, and *Liquidation* are dummy variables that assign one if the delisting motivation is due its specific delisting motivation, and zero otherwise. Columns 2-5 use a subsample of firms conditional on $Delisted = 1$. *Exposure* and *Rule* are defined as in previous tables. All specifications include clustered standard errors at the firm level, presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable:				
	Delisted	*RAG*	*Cancellation*	*Incorporation*	*Liquidation*
	(1)	(2)	(3)	(4)	(5)
Exposure	−0.060	−0.459***	−0.055	0.023	0.491***
	(0.050)	(0.134)	(0.121)	(0.105)	(0.123)
Rule					
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Exposure × *Rule*	0.014	0.083*	−0.043	0.118**	−0.159***
	(0.025)	(0.049)	(0.062)	(0.046)	(0.056)
Full Firm Controls	✓	✓	✓	✓	✓
State-Year FE	✓	✓	✓	✓	✓
Cluster	Firm	Firm	Firm	Firm	Firm
Observations	2,939	371	371	371	371
R^2	0.136	0.400	0.284	0.437	0.402

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 10: Second-order effects on firms' *ex-post* outcomes - pricing effects

This table presents the estimation results of the *ex-post* pricing outcomes specification, presented in Equation (10) and described in Section 7. $\log{(Price)}_{i,a,t+1}$ is the natural logarithm of the refence price calculated for firm i, age bracket a in period $t+1$. $Exposure$ and $Rule$ are defined as in previous tables. All specifications include clustered standard errors at the firm, state, and age bracket level, presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable: $\log(Price_{i,a,t+1})$
$Exposure \times Rule$	-0.058^{***}
	(0.017)
Full Firm Controls	✓
Firm FE	✓
State-Year FE	✓
Cluster	Firm + UF + Age Bracket
Observations	20,107
R^2	0.831
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 11: Second-order effects on firms' *ex-post* outcomes - Pricing effects, varying on Age Brackets

This table presents the estimation results of the IV specification, presented in Equation (10) and described in Section 7, varying on age bracket. Column 1-10 denote single regressions for each of the age brackets available. $\log{(Price)}_{i,t+1}$ is the natural logarithm of the refence price calculated for firm i in period $t+1$. *Exposure* and *Rule* are defined as in previous tables. All specifications include clustered standard errors at the firm and state level, presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable:									
	[0,18]	[19,23]	[24,28]	[29,33]	[34,38]	[39,43]	[44,48]	[49,53]	[54,58]	[59,∞)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exposure × *Rule*	-0.064^{***}	-0.064^{***}	-0.065^{***}	-0.060^{***}	-0.057^{***}	-0.054^{***}	-0.050^{***}	-0.037^{**}	-0.039^{*}	-0.047^{**}
	(0.021)	(0.022)	(0.019)	(0.019)	(0.019)	(0.018)	(0.016)	(0.017)	(0.021)	(0.017)
Full Firm Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
State-Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cluster	Firm × UF	Firm × UF	Firm × UF	Firm × UF	Firm × UF	Firm × UF	Firm × UF	Firm × UF	Firm × UF	Firm × UF
Observations	2,056	2,056	2,056	2,056	2,056	2,056	2,056	2,056	2,056	2,056
R^2	0.731	0.716	0.727	0.712	0.719	0.714	0.715	0.726	0.735	0.729
Note:										*p<0.1; **p<0.05; ***p<0.01

Table 12: OLS - State-level Market Concentration and Solvency Margin Rule

This table presents the estimation results of the *DDD* specification, presented in Equation (10) and described in Section 8. $HHI_{s,t}$ is defined as the *Herfindhal-Hirschman* index of market concentration at the state level. All specifications include clustered standard errors at the state level, as well as state and year fixed effects. Standard errors are presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	$\log(1{+}HHI_{s,t})$		
	(1)	(2)	(3)
$EmpFlow$	-	-	0.012
			(0.008)
$Exposure$	-0.102^{**}	-0.116^{**}	-0.128^{**}
	(0.049)	(0.053)	(0.051)
$Rule \times EmpFlow$	-	-	-0.004
			(0.008)
$Rule \times Exposure$	-	0.018	0.044^{**}
		(0.020)	(0.016)
$EmpFlow \times Exposure$	-	-	-0.154^{**}
			(0.072)
$Rule \times EmpFlow \times Exposure$	-	-	0.214^{**}
			(0.078)
Year FE	✓	✓	✓
State FE	✓	✓	✓
Cluster	State	State	State
Observations	249	249	246
R^2	0.968	0.968	0.968
Note:	$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$		

Table 13: State-level Health Outcomes according to Exposure to Solvency Margin

This table presents the estimation results of the *DDD* specification, presented in Equation (10) and described in Section 8. log(Internations) and log(Outpatients) is the natural logarithm of internations and medical procedures held at the Brazilian Public Healthcare Service, respectively. log(Complaints) is the natural logarithm of all complaints filled by private healthcare customers residing in a given state and year. All specifications include clustered standard errors at the state level, as well as state and year fixed effects. Standard errors are presented in parenthesis. *, **, and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

	Dependent Variable:		
	log(*Internations*)	log(*Outpatients*)	log(*Complaints*)
	(1)	(2)	(3)
EmpFlow	−0.018	−0.058*	0.214*
	(0.027)	(0.028)	(0.127)
Exposure	−0.066	−0.029	0.276
	(0.046)	(0.115)	(0.227)
Rule × *EmpFlow*	−0.005	0.089**	−0.216
	(0.020)	(0.034)	(0.175)
Rule × *Exposure*	0.004	−0.036	−0.184
	(0.032)	(0.067)	(0.223)
EmpFlow × *Exposure*	0.160	0.279	−0.934
	(0.132)	(0.329)	(0.798)
Rule × *EmpFlow* × *Exposure*	−0.180	−0.226	0.570
	(0.151)	(0.331)	(0.996)
Year FE	✓	✓	✓
State FE	✓	✓	✓
Cluster	State	State	State
Observations	237	246	246
R^2	0.994	0.982	0.958
Note:			*p<0.1; **p<0.05; ***p<0.01