Impact of Mergers on product repositioning: Evidence from the French Hospital Industry

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March 15, 2019

Abstract

This paper aims to provide insights on the impact of mergers on the repositioning of hospital services by: (1) providing a theoretical framework where multiproduct firms are allowed to change their product assortment and compete in quality; (2) exploiting a rich and unique database on the French hospital industry for the years 2009-2014. Our findings show that following a merger, private hospitals distance themselves from each other by repositioning their health services offered. This non-cannibalization strategy is in line with our theoretical framework. Also, we find that merging and non-merging hospitals increase their qualities after post-merger. To our knowledge, no economic studies have attempted to evaluate the economics effects of mergers and acquisitions in the hospital industry on service repositioning. We contribute to the existing literature on the use of positioning of products/services health services as a competitive tool. We believe that such studies can help competition authorities improve their assessment of potential effects of mergers by accounting for another dimension of competition.

JEL Codes: C23, I11, L40.

Keywords: Product differentiation, mergers, acquisitions, hospitals.

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Introduction

Horizontal mergers policy for differentiated product industries derive generally from models of price competition giving rise to ‘unilateral effects’ (Gandhi et al. 2008; Werden and Froeb, 2008). A less aggressive pricing strategy by merging parties increases the marginal profits of non-merging parties leading to an overall rise in prices. Empirical evidence suggests, however, that firms might compete in a range of other dimensions than price, including product quality in hospitals (Propper et al, 2008), departure times of airplane flights (Borenstein & Netz (1999)), movie release dates (Corts (2001)), or the geographical location and product assortment in the movie theater market (Davis (2006)).

Models of single-dimension non-price competition suggest that horizontal mergers may be detrimental to merging parties (Salant et. al, 1983). In a setting where firms compete in quality, the merger internalizes the competition between products combined by the merger, causing the merged firm to prefer lower quality for any given quality of rivals. Non-merging rivals benefit from increases in their demands resulting from the merged firm’s quality decrease, and they increase their qualities in accord with their unchanged best-response functions. A significant limitation of such a model, however, is that competition may occur in dimensions other than product quality, such as product repositioning.\(^1\)

In this paper, we measure and explore firms product repositioning strategies after a merger in an industry engaged in non-price competition. A recent wave of mergers in the French Hospital Industry combined with a fixed price reimbursement system makes this market uniquely suited for product repositioning analysis. Since 2008, all hospitals (both private and public) are reimbursed at a fixed price, based on a Diagnosis Related Group system (from here onwards, DRG system). As prices for treating patients are fixed, hospitals have incentives to compete in quality with the aim of attracting patients and increasing their profits.\(^2\) Moreover, private hospitals (clinics) are relatively free to open and close services, providing a second means of differentiation, service offering. An in depth research on the institutional setting allowed us to construct a structural model that mimics closely the way clinics actually compete in this market.

Existing theoretical literature provides some insights on the competitive role played by repositioning in a post-merger situation. Gandhi et al. (2008) introduces a theoretical model where firms compete both in price and location. They show that products combined by a merger are repositioned away from each other in the aim of reducing cannibalization. Non-merging rivals re-position their products between merged products. In addition, they find that when merging products are close substitutes, the merger is considered as less anti-competitive in the price-location model than in the price-only model. That is, the anti-competitive effects of mergers are shown to be mitigated by the repositioning

\(^1\)We will use interchangeably changes in product assortment and product positioning.

\(^2\)In the hospital industry, quality is a multi-dimensional object. For simplicity’s sake, we will consider quality as a single index measure capturing vertical differentiation across similar products. In this sense, quality is assumed to be manipulated by each hospital.
of merging products. In a similar paper, Mazzeo, Seim, Varela (2014) provide a model that endogenises both product offering and pricing. They conduct equilibrium market simulations for mergers and find that predictions vary substantially with respect to a 'price-only' model as repositioning reduces the incentives to increase prices. The find that higher prices post-merger induce firms to offer more varieties but the merged firm can save on costs by not offering duplicate products with similar characteristics.

Empirical literature studying the question of the impact of mergers on product positioning remains scarce. Berry and Waldfogel (2001) study the relationship between per-firm variety and market concentration in the U.S. radio broadcasting industry, focusing on the impacts of recent regulatory changes. They find that greater concentration of ownership in a market raises variety per firm, where variety is measured by the number of different programming formats on air. George (2007) examines the effect of market structure on product variety in the market for US daily newspapers. More concentrated markets are characterized by more differentiated newspapers in terms of variety and topics covered. Draganska et al. (2009) develop an integrated empirical framework to investigate how firms make product-choice decisions in the ice-cream industry. Mergers simulations suggest that product assortment adjustments by merged firms reflect attempts to balance product cannibalization and higher margins captured by each product in the assortment. Fan (2012) develops a structural model of newspaper markets to analyze the effects of ownership consolidation, taking into account not only firms’ price adjustments but also the adjustments in newspaper characteristics. She finds that ignoring adjustments of product characteristics causes substantial differences in estimated effects of mergers.

Similarly, Sweeting (2010) shows, in the US music radio industry, that mergers between close competitors lead to important changes in product positioning. In particular, repositioning is used as a competitive tool. Mergers are shown to result in a higher degree of differentiation between the merging stations with the goal of limiting cannibalization. Furthermore, merging radio stations decide to position themselves closer to competitors to attract new listeners. repositioning is used to gain market shares at the expense of competitors. Argentesi et al. (2016) study the impact of retail mergers on prices and product variety. They show that choice of product assortment and product positioning play a key competitive role in the retailing sector. While they find no effect of mergers on prices, their results suggest that the merging parties reduced the depth of their assortment. They explain this finding by merging firms wanting to re-position their product offerings in order to avoid cannibalization. This reduced variety effect is partially (but not fully) outweighed by increased variety provided by competitors.

None of the existing studies focus on the hospital industry, yet the hospital sector is a highly dynamic industry. Mergers in the hospital industry are justified on cost savings by better use of resources or management (Gaynor et al. 2012). Reductions in costs might be generated by efficiency gains, learning-by-doing, reduction in excess capacity, reduction in transaction costs, increases in the ability to accept risk-based payment and
increases hospital negotiating power with buyers and allow for the provision of better services for the users of services. Recent empirical evidence appears to confirm the cost savings hypothesis. Spang et al. 2001 show that cost growth for merging hospitals for the period 1989 to 1997 was lower than that of non-merging hospitals, supporting the view that the efficiency gains of hospital mergers outweigh their anti-competitive effects. However, this effect does not hold in concentrated markets where merging hospitals display higher percentage price increases. Connor and Feldman (1998) report modest to no costs in more concentrated markets. In particular, these result may reflect the finding that scale economies exist only for small hospitals. Hass-Wilson & Gaynor (1998) report cost savings of $15 million dollars in the first year after the merger of Maine Medical Center with Brighton Medical Center in 1995. Maine Medical Center closed 150 beds at Brighton and converted Brighton to an outpatient center for day surgery and drop-in treatment.

Some studies that have assessed the impact of mergers on price and non-price attributes find ambiguous results. These studies find, in general, little benefit from merger and consolidation. For instance, Hamilton & Ho (2000), compare the quality of hospital care before and after mergers and acquisitions in California between 1992 and 1995. Prior to Hamilton & Ho (2000), no industrial organization studies or health care studies explicitly examine the impact of mergers and acquisitions on quality. They find mixed evidence of detrimental effects of mergers and acquisitions on quality: no measurable impact on inpatient mortality, while they found an increase in readmission rates and early discharges. In a similar study, Gaynor et. al 2012 find that a wave of mergers in the UK between 1997 and 2002 resulted in a fall on the scale of a hospital in terms of total activity and total staffing. Other than this removal of capacity, the authors find no evidence that performance improves due to merger. After the merger, financial performance declines, labor productivity does not change, waiting times for patients rise, and there is no indication of an increase in clinical quality.

To our knowledge, the question of product repositioning as a competitive tool in the context of the hospital industry has not been addressed in the existing literature. Meanwhile, health practitioners often underline that mergers between hospitals lead to repositioning of their services (so called “organizational re-engineering”) . Past research has found that in situations when prices are set administratively, price declines, as well as mergers, had a significant detrimental impact on inpatient mortality (Cutler, 1995; Hamilton & Ho, 2000). Therefore, it seems reasonable to hypothesize that mergers and acquisitions may affect service re-composition as well (Dranove et al., 1992; Luft et al., 1986).

Economic theory and most empirical evidence suggest that a key factor determining the anti-competitive impact of consolidation in a given market is the height of the entry barriers. The lack of free entry in the hospital sector due to tight regulatory environment might be of some concern for the Competition Authority in the French setting. In the U.S. federal antitrust agencies, as well as, patient and consumer groups, have voiced concern that these mergers have negative implications for the quality of health care. In three
proposed hospital mergers, the Justice Department and the Federal Trade Commission argued that the merger of two hospitals would decrease competition and therefore reduce quality of care in the local market (United States of America, Plaintiff v. Mercy Health Services and Finley Tri-States Health Group, 1994; Rather, 1997; Vandewater, 1998). Thus, an examination of the impact of hospital mergers and acquisitions on service re-composition will provide a more complete picture of market consolidation. Our goal is to contribute to the studies performing ex-post merger evaluation with the goal of helping competition authorities to improve their assessment of potential effects of mergers and thus improving future decision making.

Our paper intends to contribute to the existing empirical and theoretical literature by performing an empirical study of the impact of mergers once repositioning of services is possible accounting of the characteristics of the French hospital industry of medicine, surgery, obstetrics (hereafter, MSO). Addressing this question in the context of the hospital industry is of particular public relevance, as the quality of services offered to patients is at stake. We provide insights on the impact of mergers on positioning of hospital services by: (1) providing a theoretical framework where multiproduct firms are allowed to change their product assortment and compete in quality; (2) exploiting a rich and unique database on the French hospital industry for the years 2009-2014.

The paper proceeds as follows. Section 1 provides an overview of the French hospital industry. Section 2 provides a two stage structural model; Section 3 discusses the expected effects of a merger; Section 4 describes the Monte Carlo simulation results; Section 5 introduces our unique and original dataset constructed for the purpose of the study, and reports on summary statistics. Section 6 presents our empirical approach. Finally, section 7 concludes and highlights potential paths for further extensions and improvements.

1 French hospital industry

The hospital sector in France is large and it is publicly funded. In 2009, the hospital sector alone was assigned the equivalent to 12% percent of French GDP (DGOS, 2009). A sizable share went to the private sector as the French hospital health care system is provided by private and public actors, each with a significant share of patients. In particular, there are three main hospital ownership statuses in the sector: public, private not-for-profit and private for-profit. There are two main differences between each hospital ownership statuses: 1) public hospitals need to transfer their profits to the state, whereas not-for-profit need to reinvest the earnings, and for-profit hospitals can keep it; 2) public hospital employees are civil servants, whereas private employees are salaried and private practice doctors. Among the 1700 hospitals providing MSO, nearly half are private hospitals.

The French hospital sector is a regulated sector with two different instruments, namely, health care authorizations and DRG-pricing. In this section we present a non-exhaustive summary of each regulation instrument, as well as, how the sector has evolved.
1.1 Health care authorizations

Regulators act from a national point of view with the Directorate of Health Care (fr, Direction générale de l’offre de soins - DGOS), and from a regional point of view with the Regional Health Agency (fr. Agence Regional en Santé - ARS). These national and regional agencies shape, to some extent, the health supply landscape by providing hospitals with authorizations (or not) to practice a service.

There are nineteen ARS covering France. Each ARS has the obligation to generate a five-year plan (fr. Schéma Régional d’Organisation des Soins - SROS) to organize health care supply within its territory. To accomplish their goals, the ARS have the faculty to deliver service authorizations. This tool allows health authorities to reach their health services provision objectives, and constitutes the general framing for competition and cooperation in the hospital sector.

The creation of a new health institution, or a creation, transformation or gathering of health services and installation of new medical device are subject to authorization. An authorisation needs to specify the type of activity that is allowed. For example, an authorization for surgery does not grant a health institution to perform neurosurgery, cancer surgery nor heart surgery.

New or renewal of authorizations can only be granted to the activity that have been prior identified to be in need for an expansion; though exceptions do apply. The "bilan quantifié de l’offre de soin" (BQOS) characterizes the population’s needs in terms of health and is constructed retrospectively using hospital discharge data. BQOS states the number of current authorizations and the number of desired authorization. The difference between realized and desired number of authorizations is an indicator of how well the planning objectives are satisfied. New authorization permits are only received for those areas where a need is identified. An authorization is given if: 1) it satisfies the populations’ health needs identified in the SROS and published in the BQOS; 2) if it complies with the objectives established by the SROS; 3) if it complies with physical and technical requirements.

An authorization may last up to five years, and the length of time may be modified by the ARS when a change of the initial conditions of the authorization occurs (e.g., cooperation between hospitals). However, all authorizations, even public hospital activity

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3The French health code requires that medicine, surgery, gynecology-obstetrics, neonatology, neonatal reanimation, psychiatic, acute care and rehabilitation, long term care, organtransplants and hematopoietic cell transplants, the treatment of severely burned patients, heart surgery, interventional endovascular radiology for cardiology, neurosurgery, neu-roradiologie, medical emergenecies, reanimation, treatment of chronic renal insufficiency through haemodialysis, clinical and biological medical assistance for procreation and pre-natal diagnostic, cancer treatment, genetic iden-ification for medical uses. Similarly, heavy medical equipment subject to authorization are scintillation camera with or without positron detectors, tomography, positron emitters, spectroscopy, scanography, hyperbaricchamber, cyclotrons.

4If the authorization is denied, the ARS needs to motivate the decision and, if required by the authorization seeker transmit the reasons of denial to the seeker. An appeal to the courts can be performed.
authorizations can be transferable. All transfers are subject to the confirmation from the inbound ARS director. Nevertheless, the director can only disapprove the transfer if the moral person benefiting from the transfer changes substantially the nature of the authorization. Given this, transferring authorizations between hospitals is more likely to happen than the creation of a new authorization. Physical grouping of hospital in one site, physical relocation of a single hospital and a transformation of a service into a different service also requires an authorization from an ARS. Nevertheless, conditions for groupings, relocation and transformation are generally satisfied and agreed upon with the ARS.

Finally, in the case of a merger, all the authorizations owned by both merging parties are shared. Moreover, merging firms can easily decide to close a service. This is because, as opposed to the creation of a new service, closure of a service does not require prior authorization to the ARS. In addition, it is important to underline that authorizations are given for the provision of a broadly defined activity covering a large number of services. Repositioning can happen both within the limits of an authorization (i.e., at the intensive margin) or across services requiring different authorizations (i.e., at the extensive margin).

1.2 Financing system

A hospital in France is a moral personal that is administratively and financially autonomous. Generally a hospital can be funded by their hospital activity; subventions, grants and endowments given by a public person, government or the public health insurance; good and services, rent and intellectual property rights; loans and advances; generosity and gifts. Yet, most of hospitals’ funding come from the activity they perform. In particular, the activity-based payment (fr. Tarification à l’activité - T2A) is currently the only mode of financing medical, surgical and obstetric activities of both public and private hospitals. It was gradually introduced in 2004 and came fully into force in 2008. Prior to 2004, health establishments were financed depending on their legal nature. Public hospitals and not-profit private hospitals received global budgets, mainly based on historical costs. Financing of private for-profit hospitals was based on an itemized billing system supplemented with fee-for service payments (see Or (2014)). This restructuring of hospital funding was part of the Plan Hôpital 2007 with the objective to improve efficiency in the hospital sector. Medicine, obstetric and surgery services today are uniquely financed through activity-based DRG-pricing since 2008.

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5Law L6141-1 from the Public Health Code

6In France, DRG-pricing is a two step process. First, patients are classified into homogeneous groups of patients (fr. groupe homogène de malades, GHM). To every GHM, one or more homogeneous groups of stays are assigned (fr. groupe homogène de séjour, GHS). The average cost of each GHM is calculated from a sub-sample of representative hospital (public and private) and expressed using an indexation summarizing the activity performed (fr. indice synthétique d’activité - ISA). Average costs is public information, but individual hospital costs are not. Second, based on this average, the price of every activity is fixed yearly, prospectively and nation-wide. The resulting health insurance payments are determined using yearly prices. The french regulator, agence tech-
This activity-based funding entails one main consequence: it encourages hospitals to compete for patients. The incentive structure for hospitals has changed dramatically because additional patients now represent additional revenue for the facility. Furthermore, some hospitals receive more funding now than in the past as opposed to others which have been over funded by yearly endowments and now receive less resources. Each public facility have now incentives to monitor its own cost-efficiency. Public and private pricing structure still differs slightly. Primarily, practitioners’ fees are part of the tariff for the public sector while they are financed separately in the private sector.\footnote{7} Practitioners tariffs in the private sector are not set by the private clinics. The clinics serve as a platform and rent their space to practitioners.\footnote{8}

2 Model

Suppose there are $H$ firms, each of which produces a subset of products, $F_c$, within a category $c \in \mathcal{C}$. Each firm $h$, offers $n^c=1,\ldots,N^c_h$ products per category. Let $d^c_{ht}$ indicate whether product 1 in category $c$ is offered by $h$ at period $t$. Define the vector $d^c_{ht} = (d^c_{h1t},\ldots,d^c_{hN^c_h,t}) \in \{0,1\}^{N^c_h}$. In the following, without loss of generality, we will focus on one category and will drop superscript $c$.\footnote{9}

We consider a two-step model where firm $h$ decides which products to offer in a given market followed by which quality to assign them. Firms decisions are made given the expectation of their competitor’s offering, fixed prices, marginal and fixed cost of offering each product. In the first stage, firms decide which services to offer. Each firm starts with a fixed set of potential services to offer and selects the optimal subset of services among this potential set. In the second stage, firms observe each others service offering. Conditional on their own and their competitors choice of offerings, firms choose quality.

\footnote{7}{Such differences resulting in higher tariffs for the public sector have been subject of a complaint from the French private clinics organization to the European Commission regarding an anti-competitive pricing structure in favor of public hospitals.}

\footnote{8}{Supplementary resources for public hospitals are provided by the missions d’intérêt général et d’aide à la contractualisation interne (MIGAC), which are dedicated to purposes including teaching, information, research, and innovation (in French, missions d’enseignement, de recherche, de référence et d’innovation; MERRI). The costs of these activities are financed via individual budgets per facility. Additional further resources are available for specific activities such as emergency care and organization of organ transplants. Specific expensive medication and medical devices can also receive supplementary funding.}

\footnote{9}{Given the structure of our markets, it seems reasonable to assume that there is no competition between products such as knee replacement and c-sections. Nevertheless, there might be economies of scope of having of providing these very different services. We will abstract from this possibility.}
2.1 Stage 2

To determine which products are to be offered by firms in the first stage, all potential combinations of product offered need to be assessed by firms. In the second stage, we solve for equilibrium qualities for every possible combination of service offerings.

Patients demand

To specify the demand model, let consumer’s $i$ utility of choosing firm $h$ for product $l$ at market $t$ be denoted by $U_{hlit}$. We model utility as:

$$U_{hlit} = \beta_i^* q_{hlit} - \alpha_i^* \text{dist}_{ihlt} + \epsilon_{hlit},$$

(1)

$$i = 1, \ldots, I, \quad l = 1, \ldots, L \quad t = 1, \ldots, T$$

where $x_{hl}$ is a K-dimensional (row) vector of observable product characteristics, $\text{dist}_{ihlt}$ corresponds to the distance between the firm $h$ offering product $l$ and the geographical center of the market. Finally, $(\alpha_i^*, \beta_i^*)$ are $1 + 1$ individual-specific coefficients.

We model consumer taste parameters for the characteristics as a multivariate normal distribution. Let,

$$\begin{bmatrix} \alpha_i^* \\ \beta_i^* \end{bmatrix} = \begin{bmatrix} \alpha \\ \beta \end{bmatrix} + \Sigma v_i, \quad v_i \sim N(0, I_{1+1}),$$

(2)

where $\Sigma$ is a scaling matrix.

The specification of the demand system is completed with the introduction of an ‘outside good’; the consumer may decide not to purchase any of the inside products. The indirect utility from this outside option is:

$$U_{0lt} = \xi_{0lt} + \epsilon_{0lt}.$$  

As the mean utility of the outside good is not identified, thus we normalize $\xi_0$ to zero. Combining equations (1) and (2) we obtain:

$$U_{hlit} = \delta_{hlit} + \mu_{hlit} + \epsilon_{hlit},$$

(3)

$$\delta_{hlit} = \beta q_{hlit} - \alpha \text{dist}_{ihlt}, \quad \mu_{hlit} = [q_{hlit}, \text{dist}_{ihlt}]' \times \Sigma v_i$$

where utility is now expressed as the mean utility, represented by $\delta_{hlit}$, and a mean-zero heteroskedastic deviation form that mean, $\mu_{hlit} + \epsilon_{hlit}$, which captures the effects of the random coefficients (Nevo, 2001). We assume that consumer heterogeneity enters the model through the separable additive random shock, $\epsilon_{hlit}$, and we assume these shocks are distributed according to an extreme value distribution. Idiosyncratic shocks are assumed to be known by consumers but not by firms, nor the researcher. Consumers are assumed to
choose only one unit of the product that yields the highest utility. We treat mean utility as the sum of two elements. A first element composed of the dis-utility of the distance of the product with respect to the consumers location. A second element composed of a mean quality index, \( q_{hlt} \), for product \( l \) produced by \( h \) in market \( t \).

Until now, we have considered all products \( l \) to be potential substitutes of each other, whereas in the industry we are considering it might not be the case. To compute a market share, we need to account for all substitute products.

We integrate the consumer-level probabilities to derive an offered service aggregate market share across all patients for hospital’s \( h \) product \( l \):

\[
\begin{align*}
    s_{hlt}(q_t, \text{dist}_t, \delta_t; d_t) &= \int \frac{d_{hlt}e^{\delta_{hlt}+\mu_{hlt}}}{1 + \sum_{h'}\sum_{t'}d_{h't'}e^{\delta_{h't'}+\mu_{h't'}}}dF(\nu).
\end{align*}
\]

(4)

where \( q_t = [q_1t, \ldots, q_Ht] \), \( \text{dist}_t = [\text{dist}_1t, \ldots, \text{dist}_{Ht}] \), \( \delta_t = [\delta_1t, \ldots, \delta_{Ht}] \), and \( d_t = [d_1t, \ldots, d_{Ht}] \). Notice that market shares depend on mean product characteristics (observed and unobserved), \( \delta_{hlt}, \ldots, \delta_{Hlt} \), deviations from these mean, \( \mu_{hlt}, \ldots, \mu_{Hlt} \), as well as product offerings, \( d_1t, \ldots, d_{Ht} \). We can easily compute the integral given in equation (4) numerically.

**Firms profits**

For a set of products determined in the first stage, firm \( h \) chooses qualities, \( q_{ht} \), to maximize expected profits. Firms are assumed to compete in Bertrand-Nash fashion, given their costs structures.

Firms \( h \) incurs a marginal cost of \( c_{hlt} \) for each product \( l \) offered in market \( t \). We specify it as:

\[
    c(q_{hlt}) = \omega q_{hlt} + \kappa(1 - s_{hlt}(\cdot))\gamma + \zeta_{hlt},
\]

(5)

where \( \omega, \kappa \) and \( \gamma \) are parameters, and \( \zeta_{hlt} \) is a firm-product-specific component of the marginal cost. We allow part of the marginal cost, \( \zeta_{hlt} \), to be unobserved to the research (Berry et al. 1995). To simplify notation, we suppress \( (q_t, \text{dist}_t, \delta_t; d_t) \) as arguments of \( s_{hlt} \).

In addition, we assume that firm \( h \) has a fixed cost to offer product \( l \) in each market \( t \), \( \varphi_{hlt} \), distributed according to probability distribution function \( G_{hl} \) that differs across hospitals and services. We assume that this fixed costs is only observed by the firm itself, but not by its competitors, i.e., it is private information. In contrast to marginal costs, which are primarily driven by observable costs for inputs, fixed costs may depend on the efficiency of each firm’s processes, proprietary strategic decisions.\(^{10}\)

\(^{10}\)We also constructed a model without private information, and solve it using a stochastic response dynamic algorithm. The qualitative results are robust to the information structure.
Firms’ objective is to maximize the profit from the product that it offers, as indicated by $d_{ht} = (d_{ht1}, ..., d_{htN_h})$:

$$\max_{q_{ht}} \sum_{l=1}^{N_h} (\bar{p}_t - c(q_{htl}))M_l s_{htl}(\cdot) - \sum_{l=1}^{N_h} \phi_{htl} d_{htl},$$

(6)

where $\bar{p}_t$ is the fixed price for product $l$ at market $t$ and $M_l$ is the size of the market for product $l$. We emphasize the dependency of quality on product offering.

Assuming the existence of a pure-strategy Bertrand-Nash equilibrium in quality, and the vector of qualities that support it are strictly positive, quality $q_{htl}$ produced by the firm $h$ for product $l$ must satisfy the following first-order condition:

$$\sum_{r=1}^{N_ht} (\bar{p}_t - c(q_{rht})) \frac{\partial s_{htl}(\cdot)}{\partial q_{htl}} - \left(1 + \sum_{r=1}^{N_ht} \frac{\partial c(q_{rht})}{\partial q_{htl}}\right) s_{htl}(\cdot) = 0.$$  

(7)

This set of $L$ equations implies price-cost margins for each good. The markups can be solved explicitly by defining:

$$\Omega_{lr} = \begin{cases} \frac{\partial s_{htl}(\cdot)}{\partial q_{htl}}, & \text{if } \exists n : \{l, r\} \in F_h \\ 0, & \text{otherwise} \end{cases}$$

and,

$$\Gamma_{lr} = \begin{cases} \frac{\partial c(q_{htl})}{\partial q_{htl}}, & \text{if } \exists n : \{l, r\} \in F_h \\ 0, & \text{otherwise} \end{cases}$$

where $\Omega$ and $\Gamma$ are $L \times L$ matrices. In vector notation the first order conditions become:

$$\Omega \ast (\bar{p} - c) - (I - \Gamma) \ast s = 0.$$  

(8)

We solve for equilibrium qualities for the remaining possible product sets analogously. This gives us a vector of $2^{\sum_{h=1}^{N_h}}$ different qualities for hospital $h$, for each possible bundle of products that could be offered. Notice that, using estimates of the demand parameters, we can estimate the price-cost margins. Moreover, given that prices are fixed, we can in principle recover the average cost.

2.2 Stage 1

Each firm chooses the optimal set of products given its expectation of the other firms’ choice and qualities under each configuration. Firm $h$ chooses $d_{ht} = (d_{ht1}, ..., d_{htN_h})$ to
maximize expected profits given by:

\[ E[\Pi_{ht}(d_{ht}; d_{-ht})] = E \left[ \sum_{l=1}^{N_h} (p_{htl} - c_{ht}) M_l s_{htl}(\cdot) - \sum_{l=1}^{N_h} \varphi_{htl} d_{htl} \right] \]

\[ = \sum_{d_{-ht}} \left( \sum_{l=1}^{N_h} (p_{htl} - c_{ht}) M_l s_{htl}(\cdot) \right) Pr(d_{-ht}) - \sum_{l=1}^{N_h} \varphi_{htl} d_{htl} \]

\[ = \bar{\Pi}_{ht}(d_{ht}) - \sum_{l=1}^{N_h} \varphi_{htl} d_{htl}. \] (9)

The first part of the expression, \( \bar{\Pi}_{ht}(d_{ht}) \), is the expected variable profit and the second part, \( \sum_{l=1}^{N_h} \varphi_{htl} d_{htl} \), represents the fixed costs. Since firm \( h \) does not know the fixed costs of its rivals, it cannot predict their service offerings with certainty. Hence, firm \( h \) forms expectations over its rivals’ offering. In particular, \( Pr(d_{-ht}) \) is the joint probability that its rivals offer the particular subset of services in \( d_{-ht} \). The marginal probability that firm \( h \) offers bundle \( d_{ht} \) is:

\[ Pr(d_{ht}) = Pr \left( E[\Pi_{ht}(d_{ht}; d_{-ht})] \geq E[\Pi_{ht}(d'_{ht}; d_{-ht})] \right. \] \( \forall d'_{ht} \in \{0, 1\}^{N_h} \)

\[ = \int_{A(d_{ht})} \prod_{l=1}^{N_h} dG_h(\varphi_{htl}), \] (10)

where we let \( A(d_{ht}) \) denote the set of values for \( \varphi_{ht} = (\varphi_{h1}, \ldots, \varphi_{HN_h}) \) that induce the choice of product bundle \( d_{ht} \):

\[ A(d_{ht}) = \left\{ \varphi_{ht} | \bar{\Pi}_{ht}(d_{ht}) - \bar{\Pi}_{ht}(d'_{ht}) \geq \sum_{l=1}^{N_h} \varphi_{htl}(d_{htl} - d'_{htl}) \right\}. \] (11)

Assuming independence across firm costs shocks, \( \varphi_{htl} \), entails that the joint probability of observing a particular set of service offerings in the market is the product of the marginal probabilities for \( d_{ht} \) defined above. Substituting the product choice probabilities defined above into each firm’s expected profit yields a measure of the attractiveness of each choice as a function of the competitor’s probabilistic choices. The probability that hospital \( h \) chooses offering \( d_{ht} \) is then the probability that the expected profit of the offering \( d_{ht} \) exceeds expected profits for any other product offering \( d'_{ht} \), given its conjecture of its competitors behavior.

### 3 Merger Analysis

There are several mechanisms that might lead industry participants to a change product offering after a merger occurs in the market.
**Quality**  The consequences for merging parties in terms of qualities are straightforward. Holding constant product offering, merged firms decrease quality. The reaction of competitors depend on the functional form assumption on costs. As we are explicitly allowing for economies of scale, qualities are strategic substitutes. That implies that a decrease in quality by merging parties increases quality of non-merging parties. In turn, the additional profitability for non-merging parties might provide incentives to introduce new products. Moreover, merging parties might opt to forgo on product due to the decrease profitability.

**Saving in costs**  Merging firms internalize the business stealing effects that their entry decisions have on each others’ profitability. Even when holding qualities fixed at pre-merger values, the merging firm may want to reduce its offering (the number of products offered), decreasing the cannibalization of their own products and saving on both the fixed costs of the products being eliminated, and on average costs benefiting from the economies of scale.

### 4 Monte Carlo Experiments

#### 4.1 Setting

We consider a simple framework for the market of one product, \( l \), in which with five firms are located along a line segment of unit length. Initially, each firm is separately owned and offers (or not) the product. Then, two firms merge (Firm 1 and Firm 2). Before and after the merger, the firms play the game describe earlier. First the firms decide to enter or not into the market, then firms decide on qualities. We compare the effects of a merger in this game to: (1) those when firms are constrained to their pre-merger product offerings; those when firms do not merge (i.e., status-quo). The five model firm allows for a rich setting to exhibit interesting effects on post-merger product repositioning.

We assume the following parameters value: each firm \( h \) offering product \( l = 1 \) receives a price \( \bar{p}_l = 5 \). Average cost parameters are common to all firms and are defined as, \( \kappa = 1 \) and \( \gamma = 2 \). We assume that \( \omega = 1 \) and that the firm-product-specific component of the marginal cost, \( \zeta \), is equal to zero for all firms. We normalize the size of the market, \( M_l \), to one. We model distance as \( \text{dist}_{hi} = |z_i - z_{hl}| \), where \( z_i \) and \( z_{hl} \) are the locations of the consumer \( i \) and firm \( h \). We assume that consumers are equally spaced in a unit interval and firms are located at, \( z_j = [1, 0, 0, 0, 0] \). We assume that the transport dis-utility parameter is equal to one, \( \alpha = 1 \) and that \( \Sigma = I \), where \( I \) is the identity matrix. Average fix costs

---

\(^{11}\)For example, the market for knee surgery.

\(^{12}\)Note that the decision of the firm consists on whether to enter the market or not. As we are not modelling the firms location within the segment line, the entering location if predetermined.
are assumed to be equal to all firms. The fix cost distribution is assumed to follow a log-normal distribution with mean equal to $1/7$ and standard deviation equal to unity.

4.2 Measure of product assortment differentiation

To assess product assortment differentiation, we compare the offer of products between pairs of competitors. That is, for a pair of firms belonging to the same market, say $h$ and $h'$, we compare pairwise the elements of $d_{ht}$ and $d_{h't}$. Let $d_{hh't}$ denote our measure of differentiation. This measure takes the value 1 if a product is offered by one firm and not by the other, that is:

$$d_{0;hh't} = \begin{cases} 
0, & \text{if } d_{ht} = d_{h't}, \\
1, & \text{otherwise.} 
\end{cases}$$

(12)

In addition, we develop two measures to help illustrate how differentiation takes place in the market. The first measure, $d_{1;hh't}$, is a variable equal to 1 if the product if offered by both firms, and zero otherwise. The second measure, $d_{2;hh't}$, correspond to the opposite case; it is equal to 1 if both firms do not offer the product, and it is zero otherwise. As, by construction, we have that $d_{0;hh't} + d_{1;hh't} + d_{2;hh't} = 1$, analyzing these measures jointly illustrates the transition between states.

4.3 Monte Carlo simulation results

Before the merger, each firm $h$ decides to enter in the market of product $l$, and conditionally on entering, chooses the quality $q_{hl}$. We denoted this game $G^{pre}$ and the vector of second stage Nash equilibrium qualities is denoted as $q^{pre}$ ('pre' stands for pre-merger). As reported by Table 1 Under $G^{pre}$, all firms enter the market and choose a positive quality. Firms 2 - 5 are closer together and are expected to provide higher levels of quality due to tougher competition. Yet, competitive effects are dominated by the economies of scale effects yielding higher levels of quality for firm 1 than for firms 2 to 5. As reported by Table 3, quality levels are reflected in larger shares for firm 1 than for firm 2-5.

We denote $G^{RE}$ ('RE' stands for repositioning) the post-merger game, where a merger between firms 1 and 2 occurs. This game has an equilibrium second stage Nash equilibrium quality $q^{RE}$. Under $G^{RE}$, merging firms 1 & 2 decide to close down the firm 2. Resulting qualities and shares are reported in Table 1 and 3, respectively. As compared to $G^{pre}$, qualities in $G^{RE}$ increase by no less than 1% for all firms that entered the market.

In order to properly disentangle the effects between $G^{pre}$ and $G^{RE}$, we introduce a hypothetical game $G^{QO}$ (QO signifying quality-only) similar to the $G^{RE}$ game, except that firms are not allowed to change their product offering. That is, all firms are bound to stay in the market and compete in quality. Equilibrium qualities under $G^{QO}$ are denoted by $q^{QO}$. The quality change $\Delta_{q}^{QO} = (q^{QO} - q^{pre})/q^{pre}$, reflects the change in quality
only due to the post-merger effect, without repositioning. As expected, merging parties internalize their joint competitive effects and decrease qualities by 8 to 10.6%. As firms compete in strategic substitutes, non-merging parties reaction to merging parties decrease in quality is to increase qualities by around 1%. As reported in Table 3, market shares of non-merging parties increase by around 15%, while market shares of merging parties decrease by at least 18%.

To avoid joint losses, the merging party’s reaction is to no longer offer product from firm 2. As firm 2 is closest to their competitors, the closure is highly strategical. Repositioning allows merging parties to water-down the free-riding effects of the merger on non-merging parties. Firm’s 2 net share decrease is 76%, as opposed to 100%, while the net share increase for firm 1 is close to 40%. Non-merging parties shares increase are halved to around 8.5%. Overall, repositioning allows qualities to increase by around 10% for firm 1 and by around 0.5% for non-merging firms.

Table 2 reports on the changes of the product assortment as measured by equation (12). The first column reports on the differentiation between pre-merger and post-merger outcomes across the pair with same owner (i.e., pair {1,2}), and the average differentiation between pairs formed by merging firms and their competitors (i.e., pairs {1,3}, {1,4}, {1,5} and {2,3}, {2,4}, {2,5}). The differentiation between pairs with same owner is maximum, while the average across merging firms and their competitors is equal to 0.5. This results comes naturally as only firm 2 exits the market. Column 2 allows for a refinement of the differentiation measure by constructing the pair that minimizes the distance between the merging firms and their competitors (i.e., the pairs {2,3}, {2,4}, {2,5}). As expected, the size of the effect is equal to one for the interaction term, while the main term is equal to zero.

In addition, the last three columns of table 2 reports on the transition states. As all the firms find it optimal to enter the market prior the merger, the firms transition form a state in which all enter \((d_{ij,h,h'} = 1 \forall h, h')\) to a state in which firm 2 does not \((d_{0;2,h'} = 1 \forall h')\). By construction, the sum between the last three columns equals zero.

The overall impact of the merger on consumers depend on whether the effect of increased quality dominates over having a decreased variety. That is, consumers are entitled to higher quality products, but in order to access them (some) consumers need to travel further. To assess the impact of the merger, We measure compare consumer surplus before and after the merger. Consumers are assumed to select the alternative that provides them the greatest utility. Consumer surplus is therefore:

\[
E(CS_i) = \frac{1}{\alpha_i} \ln \left( 1 + \sum_{h' = 1}^{5} d_{i,h'} e^{\delta_{h'} + \mu_{h'} \alpha_i} \right).
\]  

(13)

Table 4 reports on the expected consumer surpluses \(CS_{pre}\), \(CQO\), and \(QRE\) under \(G_{pre}\), \(GQO\), and \(GRE\) respectively. As compared to \(CS_{pre}\), consumers’ surplus \(CQO\), and \(QRE\)
are lower after the merger. As compared to a situation where firms are not allowed to reposition their product, allowing for repositioning increases consumers surplus by $\Delta_{CS} = 1.5\%$.

The effects of a merger in an industry where there are significant economies of scale and where competition occurs in non-price elements yields different results as an industry where competition occurs in prices. Not accounting for repositioning might lead to a flawed assessment of the merger’s impact on consumer surplus.

Table 1: Changes in quality due to merger and repositioning

<table>
<thead>
<tr>
<th></th>
<th>Firm 1</th>
<th>Firm 2</th>
<th>Firm 3</th>
<th>Firm 4</th>
<th>Firm 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q^{pre}$</td>
<td>3.432</td>
<td>3.403</td>
<td>3.403</td>
<td>3.403</td>
<td>3.403</td>
</tr>
<tr>
<td>$q^{QO}$</td>
<td>3.140</td>
<td>3.060</td>
<td>3.438</td>
<td>3.438</td>
<td>3.438</td>
</tr>
<tr>
<td>$\Delta_{QO}^q = (q^{QO} - q^{pre})/q^{pre}$</td>
<td>-8.48%</td>
<td>-10.07%</td>
<td>1.03%</td>
<td>1.03%</td>
<td>1.03%</td>
</tr>
<tr>
<td>$\Delta_{RE}^q = (q^{RE} - q^{pre})/q^{pre}$</td>
<td>1.23%</td>
<td>1.54%</td>
<td>1.54%</td>
<td>1.54%</td>
<td></td>
</tr>
<tr>
<td>$\Delta_q = \Delta_{RE}^q - \Delta_{QO}^q$</td>
<td>9.71%</td>
<td>0.52%</td>
<td>0.52%</td>
<td>0.52%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Changes in product assortment due to merger and repositioning

<table>
<thead>
<tr>
<th>Measures of differentiation</th>
<th>$d_{i;10,01}$</th>
<th>$d_{i;10,01}$</th>
<th>$d_{i;11}$</th>
<th>$d_{i;00}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair, same owner</td>
<td>1</td>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>Pair, merging firm - competitor</td>
<td>0.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pair, merging firm - closest competitor</td>
<td>1</td>
<td>-1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

5 Data

To consistently estimate the effect of mergers on service repositioning we require information on merging and non-merging entities. In particular, we need: to identify when a merger occurs; to identify services offered by each hospital; and to identify each hospital-service level of activity. We construct a unique and original dataset on services offered
Table 3: Changes in shares due to merger and repositioning

<table>
<thead>
<tr>
<th></th>
<th>Firm 1</th>
<th>Firm 2</th>
<th>Firm 3</th>
<th>Firm 4</th>
<th>Firm 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$s^{pre}$</td>
<td>0.202</td>
<td>0.181</td>
<td>0.181</td>
<td>0.181</td>
<td>0.181</td>
</tr>
<tr>
<td>$s^{QO}$</td>
<td>0.164</td>
<td>0.139</td>
<td>0.207</td>
<td>0.207</td>
<td>0.207</td>
</tr>
<tr>
<td>$s^{RE}$</td>
<td>0.249</td>
<td>0</td>
<td>0.224</td>
<td>0.224</td>
<td>0.224</td>
</tr>
</tbody>
</table>

$\Delta^{QO} = \left( \frac{s^{QO} - s^{pre}}{s^{pre}} \right)$

$\Delta^{RE} = \left( \frac{s^{RE} - s^{pre}}{s^{pre}} \right)$

$\Delta_s = \Delta^{RE} - \Delta^{QO}$

Table 4: Changes in Expected Consumer Surplus due to merger and repositioning

<table>
<thead>
<tr>
<th></th>
<th>Expected CS</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E(CS^{pre})$</td>
<td>11.355</td>
</tr>
<tr>
<td>$E(CS^{QO})$</td>
<td>11.129</td>
</tr>
<tr>
<td>$E(CS^{RE})$</td>
<td>11.353</td>
</tr>
</tbody>
</table>

$\Delta^{QO} = \left( \frac{E(CS^{QO}) - E(CS^{pre})}{E(CS^{pre})} \right)$

$\Delta^{RE} = \left( \frac{E(CS^{RE}) - E(CS^{pre})}{E(CS^{pre})} \right)$

$\Delta_{cs} = \Delta^{RE} - \Delta^{QO}$

1.97%
by private and public hospitals activity on MSO activities in the French hospital industry covering the period 2010-2014. The following section describes the different data sources used to construct our dataset.

5.1 Data sources

Our main source of information is ScanSanté (an extraction from the *Programme de médicalisation des systèmes d’information*, PMSI) data, which is a publicly available dataset providing an exhaustive, nationwide, database on hospital activity. ScanSanté is based on a DRG-classification of activities, covering all public and private hospitals. It provides data on all claims paid by the Social Security System to hospitals and is therefore the main source of information on hospital activity and associated expenditure. From Scansanté, we use information on the total number of acts made within each service, average length of stay, average age of patient, sex ratio, as well as the percentage (%) of death at the DRG level for each hospital from 2010 until 2014. Also, ScanSanté allows us to recover the number of standardized discharge summaries per DRG and zip-code of residence of patients in each hospital. We aggregate each DRG to a group of activities (fr. *Groupe de planification*, from here onwards we refer to the groups of activities as GP) where each group of activity can be attributed to either medicine, surgery or obstetrics.

Moreover, we also used data from *Fichier National des Etablissements Sanitaires et Sociaux* (FINESS) database, which is a national directory of health and social establishments maintained by the Regional Department of Health and Social Affairs (fr. *Direction régionale des affaires sanitaires et sociales*) and the Departmental Directorate for Health and Social Affairs (fr. *Direction Départementale des Affaires Sanitaires et Sociales*). FINESS allows us to identify all mergers and acquisitions. All health establishments are identified by a geographical and legal FINESS number. Each FINESS identifier is paired with data on the hospital’s name, geographic location, legal status, field of activity, date of opening and closure (if any) are reported. Information provided in the FINESS database allows us to identify mergers and acquisition occurring in the industry. A merger is identified when two or more hospitals previously registered under different legal FINESS identifiers, obtain a new common legal identifier. An acquisition occurs when one hospital acquires the legal pre-existing FINESS identifier of another hospital.

Finally, we use data from *Statistique Annuelle des Etablissements*, SAE. This database is a mandatory administrative survey of all public and private healthcare establishments in France. The data are collected by the Regional Department of Health and Social Affairs (fr. *Direction régionale des Affaires Sanitaires et Sociales*). The SAE database provides us with historical information on capacity of public and private hospitals, that is the number of beds that each hospital attributes to medicine, surgery and obstetrics, respectively.
5.2 Market definition

For defining a market, the two main elements are required: product definition and geographic definition. In our data, each patient stay is classified in a DRG, which then can be attributed to a GP. In turn, each GP can be categorized to either medicine, surgery or obstetrics. In total, there exist 91 GP, 43 are attributed to surgery, 44 to medicine and finally 4 to obstetrics. Table 5 summarizes the “top3” groups of activities in each discipline defined by the highest average yearly number of discharges attributed to them.

For practical purposes, we define a product to be a service provided at the GP level.\textsuperscript{13} There are two main implications of this assumption. First, from the patients point of view, there is no substitution across GP. That is, we assume, for example, that knee surgery is unlikely to be an adequate substitute for a hip replacement. Within a GP, however, we do not distinguish uses of different approaches for a similar treatment that may be considered as substitutes. Second, we are only able to capture clinics’ decisions to change their assortments across GP, and not within.\textsuperscript{14}

Table 5: “Top 3” GP

<table>
<thead>
<tr>
<th>GP</th>
<th>Yearly # of discharges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery - of total 43 activities</td>
<td></td>
</tr>
<tr>
<td>Surgery of the musculoskeletal system, amputations</td>
<td>794,709</td>
</tr>
<tr>
<td>Visceral Surgery: Spleen, Hail, Colon, Proctology, Hernias</td>
<td>439,552</td>
</tr>
<tr>
<td>Ophthalmological Surgery and Corneal Transplantation</td>
<td>435,816</td>
</tr>
<tr>
<td>Medicine - of total 44 activities</td>
<td></td>
</tr>
<tr>
<td>Hepato–Gastroenterology</td>
<td>846,765</td>
</tr>
<tr>
<td>Cardio–vascular disorders</td>
<td>689,572</td>
</tr>
<tr>
<td>Pneumonology</td>
<td>687,083</td>
</tr>
<tr>
<td>Obstetrics - of total 4 activities</td>
<td></td>
</tr>
<tr>
<td>Vaginal deliveries</td>
<td>345,414</td>
</tr>
<tr>
<td>Other obstetrics acts</td>
<td>257,478</td>
</tr>
<tr>
<td>Cesarean sections</td>
<td>145,110</td>
</tr>
</tbody>
</table>

Notes: Average yearly # of discharges is computed for the years 2009–2010.

As patients are assumed to minimize their travel distances, geographic market definition is required. For simplicity’s sake, we assume that all products offered by a clinic have a common geographical market definition. We expect, however, patient to be heteroge-

\textsuperscript{13} Even though we have data at the DRG level, our identification strategy becomes computationally unfeasible with a smaller level of disaggregation.

\textsuperscript{14} Typically, courts and competition authorities consider a larger aggregation of services. For example, the Federal Trade Commission (FTC) in the US defines the product market for hospital services as inpatient acute care services. Please visit: https://www.justice.gov/atr/chapter-4-competition-law-hospitals. [last visited on Wednesday 31 Oct. 2018, 11h00 am Paris time]
neous on their traveling preferences, leading to markedly different geographical markets across GPs (Capps et al. 2001; Cooper, 2010; Varkevisser et al., 2007). Defining geographical markets in this way, may ignore the preferences and travel patterns of certain patients. Introducing different geographical market definitions per GP, however, does not qualitatively affect our results.

We use a catchment area analysis to define geographical markets. We do so by computing the driving time required to go from the patient’s to the clinic’s location, as defined by the centroids of the postal codes. The geographical market around a clinic is defined by the traveling distance times around the clinic (from now on, the focal clinic) from which 80% of patients originate. That is, the clinic’s catchment area can be understood as the distance (in traveling time) that the majority (80%) are willing to travel. Any public hospital or clinic within this traveling distance is considered to exert a competitive constraint on the focal clinic. Using driving time, as opposed to a fixed radius, reduces the likelihood of having distorted geographical markets due to population density (Cooper et al., 2010). Figure 1 illustrates the computed isochrones.

Figure 1: Visual illustration of geographical markets per clinic

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15There are several precedents of use of isochrones as proxies for geographical markets. In France, the relevant geographic markets are defined as local markets within a radius of 30min driving time. The radius may be extended up to one hour depending on the type of care, the population density, the available hospital infrastructure (Choné, 2016). In UK, merger investigations used isochrones of 30 minutes defined by having 80% of private hospital patients come from areas within a 30-minute drivetime (Office of Fair Trading, 2008a; Office of Fair Trading, 2008b). Isochrone analysis has also been used for defining geographic markets in the NHS hospital mergers. All hospitals within a 30-40 minute drive time were considered in the same geographical market.
5.3 Summary statistics

In the following section, we present summary statistics on the markets, mergers and acquisitions and on the differentiation measures.

5.3.1 Market differences

Table 6 provides information on the markets included in our analysis, as well as the offer of activities of clinics/hospitals belonging to those these markets. In our sample, we observe, on average, 38 hospitals per market. The average catchment area of a focal clinic is close to 45 minutes. Moreover, the focal hospital is on average 25 minute drive away from its competitors.

We use pairs of hospitals to examine whether a change in ownership tends to differentiate the services provided. Following our measures of differentiation defined by equation (12), we compute its average value across all pairs formed within markets. A third of all pairs of hospitals have one that provides a service while the other does not. Hence, our first measure of differentiation, \( d_0 \), is equal to 0.33. However, the most common combination across pairs is to have both hospitals offer the same service. This corresponds to our second measure of differentiation, \( d_1 \), which equals 37%. Finally, our last measure of differentiation, \( d_2 \), corresponds to having both hospitals in a pair not offering the service and it occurs for 30% of pairs.

Table 6 also reports on the joint pair market shares per service, as well as the joint market shares in terms of deaths per services. Market shares, either in activity or in number of deaths, for each hospital are computed based on its own catchment area. That is, we take the ratio between the number of cases treated in the focal hospital and the number of total cases treated within the catchment area.\(^{16}\) Next, we proceed to sum market shares between each pair that is formed across markets. In average, the joint market shares between pairs is 18%, while the market shares in terms of number of deaths is 5%.

Figure 2 depicts the evolution of our measures of differentiation from 2009 to 2017. The white area in the middle corresponds to our first measure of differentiation, \( d_0 \). The shaded area corresponds to our second measure of differentiation, \( d_1 \), and the dotted area corresponds to our third measure, \( d_2 \). Figure 2 suggests that there is an increase in the number of pairs where only one of the pair provides a services. This increase in differentiation is accompanied by an increase in the number of pairs that do not offer the same service. As the sum across these measures of differentiation needs to be equal to one, the increase in measures \( d_0 \) and \( d_1 \) come at the detriment of \( d_2 \). The share of pairs providing both the same service decreases across time. The evolution of the joint market shares, in activity and in the number of deaths, is reported by Figure 3. As opposed to

\(^{16}\)This is done for each hospital, including private and public hospitals.
the differentiation in terms of services provided, there is no apparent trend in hospitals
joint market shares.

Table 6: Summary statistics – average measured per market

<table>
<thead>
<tr>
<th></th>
<th>mean</th>
<th>s.d.</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td># Hospitals providing a service per market</td>
<td>37.70</td>
<td>31.56</td>
<td>1.00</td>
<td>111.00</td>
</tr>
<tr>
<td>Catchment area (min)</td>
<td>44.55</td>
<td>25.64</td>
<td>5.31</td>
<td>183.10</td>
</tr>
<tr>
<td>Distance to competitor</td>
<td>24.18</td>
<td>18.37</td>
<td>0.03</td>
<td>163.90</td>
</tr>
<tr>
<td>% One of the pair providing the service ($d_0$)</td>
<td>0.33</td>
<td>0.47</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>% Both pairs providing the service ($d_1$)</td>
<td>0.37</td>
<td>0.48</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>% Neither pair providing the service ($d_2$)</td>
<td>0.30</td>
<td>0.46</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Pair joint market shares per service</td>
<td>0.18</td>
<td>0.27</td>
<td>0.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Pair joint death market shares per service</td>
<td>0.05</td>
<td>0.20</td>
<td>0.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Notes: Markets are defined per service using each focal clinic’s catchment area. The variable on the number of hospitals includes all private and public hospitals within the catchment area of a focal clinic. All pairs are formed within a market. Joint market shares (and death market shares) correspond to the sum between the market shares across pairs of clinics. Hospital market shares are computed on the basis of each individual catchment area.

Figure 2: Measures of differentiation from 2009 to 2017
5.3.2 Estimation sample and ownership changes

As we are interested in assessing whether a change from separate to common ownership of a pair of clinics tends to differentiate the services by parties, we report in this subsection the variation that we intent to use. From 510 focal clinics in our data, there are 63 focal clinics that merged with competitor belonging to its catchment area, 158 clinics that were not exposed to any merger and 289 that were indirectly exposed to a merger (i.e., a competitor was directly exposed, but the focal clinic was not).

We create two complementary measures to assess the impact of changes in ownership in our data. First, we create a dichotomous variable that is equal to one if a pair of hospitals are commonly owned, and it is equal to zero otherwise. This variable identifies whether parties within a pair are commonly owned or not; we label this variable "common ownership". Next, we create a second dichotomous variable that is equal to one if two conditions are satisfied: (1) both parties are not commonly owned; (2) either party in the pair experienced an ownership change; the variable is zero otherwise. This variable identifies pairs of competitors where either party ever experienced a change in ownership; we label this variable "competitor merged".

Figure 4 reports on the evolution between 2009 and 2017 of our two measures of changes in ownership is our data. The solid line corresponds to the percentage of pairs of hospitals within each market that are commonly owned. The dashed line corresponds to the percentage of pairs of competitors where only one hospital experienced a change in ownership. Between 2009 to 2017, common ownership has increased from 4% to 6.5%, while the number of pairs were a competitor has experienced an ownership change increases from zero to close to 60%. The sharp difference across these two measures stems from the fact that the majority of transactions occur in markets were there is no previous ownership by the acquiring firm.
Figure 4, however, reports an aggregate measure of ownership. In fact, there are two ways that a pair of clinics may be jointly owned. First, two clinics may belong to the same owner as defined by their legal status. That is, both clinics share the same legal identifier, and hence, are the same moral entity. This type of common ownership is usually performed between two nearby clinics. Second, two clinics may belong to the same hospital system. The first type of ownership is a necessary condition the second type, while the second type of ownership is a sufficient condition for the first type. This means that, if both clinics belong to a same system, it might be the case that they do not share the same moral entity. While, if two clinics share the same legal identifier, if one of the clinics belong to a system, the other does too.

To account for this, Figure 5 reports on the common and competitors’ ownership changes distinguishing between the two types of ownership. The dotted line and the long-dashed line correspond to the competitors’ change of ownership through a hospital system and a local ownership change, respectively. The solid line and the small-dashed line correspond to the common ownership change through a hospital system and a local ownership change, respectively. Across time, most of the variation comes from the hospital system type of ownership.

Figure 4: Evolution of common and competitors’ ownership changes
6 Empirical Implementation

This section presents the main specification results, examining the effects of ownership on positioning understood as differentiation in the offering of health services of pairs of hospitals.

6.1 Differentiation in product assortment

The first set of regressions study whether commonly owned clinics differentiate their services more than those independently owned private hospitals. We compare all pairwise combinations between hospitals in a given local geographical market. We use a linear fixed effects specification, as defined below

\[ d_{hh'gt} = X_1_{ijt}\beta_0 + (X_1_{hh't} \times Z_{hh'})\beta_3 + X_2_{hh't}\beta_2 + (X_2_{hh't} \times Z_{hh'})\beta_3 + \delta_t + \delta_{hh'g} + \epsilon_{hh'gt}, \]

where \( d_{hh'gt} \) is a measure of differentiation between hospital \( h \) and \( h' \) for service \( g \) in the year \( t \); \( X_1_{hh't} \) is a dummy variable taking the value ‘1’ when focal clinic \( h \) and hospital \( h' \) have the same owner in year \( t \); \( X_2_{hh't} \) is a dummy variable taking the value ‘1’ when the focal clinic \( h \) is facing a competitor and either the focal clinic or the competitor merged in year \( t \); and \( Z_{ij} \) are hospital pair distances. Hospital pair distances account for increased competitive pressure between pairs. We include year fixed effects, \( \delta_t \), this allows to account for any possible trends in differentiation observed in the industry, occurring independently of mergers. In addition, we include hospital-pair-service fixed effects, \( \delta_{hh'g} \), which account for fixed differences between hospital-pair services. Finally, \( \epsilon_{hh'gt} \) rational-
izes the remaining idiosyncratic variation across pairs of hospital per service. Standard errors are clustered on the department level.\textsuperscript{17} Given that we are controlling for hospital-pair fixed effects, the common ownership coefficient is identified by changes in common ownership. There are 63 market zones, where the focal clinic merges with its close competitor. These changes in common ownership identify our parameter of interest.

\section*{6.2 Results}

Table 7 reports the estimated coefficients for our differentiation measure as described by equation (14). An observation is the estimation is a pair-of-hospitals-service-year, where we defined pair of hospitals as in section 5.3.2 and services as defined in section 5.2. The dependent variable in all regressions is a variable assessing the differentiation between pairs of hospitals, as described by equation (12).

The first three columns present estimates from fixed-effects OLS regressions. All regressions include hospital-pair-service fixed effects and time fixed effects. The former controls for pair-specific differences for a particular service, while the latter control for yearly trends. The coefficients are identified from within hospital-pair-service variation, i.e., the correlation between pair’s product offering and changes in ownership over time. Most of the coefficients are statistically significant. The effects on differentiation by competitors facing a merger and the effects of the competitive pressure (as measured by distance) are modeled in columns (2) and (3), respectively.

Results suggest that following a change from separate to common ownership hospitals re-position their services away from each other, which is expressed by the increase in the probability of offering distinct services. Moreover, the results are significantly different from zero for merging clinics located closer to each other. In addition, we find no significant effect on re-positioning between clinics facing a competitor that changes ownership and their competitors. Results when allowing for distance heterogeneity between pairs suggest that closer competitors tend to differentiate, while distant competitors tend to homogenize.

In the next three columns, we examine the results by type of service; each regression uses data from the indicated category of service. They aim to capture the impact of ownership changes on our measure of differentiation across different type of services. All specifications are as in column (3). That is, these regressions also include hospital-pair-fixed effects, to control for pair-service heterogeneity, and time fixed effects to control for yearly trends. Most coefficients from Medicine and Surgery are statistically significant, while from Obstetrics they are not. Results suggest that following a change from separate to common ownership hospitals re-position their services away from each other only in Medicine and Surgery, but not in Obstetrics. This re-positioning occurs for hospitals that

\textsuperscript{17}This allows for heteroskedasticity, time-series correlation within pairs and cross-sectional correlation across pairs in the same department.
are closer to each other. Similarly, for a pair of competitors where one party changes ownership, differentiation occurs more often in Surgery than in Medicine or Obstetrics. The effect is more pronounced for closer competitors.

Table 8 reports the estimated coefficients for our differentiation measure as described by equation (14), on a different outcome. All the specifications repeat those of table 7, changing the dependent variable to the joint markets of pairs of hospitals. We use the logarithm of the joint market shares to test whether the observed changes in positioning are associated with a redistribution of patients across hospitals. The signs of the coefficients are as expected, but not all are statistically significant. The coefficients suggest that after a change from separate to common ownership, the hospitals joint market shares decrease by 3%. Similarly, market shares from pairs of competitors decrease by 2% after one party changes ownership.

7 Robustness checks

Figure 6 looks more closely at the timing of the increase in differentiation, based on pairs that experience a switch from separate to common ownership (i.e., a merger). The regression specification includes a set of dummies to measure differentiation relative to the year of the change of ownership. The figure shows the estimated coefficients and 95% confidence intervals using the angle measure as the dependent variable. There is no trend in differentiation prior to a merger. This provides some reassurance that mergers are not caused by some preexisting, but unobserved, factor that also affects positioning.\textsuperscript{18} Differentiation increases in years following a merger, all the coefficients are significant with a 10% level. The differentiation occurs gradually rather than as a step function. This might be explained by the potential frictions that might be introduced when re-allocating patients across hospitals. Provided limited resources, re-organization costs might be spread overtime closing some services sooner than others.

Figure 7 shows how differentiation between a pair of hospitals changes around the time of a merger affecting one party of the pair. There is no trend in differentiation prior to the merger, whereas the pair of competitors become more differentiated in the following years. All the coefficients are significant at 10% level. As for hospitals changing from separate to common ownership, softening of the competition is done gradually. However, we are not able to distinguish which party of the pair engages in softening of the competition.

\textsuperscript{18}It is important to note that, even though, ownership changes might cause the observed changes in differentiation, hospitals experiencing ownership changes may not be representative. We are currently testing whether hospitals characteristics were similar prior to the merger.
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**Notes**: Markets are defined per service using each focal clinic’s catchment area. The variable on the number of hospitals includes all private and public hospitals within the catchment area of a focal clinic. All pairs are formed within a market.
Table 8: Market Shares After Change in Common Ownership

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Notes: Markets are defined per service using each focal clinic’s catchment area. The variable on the number of hospitals includes all private and public hospitals within the catchment area of a focal clinic. All pairs are formed within a market. Joint market shares correspond to the sum between the market shares across pairs of clinics. Hospital market shares are computed on the basis of each individual catchment area.
Figure 6: Joint Death Market shares of Pairs Experiencing a Change in Common Ownership

Figure 7: Joint Death Market shares of Pairs Experiencing a Change in Common Ownership
8 Conclusion

This paper provide insights on the impact of mergers on the re positioning of hospital services using two complementary approaches. First, we build a theoretical framework where multiproduct firms are allowed to change their product assortment and compete in quality. Second, we exploit a rich database on the French hospital industry for the years 2009-2017.

To our knowledge, no economic studies have attempted to evaluate the economics effects of mergers and acquisitions in the hospital industry on service re-positioning. We contribute to the existing literature on the use of positioning of products/services health services as a competitive tool. We believe that such studies can help competition authorities improve their assessment of potential effects of mergers by accounting for another dimension of competition.

Our theoretical findings show that following a merger, profit maximizing hospitals distance themselves from each other by re-positioning their health services offered. This non-cannibalization strategy is in line with an internalization the inter-hospital competition. To further decrease the competitive pressure, the merged hospital decides to close off the service closest to its competitors. However, as opposed to a case with no product re-positioning, we find that merging and non-merging hospitals increase their qualities after post-merger. Economies of scales, typical in the hospital industry, lead to increases in quality due to the larger volume of patients served by each remaining service.

Finally, the effect on consumers surplus is ambiguous. Two opposing effects are at play. On one hand, effects as the quality delivered in each remain service increases. On the other hand, there is fewer variety available in the market requiring patients to travel longer distances to get an, albeit, better quality service. Ultimately, the effect on consumers’ surplus depend on whether the availability adjusted-quality is higher after the merger.

The predictions of the model are then confronted with data on the French hospital industry. Our theoretical predictions are consistent with our empirical results. We find that merging firms re-position themselves away from each other by reducing the offer of same groups of services. This is in line with hospitals wanting to avoid cannibalization of their services. Differentiation also occurs with respect to competitors. We find evidence of differentiation behavior between pairs of competitors after one party in the pair changes ownership. This strategy is consistent with a strategy of seeking to soften competition.
References


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