



University of Brasilia



Economics and Politics Research Group

A CNPq-Brazil Research Group

<http://www.EconPolRG.wordpress.com>

Research Center on Economics and Finance–CIEF
Research Center on Market Regulation–CERME
Research Laboratory on Political Behavior, Institutions
and Public Policy–LAPCIPP
Master's Program in Public Economics–MESP

Vertical Integration on Health Care Markets: Evidence from Brazil

Tainá Leandro and José Guilherme de Lara Resende

University of Brasilia

**Economics and Politics Working Paper 20/2013
July 31, 2013**

**Economics and Politics Research Group
CERME-CIEF-LAPCIPP-MESP Working Paper Series
ISBN:**

Vertical Integration on Health Care Markets: Evidence from Brazil

Tainá Leandro* José Guilherme de Lara Resende†

July 8, 2013

Abstract

This paper investigates the effects of vertical integration among health care insurance companies and hospitals in the Brazilian health care market. We find that vertical integration between an insurance firm and a hospital decreases the total costs of health care plans. This result indicates that vertical integration enhances efficiency, a positive outcome on the market. Moreover, we find that this type of vertical integration reduces mainly medical costs, which is evidence that it eliminates the agency problem between hospital and insurance companies. That is, when an insurance firm integrates to a hospital, it is able to cut unnecessary procedures and to reduce the overall medical expenditure.

Keywords: vertical integration, health care, hospitals, health insurance.

JEL classification: I11, I18, L42.

*Coordinator of the Division of Antitrust Analysis 1, Administrative Council for Economic Defense – CADE, Brasília, DF. E-mail: tainaleandro74@gmail.com

†Universidade de Brasília, campus universitário Darcy Ribeiro, caixa postal 04587, Brasília, DF. E-mail: jglresende@unb.br

1 Introduction

This paper investigates the effects of vertical integration among hospitals and health care insurance companies. We find that vertical integration between an insurance firm and a hospital decreases total costs. This result indicates that vertical integration has a positive effect on the market. Moreover, we find that this type of vertical integration reduces mainly medical costs, which is evidence that it eliminates an agency problem between hospital and insurance companies. That is, when an insurance firm integrates to a hospital, it is able to cut unnecessary procedures and to reduce the overall medical expenditure.

We built a database for the Unimed System in Brazil to investigate the effect of vertical integration between hospitals and insurance firms. The Unimed System, further described in section 3, is a decentralized health care provider that is present in all states of Brazil and representative of the overall Brazilian private health care system. We show that the Unimed System is an excellent case study and the database built permits to investigate the effects of the vertical integration between hospitals and insurance plans on the cost of health care.

We find that the Unimed insurance firms vertically integrated with health care providers present lower total costs. Furthermore, when the total costs are unbundled in three types, medical, administrative and commercial, the integration between an insurer and a hospital has a positive effect of reducing medical costs. Remarkably, the effect on administrative and commercial costs is negligible. This result is surprising, since we expected that the effect of integration would be more prominent decreasing administrative costs, due to synergies and the possibility of trimming cost by joining and reducing departments such as sales, research, marketing, etc.

We argue that the effect of vertical integration on medical costs is due to an agency problem between health care providers and health care plans: hospitals or physicians might inflate costs and overdo exams and procedures in order to receive more (Culyer and Newhouse, 2000; Gaynor and Vogt, 2000; Jacobs and Rapoport, 2003). The strategy of vertical integration is a way to eliminate this inefficiency, since it aligns the incentives between health care providers and insurers (Cuellar and Gertler, 2005).

Our empirical analysis does not assess the full effect of vertical integration in the health care market, because it was not possible to measure the impact of this strategy in the final prices faced by consumers of health care plans. Nevertheless, the study shows the existence of efficiency gains for Unimeds that have their own establishments to provide health services to its beneficiaries.

The remainder of the paper is organized as follows. Section 2 summarizes the economic theory about vertical integration and health care. Section 3 reviews the health care market in Brazil and the Unimed System. Section 4 presents the analysis and the estimations performed. Section 5 discusses the results. Section 6 concludes.

2 Vertical Integration and Health Care

Economic theory states that vertical integration has two main possible consequences: anticompetitive effects or efficiency gains. As a result of a vertical integration, there might have an increase in the market power of the integrated firm, causing anticompetitive effects, such as closing the market to rival firms, increasing barriers to entry for new competitors, or even simplifying the formation of horizontal coordination and collusion between rivals (Cuellar and Gertler, 2005; Gal-Or, 1999; Ordober et al., 1990; Bijlsma et al., 2008). These effects diminish the total well-being and would be reflected in higher prices or lower quality of final goods to consumers.

However, vertical integration also has potential positive effects on the market, reducing transaction costs, enabling better coordination of services within the integrated company, generating economies of scope, reducing problems related to the vertical externalities, aligning incentives and reducing agency problems in markets with asymmetric information, such as the health insurance market (Bork, 1993; Coase, 1937; Bijlsma et al., 2008; Gaynor, 2006; Klein et al., 1978; Williamson, 1983, 1989; Riordan and Salop, 1995; Posner, 1976). These effects represent gains in efficiency and result in lower costs in producing goods and services and have the potential to increase the economic well-being.

Since the theory concerning the impact of vertical integration is ambiguous, empirical analyzes is crucial to evaluate the impact of these integrations and their desirability in a specific market. Nevertheless, the empirical research of vertical integration in the health care market is recent in Brazil, and there are no studies concerning, specifically, integration between health insurance firms and health care providers.

There are some studies, as Ciliberto and Dranove (2006) and Cuellar and Gertler (2005), that investigate the overall effect of integration between hospitals and physicians. Using data from Arizona, Florida, and Wisconsin between 1994 and 1998, Cuellar and Gertler (2005) results indicate that there are anticompetitive effects in this type of vertical integration, which was associated with an increase in hospital prices, especially when there was an exclusive relationship between physicians and hospitals in less competitive markets.

Ciliberto and Dranove (2006) analyzed if vertical integration between hospitals and physicians has an impact in hospital pricing, using information from California from 1994 to 2001. They found that neither integration nor disintegration had a relevant impact in prices. Instead, their results point to lower prices in vertical integrated hospitals in rural areas¹.

Even though neither economic theory nor empirical analyzes is able to give a clear response regarding the effects of vertical integration on the health insurance market, vertical integration would increase the market power of the integrated firm, specially in cases that companies hold substantial market share and in industries with difficulties to import substitutes and with high barriers to entry (Gaynor, 2006). In the next section, we argue that the health insurance market presents those characteristics, which makes the analysis of the

¹The sample of such hospitals was small, so these effects are imprecisely estimated.

vertical integration effects on this market even more relevant.

3 The Legal Framework of Health Care in Brazil

Public and private health care coexist in Brazil. The Brazilian Federal Constitution states that health is a right to all individuals and a duty of the state to provide it, guaranteeing the access to all Brazilian citizens². At the same time, it also sets the right for private business to economically operate in the health sector. Therefore, both the public and the private sector provide and fund health goods and services.

Public health services are offered through the Unified Health System (Sistema Único de Saúde – SUS), which by law has to offer comprehensive coverage and universal access to the entire population. The services are paid directly by public funds and thus access to these services represents no additional or particular financial burden on patients. Theoretically, all Brazilian citizens are covered by this national public health care system. However, long waiting periods and quality issues for services provided by SUS foster a private health care sector, which includes health insurance companies and out of the pocket payments. The private sector (health insurance plus out of the pocket payments) is responsible for 52.6% of total health expenditures in 2006 in Brazil (OECD, 2008 apud Cechin (2008)). It is estimated that 25% of the Brazilian population is covered by private health care insurance, which corresponds to 27% of the total health expenditures in 2006 (OECD, 2008 apud Cechin (2008))³. Therefore, private health insurance plays a key role in the Brazilian health care sector.

The legal framework for the private health sector in Brazil, including health insurance companies, is recent and mainly set forth by laws n. 9.656, from 1998 and n. 9.961, from 2000, which introduced limits and requirements for health insurers to operate in this market (Andrade et al., 2000). Law 9.961 created the National Agency of Supplemental Health (Agência Nacional de Saúde Suplementar – ANS), responsible for regulating the private health care market.

These laws state regulatory safeguards for beneficiaries of health care plans, defining a list of mandatory procedures for contracts, which is revised almost every year, in order to include new treatments and diagnoses. Furthermore, ANS sets boundaries on cream-skimming strategies, prohibiting insurance companies to reject clients on the base of age or deny coverage to patients with pre-existing disorders.

This regulatory framework also imposes restrictions on the insurers' strategy to define the pricing of health care plans, adopting a system similar to community rating, where the premium is calculated according to the aggregate risk of the portfolio of firms (Santos, 2008). In addition, the legal framework allows price discrimination only under a single criterion: the age difference, within at most 10 categories: 0-18 years, 19-23 years, 24-28 years, 29-33 years, 34-38 years, 39-43 years, 44-48 years, 49-53 years, 54-59 years, 59 years or more. Moreover,

²Federal Constitution, art. 196-200.

³The rest of the 52.6%, 25.6%, corresponds to out of the pocket payments.

ANS defines maximum periods of time in which health plans are able to deny coverage on some events and prohibits them to set limits to coverage. Finally, ANS also monitors the financial viability of health care insurance firms, requiring economic and financial guarantees, such as minimum capital, provisions, as well as solvency margins (Andrade et al., 2000).

This recent regulatory framework had a significant impact on the Brazilian private health insurance market. By defining a mandatory list of minimum procedures, by limiting cream skimming and price discrimination, and by imposing requirements and financial guarantees, it significantly raised the cost of health insurance companies and drove smaller companies out of the market, increasing concentration (Vianna, 2003). In ten years, the number of firms active in the health insurance market decreased 30%, from 2,639 companies in 1999 to 1,697 in 2009.

Almeida (2009) reports that between 2003 and 2006, about 75% of municipalities had a Herfindahl-Hirschman Index (HHI) over 1800 points, in respect to the number of beneficiaries. This value is taken as a threshold by antitrust authorities in Brazil (SEAE & SDE, 2001⁴) and in the USA (FTC & DoJ, 1984⁵) as a necessary condition to assume the existence of market power.

In this sense, these new laws reinforced a tendency towards increasing the market concentration and the barriers to entry for new competitors. These characteristics might enable the exercise of market power by a company holding a dominant position, increasing the possibility of negative effects of vertical integration.

4 The Empirical Procedure

Studies about mergers and acquisitions typically focus in measuring the impact of the merger on two dimensions 1) the final price paid by the consumer and/or 2) the firms' costs. The first is related to non-competitive effects and the second, to gains of efficiency regarding reduction of costs and gains of scope. Our analysis concerns the second aspect⁶, which, although does not assess the entire effect of vertical integration on consumers, is able to verify if this strategy has pro-competitive effects that could be passed on to consumers.

Therefore, we analyze the effect of vertical integration between health plans and hospitals on the costs of the health insurance firms. If we observe that this type of integration reduces costs, than there is evidence that it provides gains of efficiency.

⁴Guia para análise econômica de atos de concentração horizontal. Secretaria de Acompanhamento Econômico (SEAE) do Ministério da Fazenda e Secretaria de Direito Econômico (SDE) do Ministério da Justiça. Available at: http://www.seae.fazenda.gov.br/central_documentos/guias.

⁵Non-Horizontal Merger Guidelines. Federal Trade Commission (FTC) - US Department of Justice. 1884. Available at: <http://www.justice.gov/atr/public/guidelines/2614.htm>.

⁶To be able to estimate the effects of vertical integration on health plans prices, it would be necessary to include variables regarding the market power of health insurance companies, to control for market concentration. Unfortunately, the information concerning the number of health plans per health insurance and municipality is was not available.

We first further describe the Unimed System and the data used. Then we present the estimation and the results. We run three different estimations: fixed effects, random effects and first differences.

4.1 The Unimed System

The empirical analysis conducted in this paper uses information related to the health plan companies within the Unimed brand. These companies, denominated by ANS as medical cooperatives, provide health insurance and require a contractually pre-determined payment. Unimed cooperatives are part of the overall Unimed System, organized as follows: doctors from a given municipality or municipalities are affiliated to an individual Unimed, which is autonomous. These units are linked to a state or regional federation, which has only a coordination role and does not commercialize health plans. Such federations are part of the National Confederation of Cooperatives, called Unimed Brazil, which heads the Unimed System and has as mission to: “represent, integrate and direct the activities of cooperatives and companies in the medical system, supporting, strengthening and consolidating the brand Unimed⁷”.

Although a singular Unimed unit has a high degree of administrative and managerial independence, some strategic decisions are centralized in Unimed Brazil. This central figure authorizes medical cooperatives to use the Unimed brand. It also decides about the creation of new cooperatives and the permanence of any cooperative in the system, by performing a geographic segmentation to minimize overlapping market areas among cooperatives. Thus, singular Unimed units are placed in different geographic markets and do not compete with each other for consumers.

The main reason for using data only from Unimed companies was their availability. There are two main databases that presents information about the private health care sector in Brazil: the ANS database⁸, with data regarding the health care insurance market; and the Brazil National Registry of Medical Facilities (CNES) database⁹, with information concerning health care providers. Neither collects nor processes information about vertical integration between insurers and providers in the Brazilian health care market. So, in order to collect data about health care insurers that have their own units to provide medical and hospital services, it is necessary to cross these two databases, which was not possible for all health insurance firms¹⁰.

However, it was possible to raise information about vertical integration in the Unimed System because, once all units vertically integrated with a Unimed health plan adopt this

⁷Source: http://www.unimed.com.br/pct/index.jsp?cd_canal=49146&cd_secao=49105, accessed in July 18th, 2012.

⁸<http://www.ans.gov.br/materiais-para-pesquisas/perfil-do-setor/dados-e-indicadores-do-setor>

⁹<http://cnes.datasus.gov.br>.

¹⁰We tried to analyze vertical integration in the overall Brazilian health care market, by checking the merger review data available in the Administrative Council for Economic Defense database (<http://www.cade.gov.br/Default.aspx?e142c252a3798dad8>). However, this database is incomplete, with the majority of vertical integrations not reported.

brand name, we could trace in the CNES database the hospitals and emergency rooms that belonged to a Unimed Cooperative. Thus, we assembled a new database that includes all health facilities belonging to Unimed insurers. Using the information related to the brand name of each health facility, it was also possible to identify which Unimed firms were vertically integrated. Therefore, when we searched for all health insurance companies with the Unimed brand in the ANS database, we were able to find which ones did not own a hospital and which ones were vertically integrated.

Although the use of data from Unimed cooperatives is restrictive when compared to including all health care companies registered in the ANS database, the great representation of the Unimeds in the Brazilian market mitigates this problem. The Unimed system is present in 83%¹¹ of the Brazilian municipalities, offering health insurance for more than 16 million consumers¹².

Also, according to ANS, in 2009, there were 343 (three hundred and forty-three) health care insurance firms in the form of medical cooperatives, of which 328 (three hundred and twenty-eight) were organized under the brand Unimed¹³. Therefore, health care insurance firms under the Unimed brand account for more than 90% of private companies listed as medical cooperatives.

Moreover, the geographical distribution of Unimed health insurance firms in Brazil resembles the distribution of all health insurance firms registered in ANS. The southeast region has 52% of the total of Unimed firms, the south has 19%, the northeast has 17%, the midwest has 9% and the north region has 3% of the total. For the overall number of health care insurance firms registered in ANS, the numbers are: 60% in the southeast, 16% in the south, 14% in the northeast, 7% in the midwest and 3% in the north.

Furthermore, according to ANS, in 2009, medical cooperatives accounted for 57,42% of all the health care insurers that provide medical-hospital services. Regarding revenues from the sale of health care insurance, medical cooperatives stand out with the highest percentage of the health insurance market: 36% in 2008¹⁴. This indicates that the Unimed System has a significant market share in Brazil, and resembles the overall private health care market in Brazil.

An important advantage of our empirical analysis using data only from Unimed firms is related to the fact that all insurance firms in our database share the same brand. The

¹¹4,623 cities.

¹²Information obtained in the Unimed site: <http://www.centralnacionalunimed.com.br/>. Access in march 09, 2010.

¹³Source: Agência Nacional de Saúde Suplementar, ANS. Caderno de Informação em Saúde Suplementar – Setembro de 2009. <http://www.ans.gov.br/>

¹⁴Besides medical cooperatives, ANS divides the market in other four prepaid medical organizations categories. a) health insurance companies, which are similar to indemnity plans, although they must count on physicians and hospital nets. The health insurance reimburses the health procedures received by its consumers; b) medicine groups (prepaid group practice), which can manage health plans and deliver medical services; c) companies that offer health plans, in general non-profit organizations that do not commercialize their plans, offering it only for their employees, d) philanthropic organizations, health plans provided by non-profit hospitals organizations. These other four categories represents 64% of the market in revenue

brand is a proxy for quality of the health care provider's network and gives a valuable competitive edge in the market of supplementary health care, mainly due to asymmetries of information between physicians and consumers (Almeida, 2009) Thus, using only data from Unimed firms controls for quality in the empirical analysis performed.

Other important benefit regards the fact that, due to Unimed System characteristics, the data available allows us to properly estimate the effects of vertical integration in the costs of these health insurances companies. The health services and health insurance relevant markets are defined by Antitrust Authority in Brazil usually as local. However, the health insurance accounting data in the ANS database are available only consolidated, aggregating the revenue and costs of all health plans offered by the company, regardless of their geographical location. Thus, the effects of a vertical integration with a given hospital or health care provider cannot be measured within a nationwide health insurance firm, since the financial information is not divided by region. Therefore, a reduction of costs in a certain region may be offset by a cost increase in another region. The Unimed data does not present this problem. Although they form the Unimed System, which operates nationwide, each firm has full autonomy and acts as an individual health care insurer, reporting to ANS its own accounting data. Furthermore, each individual Unimed firm commercializes health insurance locally, in a group of municipalities. These features allow the measurement of the effects of vertical integration on the costs of each Unimed firm, because the relevant geographic market for health plans and health services, in Unimed cases, coincides with the data available.

4.2 Data

We use an annual panel data from 2003 to 2008. The data is segmented by health care provider, with all providers from the brand Unimed. The dependent variable is the cost of the health care insurance provider, which was deflated using an index provided by ANS. We control for size, using revenues, and we use year dummies to control for shocks and tendencies that affect the cost of all providers. We also use a dummy related to the existence of a hospital or an ER associated to the plan, which measures the effect of vertical integration on costs. Our main goal is to estimate this parameter.

The vertical integration variable was built using data from Brazil National Registry of Medical Facilities (CNES), which contains information about all health care facilities in Brazil. As discussed in section 4.1 above, Unimed insurers' own health care providers are always named as Unimed facilities. Thus, it was possible to raise all establishments belonging to each of the Unimed health plans by searching for the ones with the same corporative name on the CNES database. Coupling the CNES and the ANS databases, it was possible to identify which Unimed were vertically integrated and which were not.

We searched for information on the electronic pages of all Unimed health insurance companies who owned hospitals or emergency rooms to identify the date when each property was acquired or opened. If it was not possible to find the date in this way, we contacted directly by telephone or electronic mail the Unimed company.

The information collected shows that from a total of 328 firms, 166 (one hundred and sixty six) have at least one type of facility to provide its own services, from clinics to general hospitals. There are a total of 279 (two hundred seventy-nine) of Unimed's health facilities, with their types classified in Table 1.

Table 1: Number of Unimed Providers, by Type of Establishment

Type of Provider	Quantity
Clinics	63
Isolated clinics	27
Hospitals	94
Emergency rooms	37
Laboratories/diagnostic units	58

Source: Cadastro Nacional de Estabelecimento de Saúde (CNES)

Over the four years analyzed, many Unimed insurers acquired health care facilities. Of the 166 vertically integrated firms, 67 have more than one health facility, as hospitals, clinics and laboratories. In particular, 11 Unimeds have 3 own establishments, 7 Unimeds have 4, and 8 Unimeds have more than 6 establishments.

Although we have identified several types of vertical integration between health insurers and medical services providers, our empirical analysis investigates only the effects of vertical integration between health plans and hospitals and emergency rooms. We assume that vertical integration between health insurance with other types of health facilities, besides hospitals and emergency rooms, has a small probability of resulting in anticompetitive effects on health plans market. These are easily contestable markets, since the entry of new competitors in the provision of services through laboratories, clinics, and diagnostic units is less costly and less regulated. The possibility of entry of new competitors is a factor that inhibits the exercise of market power.

In this sense, the analysis focus on the effects on health insurance's costs regarding the types of vertical integration that potentially brings major concern to antitrust authorities: health insurers and hospitals or ERs (SEAE & SDE, 2001; FTC & DoJ, 1997).

This pattern of integration is recent in the Brazilian health care market (Albuquerque, 2006). This is observed in the data. Nearly 95% of Unimed hospitals and emergency rooms were built or acquired during the 1990s. By the year 1989, only 2 general hospitals were owned by Unimed. Between 1990 and 1999, 32 general hospitals were acquired by Unimeds. Between 2000 and 2009, that number grew to 81 general hospitals, with the acquisition of 49 units. There is a similar pattern with respect to emergency rooms. In 1989, only one emergency room was owned by Unimeds. Between 1990 and 1999, 9 emergency rooms were acquired by Unimeds, representing about 24% of all emergency room belonging to Unimeds. Between 2000 and 2009, that number grew to 37, with the acquisition of over 26 ERs.

Finally, despite the fact that it is possible that the same operator acquires more than one facility, the Vertical Integration variable reflects only the period in which the firm acquired the first unit and became fully integrated.

The dependent variables of our empirical study are the costs that Unimed insurance firms incur to offer medical services to consumers. Information related to this variable is provided by ANS, which publishes the balance sheet of the health care insurance companies registered with the Agency. This information is published by ANS in Annual Reports, related to economic and financial aspects of health plans¹⁵.

ANS data has three categories regarding costs of the health plan firms: i) medical costs: the expenditures related to medical services, such as hospitalization, medical supplies, tests, surgeries, appointments; ii) marketing costs: expenditures related to the commercialization of health plans; and iii) administrative costs: expenditures related to salaries of non-medical staff and taxes.

Thus we have the following costs' variables, constructed dividing the respective cost by the number of consumers each Unimed has:

- i) *Average Medical Expenditure (AME)*: average expenditures related to hospital and medical services.
- ii) *Average Comercial Exenditure (ACE)*: average expenditures related to selling health care insurance plans.
- iii) *Average Administrative Expenditure (AAE)*: average expenditures related to administrative costs, wages, taxes.
- iv) *Average Total Expenditure (ATE)*: the sum of *AME*, *ACE* and *AAE*. It is the average total cost that the company incurs when operating.

Medical expenditures comprise 77.85% of total cost, administrative expenditures, 20.89%, and commercial expenditures, 1.25%.

Finally, we use total revenue (*TR*) from the commercialization of health care insurance plans, available at the ANS Annual Reports, as a control variable for the size of the Unimed company. Thus, we control for potential gains of scale in the health insurance market, which may affect the firm costs. Besides that, if we did not control for size and the majority firms vertical integrate were large enough¹⁶, then, we could misspecified gains of scale as efficiency gains resulting from vertical integration of providers by health plans and providers of medical services.

Since our primarily interest concerns the estimation of marginal effects on percentage basis, we use the logarithm of the variables *AME*, *ACE*, *AAE*, *ATE* and *TR* in our empirical procedure.

¹⁵Source: <http://www.ans.gov.br/materiais-para-pesquisas/materiais-por-tipo-de-publicacao/periodicos>

¹⁶For Brazilian legal framework, health insurances is considered large if have more than 100,000 costumers, medium-sized if have between 20 to 100 thousand and small if has less than 20,000 beneficiaries)

4.3 The Estimation

We perform two main estimations. The first has the average total cost as dependent variable and tests if vertical integration reduces the total cost of health insurance companies. The second measures the effect on each type of cost, medical, administrative and commercial, in order to investigate what type of cost vertical integration impacts more.

We employed data disaggregated by Unimed health plan companies between the years 2003 to 2008 to build a panel, in which the number of periods is equal to six and the observations in the cross-section are three hundred twenty and six (326) health insurance companies. We estimate three models: random effects, fixed effects and first differences.

The main interest of the first empirical analysis is to assess the impact of vertical integration in the total cost of Unimed health care insurers, in order to measure potential efficiency gains arising from vertical integration. The equation estimated is:

$$\ln(ATE_{it}) = \alpha_1 + \alpha_2 VI_{it} + \alpha_3 \ln(TR_{it}) + \alpha_4 D_{2004} + \alpha_5 D_{2005} + \alpha_6 D_{2006} + \alpha_7 D_{2007} + \alpha_8 D_{2008} + u_{it},$$

where:

- ATE_{it} is the average total expenditure for company i in the year t , which is the sum of medical, commercial and administrative expenditures;
- VI_{it} is a dummy variable that is 1 if Unimed insurance i has a hospital or an ER, 0 otherwise, at year t ;
- D_{2004} , D_{2005} , D_{2006} , D_{2007} , D_{2008} are year dummies;
- TR_{it} is company i total revenue at year t .

If the vertical integration dummy is significantly higher than 0, we have evidence that vertical integration increases costs. If it is significantly lower than 0, then vertical integration decreases costs. In the next subsection we present the results of our estimations.

4.4 Results

4.4.1 Total Costs

Table 2 below reports the results for the random effects, fixed effects and first differences estimations. The Total Revenue (TR) variable is positive and statistically significant at 5% for all three estimations. Since the econometric model estimated a logarithmic function, this parameter measures the revenue-elasticity of the total cost. Since the value is positive and below 1, the total cost is inelastic with respect to total revenue. Therefore, an increase in revenues results in a less-than-proportional increase in costs. This means that providers with large revenues tend to have lower ratio cost/revenue and, consequently, proportionally higher profits. This result is an evidence that there are gains of scale in the market of health insurance.

Second, the year dummies are all significant, with negative sign, according to the fixed and random effects estimations. In the first differences estimation, these dummies are not significant and their sign is positive. Therefore, two of the three estimations indicate that there are factors not associated with total revenue or vertical integration that affected total costs. According to the results using fixed effects, the year dummies indicate a decreasing trend in health insurance costs from 2003 to 2008.

Table 2: Results – Vertical Integration and Total Cost

Variable	Values Estimated		
	Random effect	Fixed Effect	First Differences
Constant	3.0579 (0.000)	-2.7796 (0.000)	-0.0883 (0.003)
Total Revenue	0.2534 (0.000)	0.6121 (0.000)	0.6142 (0.000)
VI Dummy	-0.1751 (0.001)	-0.1268 (0.030)	-0.0114 (0.850)
Year Dummy 2004	-0.0207 (0.630)	-0.0835 (0.043)	n/a n/a
Year Dummy 2005	-0.0478 (0.264)	-0.1924 (0.000)	-0.0515 (0.206)
Year Dummy 2006	-0.0354 (0.414)	-0.2211 (0.000)	-0.0050 (0.206)
Year Dummy 2007	-0.0354 (0.082)	-0.2840 (0.000)	0.2177 (0.826)
Year Dummy 2008	-0.0233 (0.604)	-0.2776 (0.000)	0.1170 (0.361)
N° Obs.	1852	1852	1526

p-values in parentheses

In all three methods, the vertical integration dummy is negative. However, this variable is significant just in the fixed and random effects models. To check which one is best fitted to data, initially we perform a Hausman test, that compares the random or fixed effects model¹⁷. The test indicates that the fixed effect model is more appropriate. Thus, the non-observable individual effect must be correlated to some dependent variable. Table 3 below shows the results for the Hausman test.

In the presence of correlation between individual heterogeneity and the observed variables, both estimators of fixed effects and first-difference are consistent. To verify the most appropriate method, we test for the presence of autocorrelation among the error terms.

¹⁷The Hausman test compares the random and fixed effects estimators. Under the null hypothesis, both of these estimators are consistent, but the random effects is efficient. Under the alternative hypothesis, fixed effects is consistent, whereas the random is not.

Table 3: Hausman Test – Vertical Integration and Total Cost

Variable	F.E. (b)	R.E. (B)	Diff ($b - B$)	S.E. sqrt ($diag(v_b - v_B)$)
Total Revenue	0.6121	0.2534	0.3586	0.0326
VI Dummy	-0.1268	-0.1751	0.4837	0.0336
Year Dummy 2004	-0.0835	-0.0207	-0.6282	0.0058
Year Dummy 2005	-0.1924	-0.0478	-0.1445	0.0122
Year Dummy 2006	-0.2211	-0.0354	-0.1856	0.0162
Year Dummy 2007	-0.2840	-0.7651	-0.2075	0.0186
Year Dummy 2008	-0.2776	-0.0233	-0.2542	0.0229
$Chi2(7) = (b - B)[(v_b - v_B)^{-1}](b - B) = 182.24, \quad prob > chi2 = 0.0000$				

If the analysis of the error term of the fixed effects estimator is such that $u_{it} = \rho u_{i,t-1} + e_{it}$, $\rho = 1$ (test 1) and the analysis of the error term of the first differences estimator is such that $v_i = \rho v_{i,t-1} + e_{it}$, $\rho = 0$ and $v_i = \Delta u_{it}$, (test 2), then the best approach is first differences because u_{it} is a random walk. However, if the error analysis of the term of the fixed effects estimator is such that: $u_{it} = \rho u_{i,t-1} + e_{it}$, $\rho = 1$ (test 1) and the analysis of the error term in first differences is such that $v_i = \rho v_{i,t-1} + e_{it}$, $\rho = 0$ and $v_i = \Delta u_{it}$, (Test 2), then the best approach is fixed effects (Cameron and Trivedi, 2005). Tables 4 and 5 below show the results for these tests.

Test 1 rejects $u_{it} = \rho u_{i,t-1} + e_{it}$, $\rho = 1$ (test 1), therefore, u_{it} is not a random walk. Also, test 2 rejects that $v_i = \rho v_{i,t-1} + e_{it}$, $\rho = 0$. Therefore, fixed effects is the most appropriate method, when compared with the differences method.

Table 4: Test 1, Autocorrelation, $u_{it} = \rho u_{i,t-1} + e_{it}$, $\rho = 1$

$u_{i,t-1}$	Coef.	Std Error	t -value	$p > t $	95% Conf. Interval
u_{it}	0.3845	0.0263	14.58	0.000	[0.3328, 0.4363]
constant	0.0023	0.0107	0.210	0.831	[-0.0188, 0.0234]

Dependent variable: u_{it} ; 1526 obs; $F(1, 1524) = 212.69$; $Prob > F = 0, 0000$; $R^2 = 0, 1225$
Test $u_{it} = 1$: $F(1, 1524) = 544,63$, $prob > F = 0.0000$

The fixed effects estimation shows that the vertical integration dummy is negative and significant. This indicates that Unimed vertically integrated with hospitals or emergency rooms have around 12% lower costs. Therefore, vertical integration provides gains of efficiency in this market.

Table 5: Test 2, Autocorrelation, $v_i = \rho v_{i,t-1} + e_{it}$, $\rho = 0$

$v_{i,t-1}$	Coef.	Std Error	t -value	$p > t $	95% Conf. Interval
v_{it}	-0.1133	0.0286	-3.95	0.000	[-0.1696, -0.571]
constant	0.0081	0.0143	0.570	0.570	[-0.0199, 0.0362]
Dependent variable: v_{it} ; 1202 obs; $F(1, 1200) = 15.63$; $Prob > F = 0,0001$					

4.4.2 Segmented Costs

Now we present the results of the impact of vertical integration in each type of costs: i) Average Medical Expenditure (AME), ii) Average Commercial Expenditure (ACE), iii) Average Administrative Expenditure (AAE). We check if vertical integration has a uniform effect on all three types of expenditures or if there is a type of cost that is more sensitive to it.

Three estimations are performed, similar to the one presented in the previous subsection. Each estimation has a different dependent variable: average medical, commercial and administrative expenditures. The equation estimated is:

$$\ln(AE_{it}) = \alpha_1 + \alpha_2 VI_{it} + \alpha_3 \ln(TR_{it}) + \alpha_4 D_{2004} + \alpha_5 D_{2005} + \alpha_6 D_{2006} + \alpha_7 D_{2007} + \alpha_8 D_{2008} + u_{it},$$

where:

- AE_{it} is the average expenditure for company i in the year t , which can be of one of the three types above;
- VI_{it} is a dummy variable that is 1 if company i has a hospital or an ER, 0 otherwise, at year t ;
- D_{2004} , D_{2005} , D_{2006} , D_{2007} , D_{2008} are year dummies;
- TR_{it} is company i total revenue at year t .

Table 6 displays the results of the estimation where average administrative expenditure is the dependent variable. Our findings show that vertical integration reduces administrative cost, except for the first difference estimation. However, for all estimation methods used, the results are statistically insignificant. Thus, we cannot conclude that vertical integration between providers and insurers results in lower administrative costs for Unimed firms.

Table 7 displays the results of the estimation where average commercial expenditure is the dependent variable. Our findings show that vertical integration reduces commercial cost only for the random effects estimation. Also, for the three estimation methods, the results are statistically insignificant. Thus, we cannot conclude that vertical integration between providers and insurers results in lower administrative costs for Unimed firms.

Table 6: Results – Vertical Integration and Administrative Cost

Variable	Values Estimated		
	Random effect	Fixed Effect	First Differences
Constant	5.2280 (0.000)	-1.1201 (0.311)	-0.2101 (0.001)
Total Revenue	0.0057 (0.848)	0.3974 (0.000)	0.4330 (0.000)
VI Dummy	-0.0559 (0.468)	-0.0394 (0.707)	0.1388 (0.298)
Dummy 2004	-0.2114 (0.005)	-0.2742 (0.000)	n/a n/a
Dummy 2005	0.1230 (0.1230)	-0.0449 (0.554)	0.3921 (0.000)
Dummy 2006	-0.2013 (0.007)	-0.0116 (0.882)	-0.6201 (0.000)
Dummy 2007	-0.2598 (0.001)	-0.0218 (0.788)	0.8710 (0.000)
Dummy 2008	0.3027 (0.000)	-0.0142 (0.868)	1.0706 (0.000)
N° Obs.	1848	1848	1522

p-values in parentheses

Finally, table 8 displays the results of the estimation where the average medical expenses is the dependent variable. Our findings show that vertical integration reduces medical cost for both the random and the fixed effects estimations. Moreover, both methods result in parameters statistically significant. For the first differences method, the variable is positive and statistically insignificant. Thus, it is necessary to check which method is most suitable for the analysis in question.

To ascertain the most appropriate method, between the fixed or random effects models, we proceed as before, using the Hausman test. This test confirms again the fixed effects as the more appropriate method for estimating the effects of vertical integration. To analyze which estimator, fixed effects or first differences, is more appropriate, we examine whether there is autocorrelation in the error term, as we have done before for the case of total cost. Again, we need to use two tests. The first test verifies that the error term u_{it} found in the estimation of fixed effects is a random walk. The second test verifies that the error term $e_{it} = \Delta u_{it}$ has zero autocorrelation. If both tests are rejected, then the most appropriate method is the fixed effects estimator.

The first test rejects $u_{it} = \Delta u_{i,t-1} + e_{it}$, $\rho = 1$, therefore, u_{it} is not a random walk. The second test rejects $v_i = \rho v_{i,t-1} + e_{it}$, $\rho = 0$. These results point that the fixed effects is the most appropriate method also for this estimation, which results in a statistically significant

Table 7: Results – Vertical Integration and Commercial Cost

Variable	Values Estimated		
	Random effect	Fixed Effect	First Differences
Constant	-4.2338 (0.001)	-9.0001 (0.000)	-0.2964 (0.020)
Total Revenue	0.3876 (0.000)	0.6795 (0.000)	0.3795 (0.017)
VI Dummy	-0.0771 (0.670)	0.0850 (0.695)	0.3535 (0.160)
Dummy 2004	-0.5055 (0.001)	-0.4994 (0.001)	n/a n/a
Dummy 2005	-0.7233 (0.000)	-0.7654 (0.000)	0.0631 (0.714)
Dummy 2006	-0.8826 (0.000)	-0.9774 (0.000)	0.1796 (0.547)
Dummy 2007	-0.9279 (0.000)	-1.0407 (0.000)	0.4244 (0.317)
Dummy 2008	-0.9542 (0.000)	-1.1055 (0.000)	0.6943 (0.207)
N° Obs.	1825	1825	1499

p-value in parentheses

negative parameter for the vertical integration variable.

The results presented in tables 6 to 8 show that the effects of the vertical integration dummy are not uniform when the dependent variable is segmented by the type of cost. Vertical Integration is statistically significant only in relation to medical expenditure, and not significant for the estimations that have the administrative and commercial costs as dependent variable. However, for all the three types of costs, we see that the effect of vertical integration under the fixed effects model, the most appropriate model, goes in the direction of reducing each type of cost.

Table 8: Results – Vertical Integration and Medical Cost

Variable	Values Estimated		
	Random effect	Fixed Effect	First Differences
Constant	-1.4809 (0.014)	-12.9826 (0.000)	-0.1996 (0.000)
Total Revenue	0.5165 (0.000)	1.2252 (0.000)	1.2540 (0.000)
VI Dummy	-0.2895 (0.001)	-0.2017 (0.040)	0.0180 (0.866)
Dummy 2004	0.0597 (0.410)	-0.1736 (0.012)	n/a n/a
Dummy 2005	-0.2083 (0.003)	0.5324 (0.000)	-0.1930 (0.007)
Dummy 2006	-0.1706 (0.017)	-0.5783 (0.000)	-0.0617 (0.618)
Dummy 2007	-0.2713 (0.000)	-0.7232 (0.040)	-0.0082 (0.963)
Dummy 2008	-0.2403 (0.001)	-0.7854 (0.000)	0.1307 (0.563)
N° Obs.	1850	1850	1524

P-value in parentheses

4.5 Discussion

The first estimation performed used the average total costs of Unimed health care insurance firms and found that the vertical integration variable is statistically significant and negative for the fixed effects method, which we checked to be the most appropriate model according to the tests results presented above. Thus, the analysis indicates that vertical integration between insurers and health care providers resulted in lowered costs for the integrated company.

Therefore, our findings support the hypothesis that vertical integration between Unimed cooperatives and hospitals or emergency rooms leads to efficiency gains, taking the form of lower costs of health plans. This fact is an indication that the strategy adopted by some Unimed firms to vertically integrate with hospitals and ERs, providing services directly to their consumers, has a significant effect in reducing total costs per person: around 12%, in total costs. This number is even bigger when we analyze the medical costs separately: 20%.

This means that even if there is an increase in the market power of the integrated firm and the possibility to exercise market power, there are efficiency gains from vertical integra-

tion, which may outweigh the potential anticompetitive effects associated with adopting this strategy, resulting in an increase in the economic well-being.

This conclusion is consistent with the results of Ciliberto and Dranove (2006), who found efficiency gains arising from vertical integration between physicians and hospitals that could offset the increase in bargaining power, and, therefore, had no effect on consumers prices.

The second round of estimations investigated if vertical integration had an homogeneous impact in each of three types of costs, administrative, commercial and medical. The estimations performed indicate that vertical integration of Unimed insurers with hospitals and emergency implies lower costs due to the payment of medical and hospital services, but does not significantly impact the other two type of costs incurred, administrative and commercial, although the sign is in the direction of reducing also these other two types of costs.

The empirical finding that vertical integration between health care insurance firms and providers implies cost reduction, mostly in medical expenditures, is a novel result in the literature. Economic theory points out that asymmetric information might artificially increase the spending by health care insurance firms and individuals. Providers have inside information about the health of the patient and the proper procedure to handle each type of situation. They have the ability to induce a higher demand for health services from the part of the consumers. Since hospitals and medical care providers are paid by the number of services performed, there is an incentive to induce their overuse, increasing unnecessarily the costs of medical health insurance firms (Jacobs and Rapoport, 2003; Culyer and Newhouse, 2000; ?; Andrade et al., 2000).

Since the type of cost mainly reduced is related to medical expenditures, the results of our empirical analysis indicate that vertical integration ameliorate the problem of asymmetric information between health insurance firms and health care providers. By offering health services through its own establishments, health insurance firms have a greater control over the number of procedures performed and the amount and type of material used in each medical service. Moreover, integrated units maximize profit together. Thus, vertical integration aligns the interests of hospitals or emergency rooms to health insurance firms, reducing the incentive for health care providers to adopt a strategic behavior that harms health insurance firms' profits.

Therefore, our findings corroborate that vertical integration between insurers and providers result in efficiency gains for the health care sector. Moreover, they indicate this type of integration reduces the agency problem between health insurance firms and providers of medical services, resulting in lower medical costs.

5 Conclusion

The growth in the number of providers of health care insurance that have vertically integrated with health care providers in the recent years indicates that vertical integration

is a trend in the overall health care market in Brazil. Since the health care insurance market presents characteristics that increase the possibility of negative effects of vertical integration, such as high market concentration and barriers to entry, it is important to investigate the impact of this strategy in this important sector. Studies that attempt to empirically assess the effects of vertical integration in the market for health insurance help to identify the effects of adopting this strategy by health care insurance firms in Brazil.

The empirical analysis undertaken in this paper concludes that vertical integration leads to a lower total cost for the Unimed insurance firms that have integrated with hospitals or ERs. We find that costs are not homogeneously affected: the cost component mostly affected is related to medical expenditures, expenses incurred by insurers to pay providers for medical services and hospital treatment delivered to its beneficiaries.

Our results suggest that vertical integration is an effective strategy to reduce costs for insurance companies by reducing the moral hazard problem between health care insurers and providers, either because it increases the capacity of insurance firms to monitor the services provided by their own facilities, either because it aligns incentives among these two agents. Thus, it is likely that the increased number of Unimeds that have medical and hospital establishments are possibly mainly related to the fact that vertical integration is an effective strategy to contain medical costs, making them more competitive in the market. Thus, this strategy has pro-competitive effects that could be passed on to consumers.

Acknowledgments

We thank Eduardo Pontual Ribeiro, Bernardo Borba, Andrea Cabello for their help. Special thanks goes to Eduardo Pontual Ribeiro.

References

- G. M. Albuquerque. *Integração vertical na medicina suplementar: contexto e competências organizacionais*. PhD thesis, Faculdade de Economia, Administração e Contabilidade (FEA) – Universidade de São Paulo, São Paulo, 2006.
- S. F. Almeida. *Poder Compensatório e Política de Defesa da Concorrência: referencial geral e aplicação ao mercado de saúde suplementar brasileiro*. PhD thesis, Escola de Economia de São Paulo – Fundação Getúlio Vargas, São Paulo, 2009.
- M. V. Andrade, A. C. Maia, D. G. Paraiso, and R. J. Brito. *Demanda no Setor de Saúde Suplementar no Brasil*, chapter 4. Quantitativos em Defesa da Concorrência. Secretaria de Direito Econômico Ministério da Justiça, IPEA e ANPEC, 2000.
- M. Bijlsma, A. Meijer, and V. Shestalova. Vertical relationships between health insurers and healthcare providers. *CPB Document*, (167):1–70, 2008.
- R. H. Bork. *The antitrust paradox: a policy at war with itself*. Free Press, 1993.

- A. C. Cameron and P. K. Trivedi. *Microeconometrics: Methods and Applications*. Cambridge University Press, New York, 2005.
- J. Cechin. *A hist'oria e os desafios da sa'ude suplementar. 10 anos de regulac'ao*. Editora Saraiva, Rio de Janeiro, 2008.
- F. Ciliberto and D. Dranove. The effect of physicianhospital affiliations on hospital prices in california. *Journal of Health Economics*, 25:29–38, 2006.
- R. Coase. The nature of the firm. *Economica*, 4(16):386–405, 1937.
- A. E. Cuellar and P. J. Gertler. Strategic integration of hospitals and physicians. *Journal of Health Economics*, 25(1):1–28, 2005.
- A. J. Culyer and J. P. Newhouse. *Introduction: the state and scope of Health Economics*, volume 1A of *Handbook of Health Economics*, chapter Introduction, pages 1–8. North-Holland, 2000.
- E. Gal-Or. The profitability of vertical mergers between hospitals and physician practices. *Journal of Health Economics*, 18(5):623–654, 1999.
- M. Gaynor. Is vertical integration anticompetitive? definitely maybe (but thats not final). *Journal of Health Economics*, 25(1):175–180, 2006.
- M. Gaynor and W. B. Vogt. *Antitrust and Competition in Health Care Markets*, volume 1B of *Handbook of Health Economics*, chapter 27, pages 1405–1487. North-Holland, 2000.
- P. Jacobs and J. Rapoport. *The economic of health and medical care*. Jones & Bartlett Learning, 5 edition, 2003.
- B. Klein, R. G. Crawford, and A. A. Alchian. Vertical integration, appropriable rents, and the competitive contracting process. *Journal of Law and Economics*, 21(2):297–326, 1978.
- J. A. Ordover, S. C. Saloner, and S. C. Salop. Equilibrium vertical foreclosure. *American Economic Review*, 80(1):127–142, 1990.
- R. A. Posner. *Antitrust Law: an Economic Perspective*. University of Chicago Press, 1976.
- M. H. Riordan and S. C. Salop. Evaluating vertical mergers: a post-chicago approach. *Antitrust Law Journal*, 63:513–568, 1995.
- T. Santos. Determinac'ao de mercados relevantes no setor de sa'ude suplementar. SEAE/MF Documento de Trabalho n. 46, march 2008.
- C. M. Vianna. O impacto da ans no mercado operador. Fórum de Sa'ude Suplementar, 2003.
- O. E. Willianson. *Markets and Hierarchies: Analysis and Antitrust Implications*. Free Press, 1983.
- O. E. Willianson. *Transaction Cost Economics*, volume 1 of *Handbook of Industrial Organization*, chapter 3, pages 135–182. North Holland, 1989.