Labor and Product Market Power, Quality of Care, and the Consolidation of the US Hospital Industry*

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Abstract

This paper analyzes, both theoretically and empirically, how hospitals leverage their simultaneous gains in market share over patients and workers through consolidation. I develop a framework for merger evaluation in which firms exploit both oligopoly power in the product market and oligopsony power in the labor market. The model allows firms to endogenously choose product quality, and shows that optimal quality provision depends on labor market power. From the model, I predict the effects of hospital mergers on patient and worker outcomes. Empirically, I combine several administrative panel data sources on the universe of hospitals over 1996-2022. Utilizing a propensity-score matched difference-in-differences design, I estimate the extent to which oligopoly and oligopsony power are exploited after merger events. Confirming the predictions of the model, I find that merging hospitals not only raise prices and lower wages after consolidating, but also reduce the number of patients treated, the number of workers employed, and the quality of care provided to each patient. Patients face worse staffing ratios, report lower satisfaction with their care, and experience greater mortality. Merger spillovers lead competitors in the local market to cut wages even as they increase employment, and the number of patients who fail to receive treatment and workers who fail to attain employment in the local market rises.

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1 Introduction

The healthcare sector accounts for nearly 20% of US GDP and employs more workers than any other sector. Within this sector, hospitals are responsible for nearly all inpatient care, playing a fundamental role in Americans' lifetime welfare and mortality.[1] This market has been concentrated by a massive consolidation wave in the 21st century, such that today the median commuting zone has only three hospitals.[2] This recent wave of mergers raises the concern that hospitals have important price-setting power. The concern is heightened by the fact that inpatient care is inherently urgent and geographically constrained, such that patients have limited flexibility to shop for lower prices. Recent studies by Dafny, Ho, and Lee (2019), Cooper, Craig, Gaynor, and Van Reenen (2019), and Brand, Garmon, and Rosenbaum (2023) indeed document significant price increases following hospital mergers, suggesting that hospitals exercise local oligopolies over millions of vulnerable patients.

While increasing prices following hospital mergers have received attention, hospital concentration raises equally concerning issues in the labor market. Healthcare occupations typically require specialized training and certifications that have limited value outside of the hospital setting—both for patient care workers, such as nurses, and non-patient care workers, such as hospital administrators—implying inelastic local labor supply.[3] Mirroring patient markets, mergers have substantially lowered the number of distinct hospital systems competing for workers in local labor markets. A natural concern is that hospitals exploit these gains in labor market share to suppress wages and employment levels below competitive benchmarks. Furthermore, the staffing ratio—the number of workers per patient—is a key determinant of the quality of care received by patients. If hospitals exploit labor market power by cutting employment, patients may be harmed not only by rising prices but also by reduced quality of care, leading to worse medical outcomes.

This paper analyzes, both theoretically and empirically, how hospitals leverage

[1] Inpatient treatments are those that require patients to be hospitalized at least one night.

[2] I document that, out of the fewer than 4,000 general-purpose hospitals in the US, there were more than 1,100 hospital consolidations between 2000 and 2018, roughly half of which were mergers among hospitals in the same local market. The hospitals involved in these mergers account for about 70% of all inpatient care and 70% of all employment in this industry.

[3] For example, using resume data, Schubert, Stansbury, and Taska (2024) find that workers in healthcare occupations are the least outwardly mobile to other occupations.

their simultaneous gains in market share over patients and workers through consolidation. I develop a framework for merger evaluation in which firms exploit both oligopoly power in the product market and oligopsony power in the labor market. The model allows firms to endogenously choose product quality, and shows that optimal quality provision depends on labor market power. Empirically, I combine several administrative panel data sources on the universe of hospitals over 1996-2022. Utilizing a propensity-score matched difference-in-differences design, I estimate the extent to which oligopoly and oligopsony power are exploited after merger events.

My structural framework for merger evaluation has three key components. First, it takes as a starting point the modern framework for the evaluation of horizontal mergers for product market concentration in industrial organization.[4] Firms face a downward-sloping product demand curve which becomes more inelastic as the firm gains product market share, leading to stronger price markups after horizontal mergers. Second, I add a rich model of the local labor market in which workers have horizontally-differentiated preferences over employers.[5] Firms face an upward-sloping labor supply curve which becomes more inelastic as the firm gains labor market share, leading to stronger wage markdowns after horizontal mergers. Third, patient care is heterogeneous both in price and quality, and—through the staffing ratio—workers are utilized to provide quality. Quality provision inherits an upward-sloping marginal

[4]For leading examples, see Houde (2012), Björnerstedt and Verboven (2016), and Miller and Weinberg (2017). This literature assumes the marginal cost is constant and product quality is predetermined, which are among my points of departure. For an alternative approach in the dialysis industry, see Wollmann (2024), who permits endogenous product quality with increasing marginal costs, but assumes prices are fixed and the marginal cost curve does not shift in response to mergers.

[5]For models of the labor market in which workers view employers as imperfect substitutes, see Card, Cardoso, Heining, and Kline (2018) and Lamadon, Mogstad, and Setzler (2022) for the monopsonistic competition case in which employers cannot exploit labor market concentration, and see Berger, Herkenhoff, and Mongey (2022), Roussille and Scuderi (2024), and Chan, Kroft, Mattana, and Mourifié (2024) for the oligopsonistic case in which employers may exploit labor market concentration. These papers do not combine product market power and labor market power, which is among my points of departure. Recent work by Kroft, Luo, Mogstad, and Setzler (2025) combines a monopsonistic competition labor market and monopolistic competition product market, but does not permit a role for concentration and therefore cannot be used for merger evaluation. Related, Yeh, Macaluso, and Hershbein (2022) and Rubens (2023) provide results on the measurement of wage markdowns under minimal assumptions about the labor and product markets, but do not fully specify economic models that could be used for predicting the effects of mergers.

cost curve from the labor market, and mergers that change labor market share shift the marginal cost curve for quality.

From the equilibrium model, I derive several propositions that characterize how the outcomes of patients and workers are impacted by hospital mergers. First, I show that hospital mergers impact the merging hospitals through two channels: *labor market diversion*, in which hospitals internalize the costs imposed on other hospitals in the same ownership system in the competition over local workers, and *product market diversion*, in which hospitals internalize the revenues lost by other hospitals in the same ownership system in the competition over local patients. Due to these two diversion effects, mergers lead hospitals to raise prices and cut wages, while reducing the number of patients treated and the number of workers employed. These two effects reinforce one another: the labor diversion effect amplifies the increase in prices and reduction in number of patients treated, while the product diversion effect amplifies the reductions in wages and employment.

Second, I show that hospital mergers have *spillovers* on other hospitals in the local market. From the perspective of local competitors, both the product demand curve and the labor supply curve shift outward, allowing competitors to raise prices and cut wages for any level of output. Local competitors re-optimize to treat more patients, employ more workers, and increase profits. However, since marginal costs fall and marginal revenues rise, it is ambiguous whether prices or wages rise or fall at local competitors. At the same time, the outside option share—patients who fail to receive treatment and workers who fail to attain employment in the local market—unambiguously rises.

Third, I show that an increase in the *labor* market share due to a merger impacts *patients* by incentivizing the hospital to reduce quality of care, providing another channel through which labor and product markets interact. As the hospital gains labor market power over workers, the labor diversion effect implies that it is more costly to provide a high staffing ratio for any given number of patients. However, the merger also reduces the number of patients treated, which may counteract the decline in labor in the staffing ratio. I characterize conditions under which quality of care falls after the merger. Incorporating both patient care and non-patient care occupations in the model, I show that the staffing ratio unambiguously declines after a merger if the elasticity of patients treated with respect to patient care labor is less than the share of hospital workers in patient care occupations.

Empirically, I investigate the impacts of hospital mergers using a comprehensive panel dataset on the universe of general-purpose hospitals in the US from 1996 to 2022. This dataset combines administrative records on hospital revenues and costs by broad patient category, employment hours and wages by broad occupational category, the ownership structure and consolidation events, patient satisfaction surveys, patient case mix index, risk-adjusted mortality rates, and markets. Using this information, I construct market concentration for each hospital labor and product market as well as the changes in market concentration induced by mergers. For the purposes of the empirical analysis, I classify hospital mergers as "presumed anti-competitive" if they meet the current thresholds utilized by US courts (US DOJ and FTC, 2023). I show that the majority of within-market hospital mergers exceed the presumed anti-competitive thresholds, both for the labor market and for the product market.

Utilizing a difference-in-differences design around hospital mergers matched on propensity score, I confirm—and put magnitudes on—the predictions of the model among presumed anti-competitive mergers. First, within the merging hospitals, I find that prices increase by approximately 6% while the number of patients treated decreases by 11%.[6] In the labor market, wages decrease by nearly 2% while employment levels fall by 9%. I find strongly negative wage and employment effects for both patient care occupations—nurses, nursing aids, and physicians—and non-patient care occupations—administration, food services, sanitation, and maintenance.[7]

I also implement a spillover design, in which I compare the local competitors of merging hospitals to comparable hospitals in other regions. I find that local competitors decrease wages by 1% yet increase employment by 4% and increase the number

[6]Dafny et al. (2019), Cooper et al. (2019), and Brand et al. (2023) estimate comparable price increases following hospital mergers using several data sources. These papers and the related empirical literature do not report a significant decrease in number of patients treated, which is an important effect for characterizing oligopoly power. A related literature studies the bargaining between insurers and hospitals, as well as between insurers and employers, in the setting of hospital prices and coinsurance rates (Gowrisankaran, Nevo, and Town, 2015; Ho and Lee, 2017). Our model of direct oligopoly power of hospitals over patients can be viewed as the reduced-form relationship that results from this bargaining process.

[7]Prager and Schmitt (2021) find a similar decline in wages after hospital mergers among certain non-patient care occupations—especially nursing administrators and pharmacists, which they refer to as "nurses and pharmacists" for short (see the definition on page 1 of their appendix). However, they do not report estimated wage effects for patient care workers, such as nurses, and do not find significant effects on hospital employment, which are important for characterizing oligopsony power.

of patients treated by 6%, consistent with the model's predictions.[8] Aggregating across all hospitals in the market, I find that the total number of patients receiving care declines by 2-3% in the short-run and the total number of workers employed in the market also declines by 2-3%. Consistent with the predictions of the model, the number of patients who fail to receive treatment and workers who fail to attain employment in the local market rises.

Lastly, I find a substantial deterioration in the quality of care in the merging hospitals, whether using input-based or outcome-based measures. The staffing ratio declines by more than 5%, while patient satisfaction ratings decrease by approximately 2%.[9] Decomposing the patient satisfaction ratings, patients note worse sanitation in the hospital as well as worse post-care instructions and communication from doctors. Most concerning, risk-adjusted mortality rates within 30-days of being treated by the merging hospitals for heart failure or pneumonia increase by 0.5-1 percentage points, relative to national mortality rates of 12-14%. To place this estimate in context, Cooper, Doyle, Graves, and Gruber (2022) find that a one standard deviation increase in the hospital price distribution results in about a 0.5 percentage point decrease in the mortality rate, implying that the worse mortality rates after hospital mergers are large relative to the distribution.

In a future update to this working paper, I will estimate the model parameters. I will do so by simulating merger effects from the model for the hospitals observed in the data, and matching the predicted merger effects to the difference-in-differences estimates using the simulated method of moments. Then, I will use the estimated model for two purposes. First, I will examine the welfare effects of mergers on patients, workers, and hospitals using compensating variation measures defined using the model. Second, I will examine how the predicted effects of mergers would change if we were to shut down labor market power or shut down quality adjustments. These are relatively simple but informative exercises to help quantify the importance of accounting for labor market power and endogenous quality in merger evaluation.

[8]Recent papers by Sharma (2023) for Brazilian textile manufacturing, Roussille and Scuderi (2024) for US tech workers, and Derenoncourt and Weil (2025) for large US retailers test for wage-setting spillovers in local labor markets. They do not find evidence of spillovers in those industries.

[9]Hackmann (2019) studies staffing ratios in the Pennsylvania nursing home industry, finding little responsiveness to changes in competition. Beaulieu, Dafny, Landon, Dalton, Kuye, and McWilliams (2020) find a similar decline in patient satisfaction following hospital mergers.

2 A Model of Mergers for Labor and Product Market Power with Endogenous Quality

In this section, I develop a model of mergers in the hospital industry. Hospitals simultaneously exploit product and labor market power by leveraging their market shares over patients and hospital workers, respectively. Hospitals hire both patient care and non-patient care labor, and utilize staffing ratios to endogenously provide quality of care to patients. Given this environment, I derive comparative statics that characterize the effects of hospital mergers on the outcomes and welfare of patients, workers, and hospital owners.

2.1 Labor Supply, Product Demand, and Technology of Care

Product Demand. Patient i's utility from being treated by hospital h in market m and time t is,

$$u_{iht}^{Q} = -\beta_P P_{ht} + \beta_Y Y_{ht} + \xi_{ht}^{Q} + \varepsilon_{iht}^{Q}. \tag{1}$$

There are four components to patient utility. The first captures the price of treatment, P_{ht}, multiplied by the relative preference for money, β_P. The second captures the observable quality of care provided by the hospital, Y_{jt}, multiplied by the relative preference for quality, β_Y. I assume that Y_{jt} is observed by both the analyst and the patients, and is endogenously chosen by the hospital, subject to constraints described below. The third, ξ_{ht}^{Q}, captures the residual component of hospital quality that is unobserved by the analyst but observed by patients. As is standard, I treat residual quality as pre-determined. Combined, $\beta_Y Y_{ht} + \xi_{ht}^{Q}$ characterizes vertical differentiation in quality across hospitals. The fourth, ε_{iht}^{Q}, represents patient i's match-specific taste for hospital h and is assumed to have the standard Gumbel distribution. These patient-hospital-specific tastes are unobserved by the hospital but observed by the patient, giving rise to horizontal product differentiation.

Aggregating across the distribution of match-specific tastes, the product demand of hospital h can be expressed in terms of the market share as,

$$s_{ht}^{Q} \equiv \frac{Q_{ht}}{\bar{Q}_{mt}} = \frac{\exp\left(-\beta_P P_{ht} + \beta_Y Y_{ht} + \xi_{ht}^{Q}\right)}{1 + \sum_{h'} \exp\left(-\beta_P P_{h't} + \beta_Y Y_{h't} + \xi_{h't}^{Q}\right)} \tag{2}$$

where $\bar{Q}_{mt}$ denotes the total number of patients in market m at time t.[10]

Labor Supply. I consider two broad occupational categories within hospitals: patient care and non-patient care. Patient care workers (physicians, nurses, and nursing aides) directly provide treatment to patients, while non-patient staff (administration, sanitation, food services, maintenance) support hospital operations. The number of patient care workers employed by the hospital is denoted by L_{ht} and the number of non-patient care workers employed by the hospital is denoted by N_{ht}. The wage offered to patient care workers is denoted by W_{ht}^L and the wage offered to non-patient care workers is denoted by W_{ht}^N.

In labor market m at time t, the preference of worker j of occupation type E for working at hospital h is,

$$u_{jht}^E = \gamma_E \log\left(W_{ht}^E\right) + \xi_{ht}^E + \varepsilon_{jht}^E, \quad E = L, N. \tag{3}$$

This specification of labor preferences has three components. First, the term $\log\left(W_{ht}^E\right)$ captures diminishing marginal utility of income, and labor supply of occupation E is more elastic when the coefficient γ_E is greater. Second, hospital-occupation-specific job quality ξ_{ht}^E represents the value of amenities enjoyed by all workers in the hospital and occupation. These amenities are unobserved to the analyst but common knowledge among workers, giving rise to vertical employer differentiation. The value of amenities may differ between patient and non-patient workers (i.e., $\xi_{ht}^L \neq \xi_{ht}^N$). Third, ε_{jht}^E represents worker j's idiosyncratic and match-specific taste for the amenities of hospital h and is assumed to have the standard Gumbel distribution. These worker-hospital-specific tastes are unobserved to the hospital but known to the worker, giving rise to horizontal employer differentiation.

Aggregating across the distribution of match-specific tastes, the labor supply to hospital h in occupation E can be expressed in terms of the market share as,

$$s_{ht}^E \equiv \frac{E_{ht}}{\bar{E}_{mt}} = \frac{\exp\left(\gamma_E \log\left(W_{ht}^E\right) + \xi_{ht}^E\right)}{1 + \sum_{h'} \exp\left(\gamma_E \log\left(W_{h't}^E\right) + \xi_{h't}^E\right)}, \quad E = L, N, \tag{4}$$

where $\bar{E}_{mt}$ denotes the total number of workers of type E in market t.

[10] As is standard, I normalize the outside option to have utility of zero without loss of generality. Below, the analogous normalization is used for the outside option in each labor market.

Technology of Care. To treat Q_{ht} patients, the amount of patient care labor required is determined by the patient care technology,

$$Q_{ht} \leq T_{ht}(L_{ht}) \tag{5}$$

where $T_{ht}(\cdot)$ is the treatment function, which is strictly increasing in the number of patient care workers. I allow that the treatment function may vary across hospitals and time, allowing that some hospitals are more efficient than others. The hospital also combines patient care labor, non-patient care labor, and the number of patients to determine the staffing ratio. I assume the staffing ratio is directly utilized to provide quality,

$$Y_{ht} \leq \frac{L_{ht} + N_{ht}}{Q_{ht}}, \tag{6}$$

where the right-hand side term is the staffing ratio.

Before proceeding, it is useful to emphasize the differences in functional form between the two care technologies. I have assumed that non-patient care workers cannot be substituted to provide patient care, such that N_{ht} is excluded from the patient care technology. This assumption reflects the reality that administrators and support staff typically cannot perform clinical duties. By contrast, I have assumed that patient care and non-patient care workers are perfect substitutes in the provision of quality, as the staffing ratio is formed from the sum of the two types of labor. This may be a reasonable approximation, e.g., if a nurse and a food services worker are equally effective in feeding a patient, or if a nurse and an administrator are equally effective in recording patient records. I provide empirical evidence in Section 3 that both L_{ht}/Q_{ht} and N_{ht}/Q_{ht} are positively correlated with observable measures of quality of care, supporting this specification.

Multi-hospital System's Problem: Hospital system H owning the set of hospitals $\mathcal{H}_H$ solves the following problem:

$$\max_{\{Q_{ht},Y_{ht},L_{ht},N_{ht}\}_{h\in\mathcal{H}_H}} \sum_{h\in\mathcal{H}_H} \left(P_{ht}Q_{ht} - W^L_{ht}L_{ht} - W^N_{ht}N_{ht}\right) \tag{7}$$

subject to product demand, the labor supply of each occupational category, the patient care technology, and the quality of care technology. I suppose that hospitals compete à la differentiated-Cournot in both the product and labor markets, competing on number of patients to treat and number of workers to employ in each occupation.

For the purposes of the comparative statics discussed below, differentiated-Bertrand and differentiated-Cournot conducts yield similar qualitative predictions, only differing in magnitudes.

2.2 Comparative Statics for Mergers, given Quality

In this subsection, I characterize how mergers among hospitals in the same market affect the price-setting and wage-setting behavior of both the merging hospitals and their competitors. Additional mathematical details are provided in the appendix. In this subsection, I do not yet account for endogenous quality provision for two reasons. First, I find it more transparent to solve the model taking quality as given before extending the results to incorporate endogenous quality in the next subsection. Second, it is rare to account for endogenous quality in merger evaluation—especially outside of the healthcare context—so these results may be applicable in a wider range of empirical settings.

Let $\text{MP}^L_{ht} \equiv \frac{\partial T_{ht}(L_{ht})}{\partial L_{ht}} > 0$ denote the marginal product of patient care labor, $\theta^L_{ht} \equiv \frac{W^L_{ht}}{s^L_{ht}} \frac{\partial s^L_{ht}}{\partial W^L_{ht}} > 0$ denote the labor supply elasticity of patient care labor, and $\theta^Q_{ht} \equiv \frac{P_{ht}}{s^Q_{ht}} \frac{\partial s^Q_{ht}}{\partial P_{ht}} < 0$ denote the product demand elasticity of patients. Impose that $\beta_Y = 0$, such that patients do not value the endogenous component of quality, which in turn implies that $N_{ht} = 0$, as non-patient care workers produce no revenue if they cannot affect quality. In this case, the only quality of care component is the pre-determined factor, ξ^Q_{ht}. I have the following result:

Lemma 1. *Suppose quality of care is pre-determined. For a single-hospital system h, the first-order condition for profit-maximization is,*

$$\underbrace{\left(1 + 1/\theta^L_{ht}\right) \times W^L_{ht}}_{\equiv MC^L_{ht}} = \underbrace{\left(1 + 1/\theta^Q_{ht}\right) \times P_{ht} MP^L_{ht}}_{\equiv MR^L_{ht}}.$$

Furthermore,

$$\frac{\partial \theta^Q_{ht}}{\partial s^Q_{ht}} < 0 \quad \textit{and} \quad \frac{\partial \theta^L_{ht}}{\partial s^L_{ht}} < 0,$$

indicating that both product demand and labor supply become less elastic as the hospital gains market share in the product and labor market, respectively.

The following proposition follows immediately from Lemma 1:

Proposition 1. *Suppose quality of care is pre-determined. For a single-hospital system h, (a) the optimal price satisfies,*

$$P_{ht} = \overbrace{\left(1+1/\theta^Q_{ht}\right)^{-1}}^{markup_{ht}} \times \frac{MC^L_{ht}}{MP^L_{ht}} = \underbrace{\overbrace{\left(1+1/\theta^Q_{ht}\right)^{-1}}^{markup_{ht}} \times \overbrace{\left(1+1/\theta^L_{ht}\right)}^{markdown^{-1}_{ht}}}_{double\ markup_{ht}} \times \frac{W^L_{ht}}{MP^L_{ht}},$$

and the optimal wage satisfies,

$$W^L_{ht} = \overbrace{\left(1+1/\theta^L_{ht}\right)^{-1}}^{markdown_{ht}} \times MR^L_{ht} = \underbrace{\overbrace{\left(1+1/\theta^L_{ht}\right)^{-1}}^{markdown_{ht}} \times \overbrace{\left(1+1/\theta^Q_{ht}\right)}^{markup^{-1}_{ht}}}_{double\ markdown_{ht}} \times P_{ht} MP^L_{ht}.$$

(b) Furthermore, the markup and double markup depend on product market share as,

$$\frac{\partial(double\ markup_{ht})}{\partial s^Q_{ht}} > \frac{\partial(markup_{ht})}{\partial s^Q_{ht}} > 0,$$

while the markdown and double markdown depend on labor market share as,

$$\frac{\partial(double\ markdown_{ht})}{\partial s^L_{ht}} < \frac{\partial(markdown_{ht})}{\partial s^L_{ht}} < 0.$$

The first insight from Proposition 1 is that product market power, as measured by the markup relative to the productivity-adjusted wage, W^L/MP^L, is determined not only by the elasticity of product demand, θ^Q, but also the elasticity of labor supply, θ^L. Similarly, not only upward-sloping labor supply but also downward-sloping product demand are relevant and distinct sources of labor market power, as measured by the markdown of wages relative to the value of the marginal product, $P \times \text{MP}^L$. The left panel of Figure 1 provides an illustration of these results. This insight is similar to the main theoretical result of Kroft et al. (2025), but extended to allow for heterogeneous markups and markdowns that depend on market concentration.

The second insight from Proposition 1 is that, as the hospital gains market share in the product and labor market, its markup increases and its markdown decreases, indicating two sources of greater market power. Since labor and product market shares increase together through the patient care technology in equation (5), it follows that the double markup increases even more than the increase in the markup alone. This implies that, for the same change in hospital size, the effective gain in product

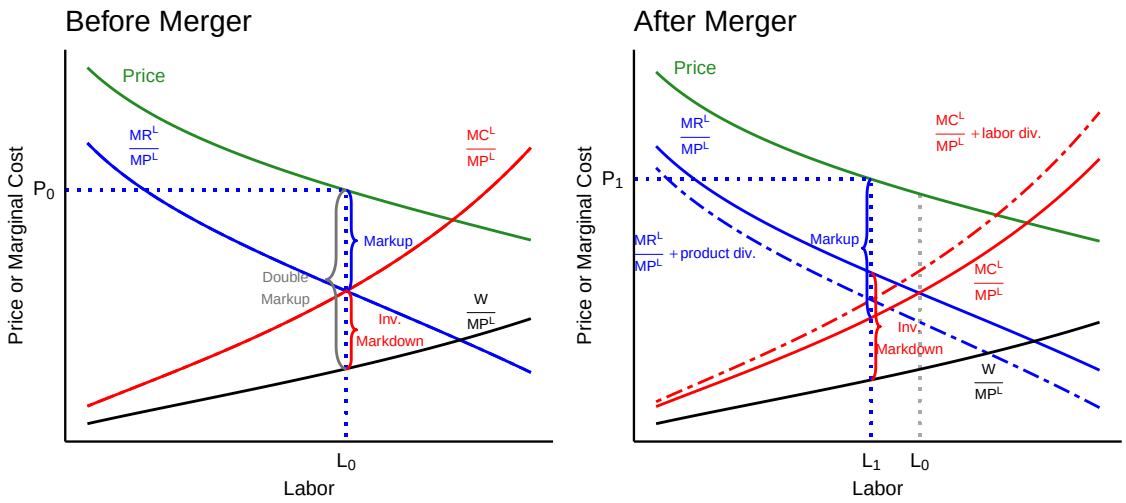


Figure 1: Price-setting in Response to a Merger

Notes: This figure demonstrates how the first-order condition for profit-maximization change from the perspective of hospital h in response to its merger with hospital g. Each diagram displays the number of patient care workers employed on the x-axis and the price for patients on the y-axis. The left diagram characterizes the price-setting decision without the merger, while the right diagram characterizes the price-setting decision with the merger. Appendix Figure A1 provides the analogous diagrams to characterize wage-setting rather than price-setting.

market power is greater if the firm also exploits its market share to markdown wages in the labor market. Similarly, the double markdown suppresses wages to an even greater extent than predicted by the markdown change alone if the hospital also exploits its market share to markup prices in the product market.

I now consider how the choices of hospitals change in response to a merger:

Lemma 2. *Suppose quality of care is pre-determined. If hospitals h and g merge to form a two-hospital system, the first-order condition for hospital h is,*

$$MC^L_{ht} + \underbrace{\frac{\partial W^L_{gt}}{\partial L_{ht}} L_{gt}}_{\text{labor diversion } (+)} = MR^L_{ht} + \underbrace{\frac{\partial P_{gt}}{\partial Q_{ht}} Q_{gt} MP^L_{ht}}_{\text{product diversion } (-)}$$

where MC^L_{ht} and MR^L_{ht} are defined in Lemma 1.

The key result in Lemma 2 is that, from the perspective of hospital h, there is effectively an increase in the marginal cost as well as a decrease in the marginal revenue when it merges with hospital g. I now provide intuition for these two channels.

The first channel, *labor diversion*, effectively increases the marginal cost of providing patient care. It expresses that, for hospital h to increase employment, it must offer a higher wage. When h offers a higher wage, some workers who would have chosen employment at hospital g are diverted to prefer hospital h. To maintain the same number of employees, hospital g must counter by increasing its wage for a given number of workers, which reduces the profits of hospital g. Since h values profits equally across h and g, it internalizes these lost profits at g as an increase in the marginal cost of hiring workers at h. The magnitude of the labor diversion effect is greater when s^L_{gt} is greater.

The second channel, *product diversion*, effectively decreases the marginal revenue of providing patient care. It expresses that, for hospital h to increase patients, it must offer a lower price. When h offers a lower price, some patients who would have chosen treatment at hospital g are diverted to prefer hospital h. To maintain the same number of patients, hospital g must counter by lowering its price for a given number of patients, which reduces the profits of hospital g. Since h values profits equally across h and g, it internalizes these lost profits at g as a decrease in the marginal revenue from treating patients at h. The magnitude of the product diversion effect is greater when s^Q_{gt} is greater.

Combined, product and labor diversion imply the following results:

Proposition 2. *Suppose quality of care is pre-determined. If hospitals h and g in market m merge at time t to form a two-hospital system, the following occurs in hospital h: (a) The number of patients decreases and price increases. (b) The number of workers decreases and the wage decreases. (c) The price markup increases and the wage markdown decreases. (d) Each of these effects is increasing in s^Q_{gt} and s^L_{gt}.*

The right panel of Figure 1 illustrates parts (a-c) of Proposition 2. In response to a merger, both labor diversion and product diversion effects shift the perceived marginal cost and marginal revenue curves, resulting in lower employment and fewer patients. Furthermore, since the product demand curve is downward-sloping and the labor supply curve is upward-sloping, a decrease in number of patients and employment imply a higher price and a lower wage. With a lower wage and higher marginal revenue, the markdown has decreased, and with a higher price and lower marginal cost, the markup has increased.

Lastly, I characterize how spillovers from the merger affect other competitors in

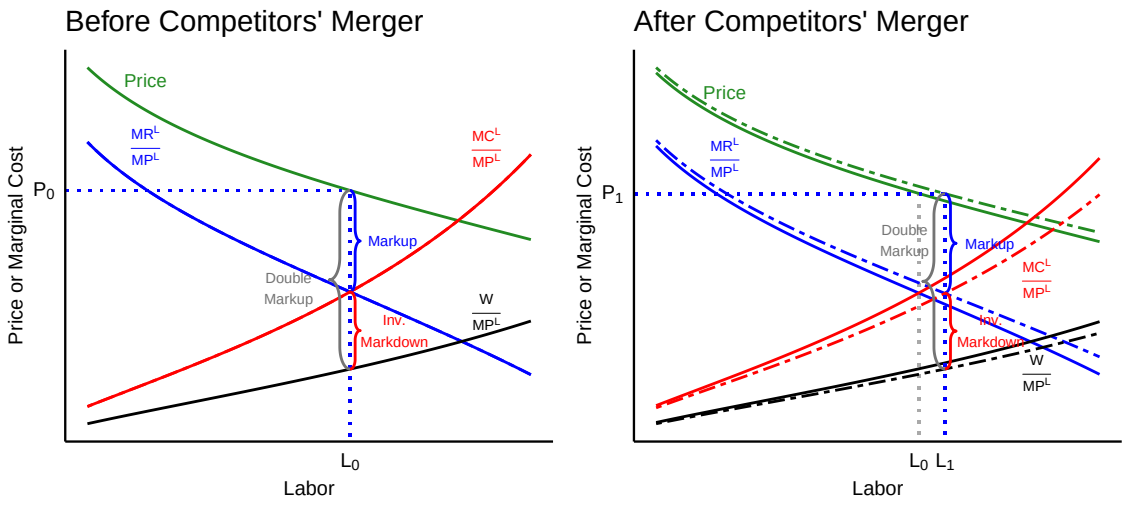


Figure 2: Spillover Effects of Mergers on Competitors in the Local Market

Notes: This figure demonstrates how the first-order condition for profit-maximization change from the perspective of local competitor j in response to a merger between two hospitals. Each diagram displays the number of patient care workers employed on the x-axis and the price for patients on the y-axis. The left diagram characterizes the price-setting decision without the merger, while the right diagram characterizes the price-setting decision with the merger. Appendix Figure A2 provides the analogous diagrams to characterize wage-setting rather than price-setting.

the local market:

Proposition 3. *Suppose quality of care is pre-determined. If hospitals h and g in market m merge at time t to form a two-hospital system, the following occur: (a) Each non-merging competitor j in the same market increases the number of patients treated and employment. (b) The magnitude of the increase in patients and employment in competitor j is greater when s_{gt}^{Q} and s_{gt}^{L} are greater. (c) The outside shares of both the product and labor market increase.*

The intuition for this proposition is provided by Figure 2, which characterizes the trade-offs faced by competitors to the merging hospitals. Since the merging hospitals optimally reduce the number of patients they treat and workers they employ, other hospitals in the same market experience an increase in patient demand – *product market spillovers* – as well as an increase in labor supply – *labor market spillovers*. Together, these spillovers lead to more patients being treated and more workers being employed in competitor hospitals. However, the decrease in patients and employment

in the merging hospitals is not fully compensated by the increase in patients and employment in competitor hospitals, implying that some patients go without treatment and some workers go without employment in the local market.

Before proceeding, note that Proposition 3 does not provide unambiguous predictions for whether prices and wages will rise or fall in competitor hospitals. Consider the product market: from the perspective of a competitor hospital, the product demand curve has shifted outward after the merger, so the price is higher for any number of patients. This is a force that raises the price. However, the number of patients increases until marginal revenue equals marginal cost, which is a force that lowers the price. If the marginal cost curve is steeper, a smaller increase in number of patients equates marginal revenue to marginal cost, so the price will not fall as far. On the other hand, the simultaneous outward shift in the labor supply curve implies that the price must fall further to equate marginal revenue and marginal cost. Thus, whether the price rises or falls in competitor hospitals is ambiguous and depends on several factors, including the slope and shift in the labor supply curve. Similarly, whether the wage rises or falls in competitor hospitals after a local merger depends on several factors, including the slope and shift in the product demand curve.

2.3 Endogenous Quality of Care in Hospital Mergers

I now allow for the endogenous provision of quality via the staffing ratio. In particular, I permit $\beta_Y > 0$ and let $\theta_{ht}^N \equiv \frac{W_{ht}^N}{s_{ht}^N} \frac{\partial s_{ht}^N}{\partial W_{ht}^N} > 0$ denote the labor supply elasticity of non-patient care workers. There are now two first-order conditions for profit-maximization, as shown in the following lemma:

Lemma 3. *Suppose quality of care is endogenous. For a single-hospital system h, the first-order condition with respect to patient care labor is,*

$$MC_{ht}^L = MR_{ht}^L + \underbrace{Q_{ht} \frac{\partial Y_{ht}}{\partial L_{ht}}}_{=1} \underbrace{\frac{\partial P_{ht}}{\partial Y_{ht}}}_{=\beta_Y/\beta_P},$$

where MR_{ht}^L and MC_{ht}^L are defined in equation (8). The first-order condition with respect to non-patient care labor is,

$$\underbrace{W_{ht}^N \times \left(1 + 1/\theta_{ht}^N\right)}_{\equiv MC_{ht}^N} = \underbrace{Q_{ht} \frac{\partial Y_{ht}}{\partial N_{ht}}}_{=1} \underbrace{\frac{\partial P_{ht}}{\partial Y_{ht}}}_{=\beta_Y/\beta_P}.$$

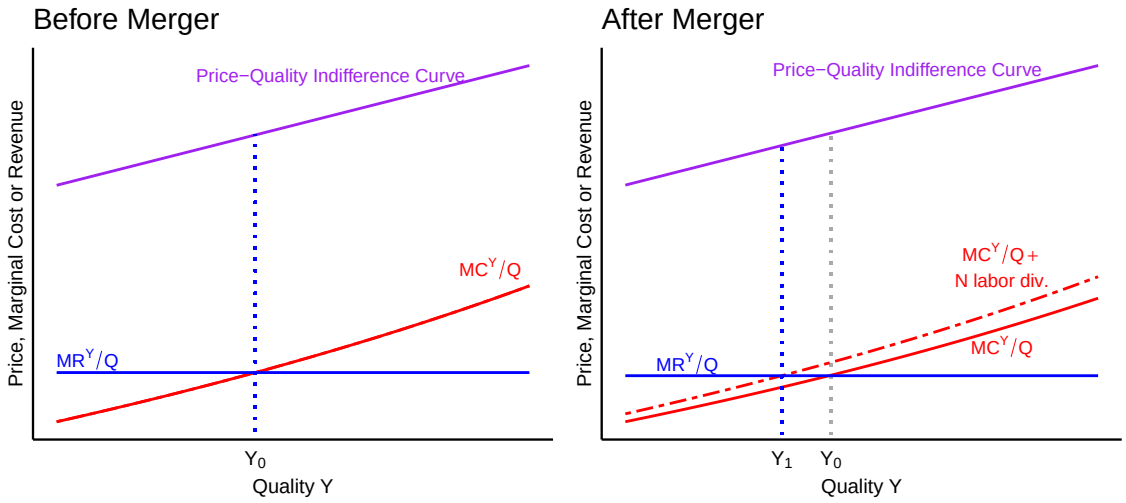


Figure 3: Endogenous Quality Response to a Merger

Notes: This figure demonstrates how the first-order condition for profit-maximization change from the perspective of hospital h in response to its merger with hospital g. Each diagram displays the staffing ratio on the x-axis and the price for patients on the y-axis, holding number of patients fixed. The left diagram characterizes the price-setting decision without the merger, while the right diagram characterizes the price-setting decision with the merger.

Intuitively, the term β_Y/β_P represents the patients' marginal rate of substitute between quality and money.[11] For each additional worker hired, quality increases by $1/Q_{ht}$, and the hospital can raise price by $(\beta_Y/\beta_P) \times (1/Q_{ht})$ for each of Q_{ht} patients, generating β_Y/β_P in additional revenue through the quality provision channel.

I now consider a merger between hospitals h and g:

Lemma 4. *Suppose quality of care is endogenous. If hospitals h and g in market m merge at time t to form a two-hospital system, the first-order condition for hospital h with respect to patient care labor is,*

$$MC^L_{ht} + \underbrace{\frac{\partial W^L_{gt}}{\partial L_{ht}} L_{gt}}_{\text{labor diversion } (+)} = MR^L_{ht} + \frac{\beta_Y}{\beta_P} + \underbrace{\frac{\partial P_{gt}}{\partial Q_{ht}} Q_{gt} MP^L_{ht}}_{\text{product diversion } (-)}$$

[11] It is analytically straightforward, but adds little instructive value, to allow a non-constant marginal rate of substitution between quality and money.

and the first-order condition for non-patient care labor is,

$$MC_{ht}^N + \underbrace{\frac{\partial W_{gt}^N}{\partial N_{ht}} N_{gt}}_{\textit{labor diversion (+)}} = \frac{\beta_Y}{\beta_P}.$$

Since the first-order condition for patient care workers is identical up to an additive constant, the intuition of Figure 1 remains unchanged.

Regarding non-patient care labor, the marginal revenue is unchanged by the merger, as the marginal rate of substitution between quality and money is unchanged from the perspective of patients. On the other hand, since non-patient care workers only serve to provide quality of care, the marginal cost of providing quality of care effectively rises due to the labor diversion effect. Figure 3 illustrates the hospital's quality of care decision. Holding the number of patients fixed, the price-quality indifference curve is represented by an upward-sloping relationship between quality and price, with constant slope β_Y/β_P, and thus constant marginal revenue curve. Quality is chosen to equate marginal revenue and cost. After a merger, the marginal cost curve shifts upwards, while the marginal revenue curve is unchanged, implying that marginal revenue and marginal cost are equated by a lower choice of quality.

While the first-order condition for non-patient care labor and the associated Figure 3 suggest that quality must decline after a merger, holding quantity of patients fixed, the actual effect of the merger on quality is more nuanced due to changes in quantity of patients. We can see from Lemma 4 that number of patient care workers declines in response to a merger, which implies a reduction in the quantity of patients treated. In turn, the decrease in quantity of patients depends on the patient care technology, $T_{ht}(L_{ht})$. Comparing the percentage change in $L_{ht} + N_{ht}$ to the percentage change in Q_{ht} is complicated due to the simultaneous decreases in L_{ht} and N_{ht}, whose magnitudes depend not only on the market shares in the product market and each labor market, but also the parameter values and outside shares.

Rather than try to characterize all possible combinations of market shares and parameters that imply a decline in quality of care after a merger, we derive a simple sufficient condition in terms of only one unknown. Denoting the elasticity of the patient care technology by $\theta_{ht}^T \equiv T'(L_{ht})/Q_{hjt}$, we have the following:

Proposition 4. *Suppose quality of care is endogenous ($\beta_Y > 0$). When hospitals h and g in market m merge at time t to form a two-hospital system, the quality of care, Y_{ht}, decreases if $\theta_{ht}^T \leq \frac{L_{ht}}{L_{ht}+N_{ht}}$.*

The condition ensures that the denominator of the staffing ratio, Q_{ht}, responds relatively less to the number of patient care workers, L_{ht}, than does the numerator of the staffing ratio, $L_{ht}+N_{ht}$, holding N_{ht} fixed. As patient care workers become a larger share of hospital employment, the numerator becomes more elastic in L_{ht}, so greater output elasticities of patient care, θ^T_{ht}, can still permit that quality is increasing in L_{ht} given N_{ht}. If the staffing ratio is increasing in L_{ht} when holding N_{ht} fixed, then it must also be increasing in L_{ht} when allowing N_{ht} to increase. From Lemma 4, we know that L_{ht} and N_{ht} both decrease in response to a merger, and the staffing ratio must decline at least as much when L_{ht} declines as when L_{ht} and N_{ht} simultaneously decline. Thus, $\theta^T_{ht} \leq \frac{L_{ht}}{L_{ht}+N_{ht}}$ provides a conservative but simple sufficient condition to ensure that quality declines in response to a merger. It is convenient because it only requires the observable $\frac{L_{ht}}{L_{ht}+N_{ht}}$ and the unobservable θ^T_{ht}.

2.4 Welfare Effects of Mergers

The final task for which I use the model is to define welfare measures. I define the welfare effects of a merger using changes induced in compensating variation (CV) by each merger, separately for patients, workers, and hospital owners.

Patient welfare is defined as

$$\text{CV}^{Q,D}_{mt} \equiv \bar{Q}_t \times \frac{1}{\beta_P}\left[\log\left(\sum_{ht}\exp(\beta_P P^D_{ht} + \beta_Y Y^D_{ht} + \xi^Q_{ht}) + 1\right)\right], \quad D = 0, 1,$$

where $D = 1$ denotes the outcome with the merger and $D = 0$ denotes the counterfactual outcome without the merger. This is the familiar expression from Small and Rosen (1981) which makes use of the linearity of (indirect) utility in prices for a discrete good. The effect on patient welfare is then,

$$\text{CV}^{Q}_{mt} \equiv \text{CV}^{Q,1}_{mt} - \text{CV}^{Q,0}_{mt}.$$

The worker welfare effect is measured by first defining worker-specific change in the CV induced by the merger,

$$\max_h\left\{U(W^{E,0}_h, \xi^E_h, \varepsilon^E_{hi})\right\} = \max_h\left\{U(W^{E,1}_h + \text{CV}^E_i, \xi^E_h, \varepsilon^E_{hi})\right\}$$

This expression accounts for the diminishing returns of (indirect) utility in income. The effect on worker welfare is then,

$$\text{CV}^{E}_{mt} \equiv \mathbb{E}[\text{CV}^E_i], \quad E = L, N.$$

Since CV_i^E does not have a closed-form representation, I follow McFadden (1999) to approximate CV_{mt}^E numerically.

Finally, hospital owner welfare is defined as profits:

$$\text{CV}_{mt}^{\pi,D} \equiv \sum_h \left(P_{ht}^D Q_{ht}^D - W_{ht}^{L,D} L_{ht}^D - W_{ht}^{N,D} N_{ht}^D \right)$$

The effect on hospital welfare is then,

$$\text{CV}_{mt}^{\pi} \equiv \text{CV}_{mt}^{\pi,1} - \text{CV}_{mt}^{\pi,0}.$$

3 Data Sources and Descriptive Statistics

3.1 Outcomes for Patients and Workers

Product and Labor Market Variables My first data source is the Centers for Medicare & Medicaid Services (CMS) Hospital Cost Reports (HCRIS), spanning 1996 to 2022. This dataset comprises government-mandated reports from all Medicare-certified hospitals in the US. Following the literature, I exclude specialty and critical-access hospitals, which comprise a small share of overall inpatient treatments. The final sample contains about 3,400 unique hospitals and 81,000 annual observations.

In the product market, I define the quantity of patients, Q_{ht}, by the total number of inpatient discharges in the hospital-year. Next, I measure prices, P_{ht}, by revenue-per-patient among non-Medicare inpatients, following Dafny (2009) and Dafny et al. (2019). Finally, I standardize prices as if all hospitals had the same payer and case mix index (CMI), following Brot, Cooper, Craig, and Klarnet (2024).

I also use HCRIS to define labor market variables. At annual frequency, the reports include the total number of hours worked as well as the average wage per hour separately for several occupational categories. I follow the National Academy for State Health Policy (NASHP) in defining the patient care occupations as nurses, nursing aides, and the hospital's directly-employed physicians (commonly known as "hospitalists"). The remaining non-patient care occupations include administration, food services, sanitation, and maintenance. I measure the number of patient care workers, L_{ht}, and the number of non-patient care workers, N_{ht}, as the annualized number of FTEs in each occupational category. I define the wage of patient care workers, W_{ht}^L, and the wage of non-patient care workers, W_{ht}^N, as the average wage per hour for the patient and non-patient care occupations, respectively.

Quality of Care Measures To measure quality of care, I use three distinct approaches. First, I construct the staffing ratio as defined in the theoretical model, calculated as $(L_{ht} + N_{ht})/Q_{ht}$, which captures the total staff resources dedicated to each patient. The staffing ratio is commonly used as a measure of quality of care in the healthcare literature.

Second, I measure patient satisfaction using Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) data, spanning 2008-2022 for the universe of hospitals. HCAHPS is a standardized national survey of a random sample of former patients. It includes an overall satisfaction rating, which has previously been studied by Beaulieu et al. (2020), as well as more specific dimensions of care quality. I decompose these ratings into components such as cleanliness, communication with doctors, and other aspects of the patient experience.

Third, I measure mortality rates utilizing the Hospital Quality Initiative (HQI) data, spanning 2008-2021 for the universe of hospitals. These data include risk-adjusted 30-day all-cause mortality rates among patients originally treated at the hospital for specific conditions, particularly heart failure and pneumonia. These mortality rates, which are based on patient-level Medicare claims and eligibility information, are estimated using a statistical model to adjust for observable patient characteristics upon hospital arrival that predict mortality risk.

Table 1 demonstrates the relationship between my primary quality measure—the staffing ratio—and patient satisfaction ratings. I regress overall patient satisfaction rating (the percent of top-box ratings) on log staffing ratio, with several control specifications. Column 1 provides the bivariate relationship without controls, while columns 2-4 progressively add year fixed effects, market fixed effects, hospital fixed effects, and the lagged value of the log staffing ratio. In all specifications, I find a strong positive relationship between staffing ratios and patient satisfaction, with a 1% increase in staffing ratio associated with a 1.8-4.3 percentage point increase in patient satisfaction, depending on the specification. Column 4 includes hospital fixed effects and a lagged staffing ratio term, indicating that the contemporaneous relationship is strong even when controlling for hospital-specific factors and past staffing levels.

Furthermore, the bottom panel of Table 1 examines specific dimensions of care quality. I find that higher staffing ratios are associated with better ratings for hospital cleanliness (column 5) and doctor communication (column 6), with hospital and year fixed effects included. These results suggest that staffing ratios impact multiple

	Overall Patient Satisfaction Rating (%)			
	(1)	**(2)**	**(3)**	**(4)**
log Staffing Ratio	4.272***	3.533***	2.824***	1.835***
	(0.281)	(0.293)	(0.307)	(0.213)
Lagged log Staffing Ratio				0.709***
				(0.177)
Market FE	No	No	Yes	No
Hospital FE	No	No	No	Yes
Year FE	No	Yes	Yes	Yes
	Additional Ratings (%)			
	Cleanliness Rating (5)		**Communication Rating (6)**	
log Staffing Ratio	1.457***		0.671***	
	(0.198)		(0.123)	
Hospital FE	Yes		Yes	
Year FE	Yes		Yes	

Table 1: Comparison between Staffing Ratio and Patient Satisfaction Ratings
Note: $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

dimensions of care quality as perceived by patients.

3.2 Ownership and Market Concentration

Ownership and Merger Database To identify hospital mergers and acquisitions, I utilize the database developed by Cooper et al. (2019). They created and extensively validated a database on the universe of hospital mergers over 2001-2014. I supplement this database to include mergers over 1999-2018 by following their process and using the American Hospital Association (AHA) Survey, Irving Levin Associates consulting reports, and digital newspaper indices to identify additional consolidation events and the year in which the consolidation was implemented.

Figure 4 illustrates the massive wave of consolidation in the hospital industry over the sample period. The left panel shows the cumulative count of consolidation events, which surpassed 1,000 mergers by the end of the sample period. The middle panel displays the exposure of patients and workers to hospitals that consolidated during the time period, indicating that approximately 70% of patients and workers were treated and employed, respectively, by hospitals participating in consolidation

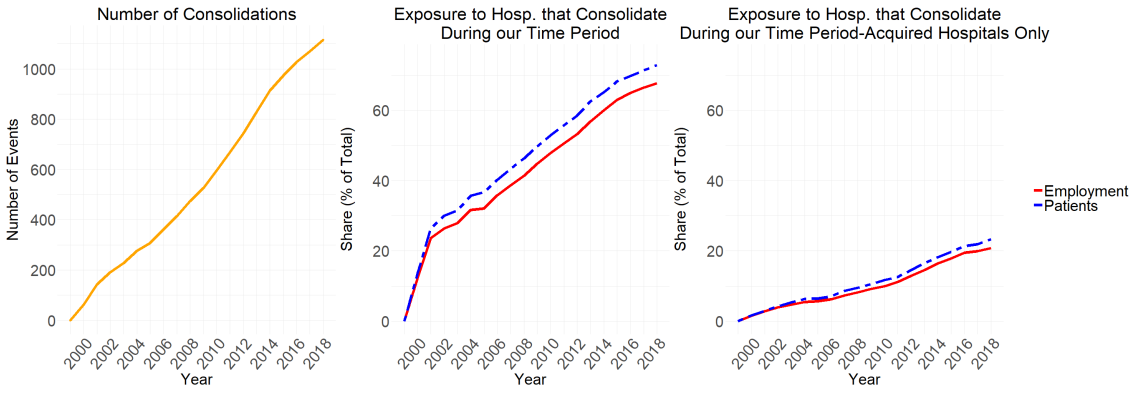


Figure 4: Cumulative Count of Consolidation Events and Cumulative Exposure of Patients and Workers

events. The right panel shows the exposure to hospitals that were specifically acquired (rather than being acquirers), revealing that more than 20% of patients and employees experienced their hospital being acquired by another hospital system.

Market Definitions and Concentration For the regression analysis, I define markets in both labor and product dimensions. For labor markets, I follow Prager and Schmitt (2021) and use commuting zones as the relevant geographic unit. This results in 561 distinct labor markets across the US that include at least one hospital satisfying the criteria. For product markets, I follow Brot et al. (2024) and define markets as a 25-mile radius around each hospital, resulting in one product market around each hospital in the sample.

To measure market concentration, I use the Herfindahl-Hirschman Index (HHI). In the product market, denoting the market share by s_{ht}^{Q}, the HHI is defined by $\text{HHI} = \sum_h (s_{ht}^{Q})^2 \times 10,000$. The change in the HHI induced by a merger between hospitals h and g at time t, based on pre-merger market shares, is $\Delta\text{HHI} = 2 \times s_{ht}^{Q} \times s_{gt}^{Q} \times 10,000$. Similarly, for labor markets, I calculate concentration using the labor market shares s_{ht}^{L} and s_{ht}^{N} for patient and non-patient care workers, respectively.

Figure 5 presents the number of within-market mergers over time, separated by labor markets (left panel) and product markets (right panel). The solid lines represent all mergers, while the dashed lines represent mergers that exceed the threshold for "presumed anti-competitive" effects according to antitrust guidelines (US DOJ and FTC, 2023): a merger is presumed to be anti-competitive if $\Delta\text{HHI} > 100$ and post-

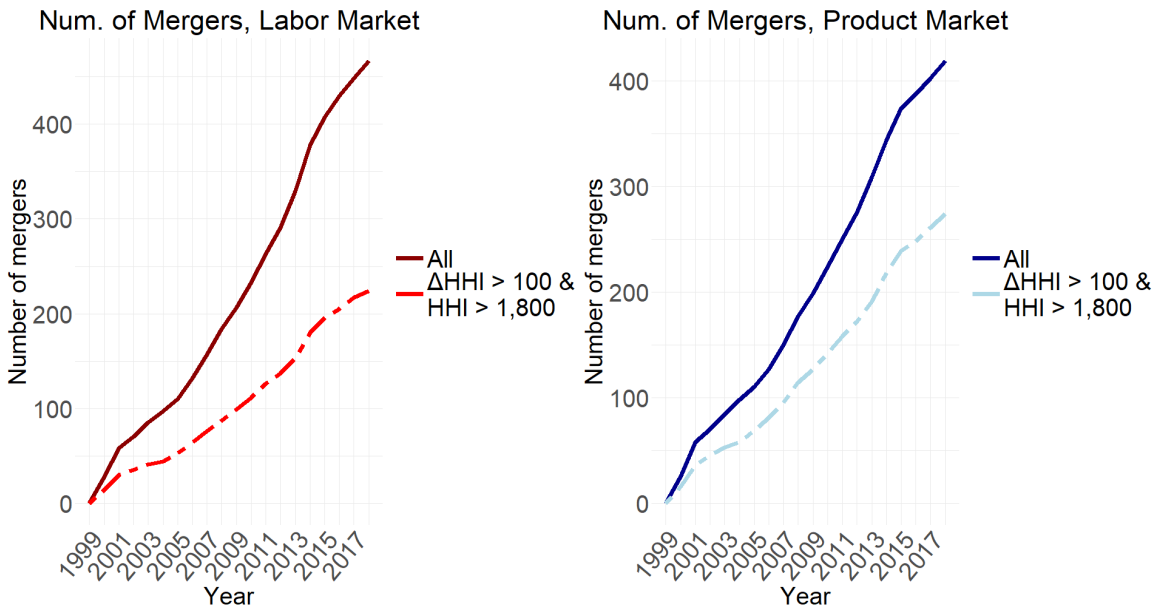
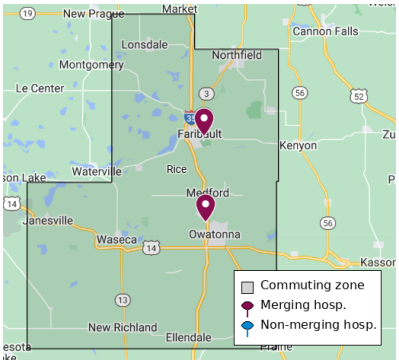
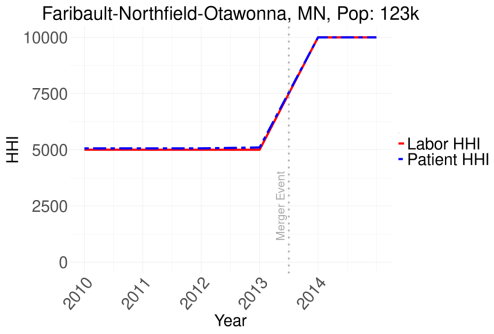


Figure 5: Number of Within-Market Mergers and Number of Mergers Satisfying the "Presumed Anti-competitive" Threshold

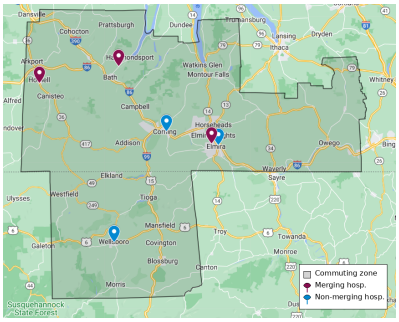
merger HHI $> 1,800$. By the end of the sample period, over 400 mergers were within labor market (i.e., ΔHHI > 0), with approximately half exceeding the presumed anti-competitive threshold. Similarly, in product markets, over 400 within-market mergers occurred, with more than half exceeding the presumed anti-competitive threshold.

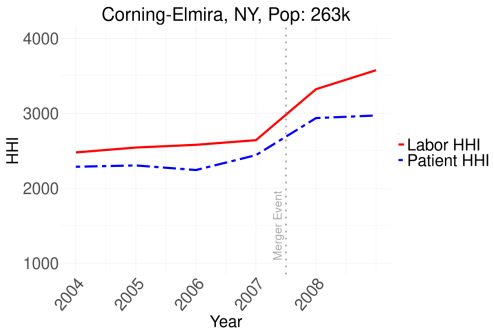
In the next section, I utilize hospital mergers satisfying the "presumed anti-competitive" definition as treated units in a difference-in-differences design. Before proceeding, I provide two examples of such treated units. Figure 6(a) considers the 2013 merger between District One Hospital and Allina Health in Minnesota. This merger occurred in a market with only two hospitals (Faribault-Northfield-Owatonna) and a population of approximately 123,000. Prior to the merger, the HHI was around 5,000 for both labor and product markets. After the merger, there was a single hospital system operating in the market, so the HHI rose to the maximum possible value of 10,000 in both markets. Figure 6(b) provides a much less extreme example. In 2008, Arnot Ogden Medical Center, St. James Mercy Health, and Ira Davenport Memorial hospitals merged in the Corning-Elmira region of New York, with a population of about 263,000. Before the merger, there were six distinct hospitals, and the HHIs were between 2,200-2,400 in the labor and product markets. Following the





(a) Merger between District One & Allina Health in Minnesota





(b) Merger between Arnot Ogden, St. James Mercy, & Ira Davenport in New York

Figure 6: Examples of Mergers and Corresponding Changes in HHI

merger, there were only four distinct hospital systems, and HHIs increased into the 3,000-3,500 range.

4 Evidence from Merger Event Studies

4.1 Difference-in-differences Design

My empirical strategy employs a difference-in-differences (DiD) design to identify the causal effects of hospital consolidation. This approach compares changes in outcomes for hospitals involved in mergers against a matched-on-observables control group of hospitals that remain independent. The treated group is comprised of hospitals participating in mergers that satisfy the "presumed anti-competitive" threshold defined in the previous section. In cases where hospitals are involved in multiple mergers

during the sample period, I focus only on the first merger event to protect against compounding effects. To implement this design, I follow Brot et al. (2024) by matching each merging entity to ten control hospitals based on pre-merger characteristics. These controls are selected from hospitals that are located in different markets and are not involved in any merger during the observation window (from four years before to seven years after the treatment hospital's merger).

The matching procedure uses a rich set of pre-merger covariates including product market characteristics (percentage of Medicare patients, log number of beds, and log number of patients) and labor market attributes (case mix index, market unemployment rate, log market average income, percentage of healthcare workers in the market, log average wage, and log total employment). I estimate propensity scores using a logistic regression model and select the ten hospitals with the closest propensity scores to each merging entity.

My regression specification accounts for staggered treatment onset following the approach of Callaway and Sant'Anna (2021). Specifically, for each merged hospital h that consolidates in year t, I calculate the difference-in-differences estimator as:

$$\text{DiD}_{h,t,e} \equiv (Y_{h,t+e} - Y_{h,t-1}) - \underbrace{\mathbb{E}\left[Y_{h',t+e} - Y_{h',t-1} \mid h' \in C_h\right]}_{\substack{\text{change from } t-1 \text{ to } t+e, \\ \text{control hospitals matched to } h}} \tag{8}$$

where $Y_{h,t+e}$ represents the outcome for hospital h at event time e relative to its merger year t, and C_h denotes the set of control hospitals matched to h. I then average these treatment effects across all merger cohorts:

$$\text{DiD}_e \equiv \sum_t \omega_{t,e} \times \frac{1}{|\mathcal{G}_t|} \sum_{h \in \mathcal{G}_t} DiD_{h,t,e}, \quad \omega_{t,e} \equiv \frac{|\mathcal{G}_t|}{\sum_t |\mathcal{G}_t|}, \tag{9}$$

where $\mathcal{G}_t$ represents the set of hospitals that merge in year t.

A data challenge in studying hospital mergers is that, in the HCRIS data, hospitals often jointly report their outcomes after merging, such that it is not possible to track each hospital separately after the merger. For example, as illustrated in Figure 7, when Largo Medical Center (Hosp. A) merged with Sun Coast Hospital (Hosp. B) in 2008 in Florida, Hosp. B began reporting its information under Hosp. A's Medicare identification number. This gives the appearance that Hosp. B stopped operating, while Hosp. A hired a massive number of workers in a single year, neither of which happened in reality. If one were to estimate DiD at the hospital-level only for hospitals

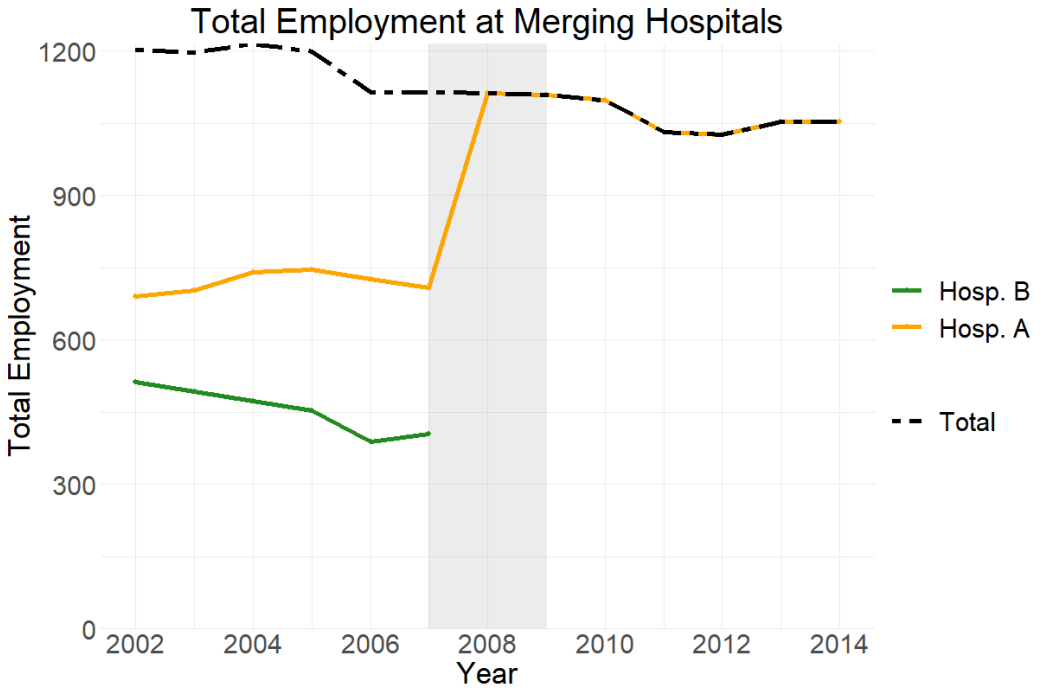


Figure 7: FTE Employment reported by HCRIS, before and after the 2008 Merger between Largo Medical Center (Hosp. A) and Sun Coast Hospital (Hosp. B) in Florida

consistently observed before and after the merger, one would only include Hosp. A in the sample, and would mistakenly conclude that this merger caused a massive increase in employment among hospitals involved in mergers.

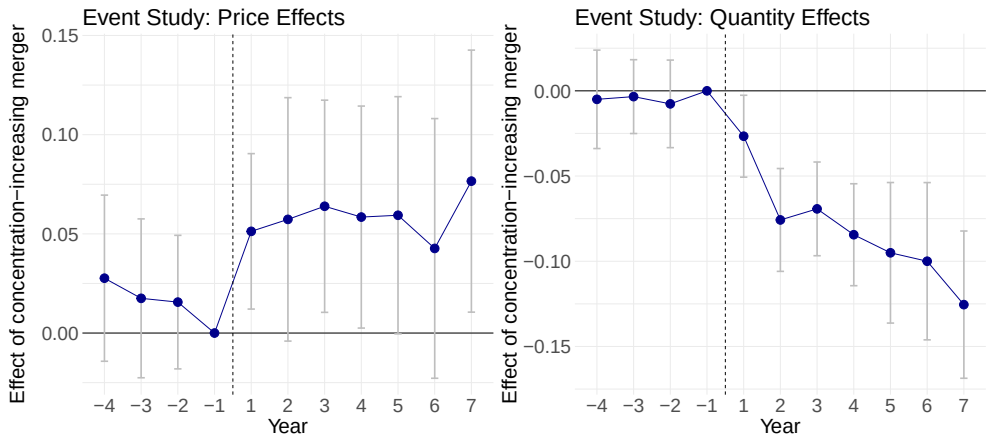
To address this issue, I construct time-consistent firm-by-market units of observation. For each merger, I define a time-consistent entity by aggregating outcomes (through sums or averages) across all hospitals that eventually consolidate, creating a consistent unit that can be followed over time. This approach allows me to determine whether total employment, patient volume, or quality metrics change after consolidation, even when individual hospital data are no longer separately reported. In Figure 7, this would mean that I estimate DiD using total employment (dashed line) rather than only using Hosp. A's employment.

4.2 Direct Effects of Mergers on the Merging Hospitals

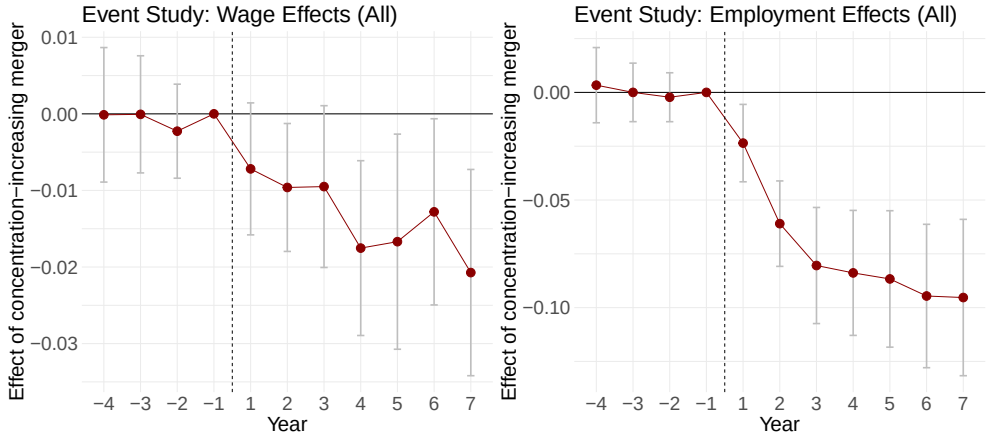
Figure 8 presents the event study estimates for the key outcomes, showing how hospital mergers affect both product and labor markets. Panel (a) displays product market outcomes, where clear evidence of post-merger market power exploitation is observed. Following consolidation, merged hospitals significantly increase prices while reducing the quantity of patients treated. The price effects grow gradually over time, reaching approximately 5.9% higher prices on average during event periods +4 through +7 compared to the pre-merger baseline. This pattern is consistent with merging hospitals leveraging their enhanced market power to charge higher prices. Simultaneously, the number of patients treated at merged hospitals decreases substantially, with an average reduction of 10.1% in later event periods. This decline in patient volume aligns with the theoretical prediction in Proposition 2 that merged hospitals would optimally treat fewer patients.

Panel (b) of Figure 8 shows that merging hospitals reduce both wages and employment following consolidation. On average, wages decrease by approximately 1.7% in event periods +4 through +7. This wage reduction is statistically significant and consistent with the model's prediction that merged hospitals would utilize their increased labor market power to suppress wages. The employment effects are considerably larger, with hospitals reducing their workforce by approximately 9.0% on average in the post-merger period. These employment reductions closely track the decline in patient volume, reflecting the relationship between labor and output in the healthcare production function. Appendix Figure A3 presents the labor market effects separately for patient care and non-patient care occupations, finding that the effects are economically and statistically significant for both.

The patterns observed across both product and labor markets provide strong empirical support for the double market power mechanism described in the theoretical model. Figure 8 also reveals important dynamics in the adjustment process. The effects generally grow over time, suggesting that the full impact of mergers may take several years to materialize as hospitals gradually reorganize their operations and adjust their strategic decisions. I observe no significant pre-trends in any of the four outcomes, supporting the validity of the difference-in-differences research design.



(a) Direct Effects in the Product Market

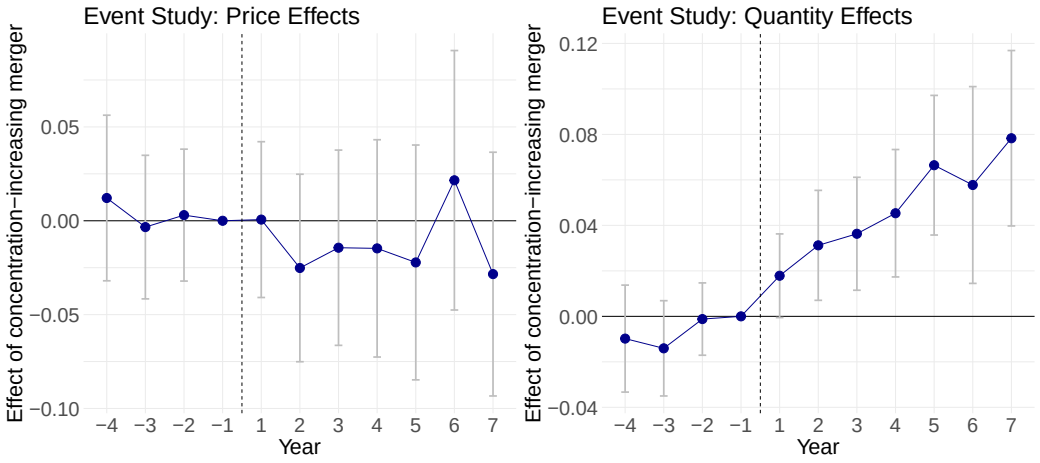


(b) Direct Effects in the Labor Market

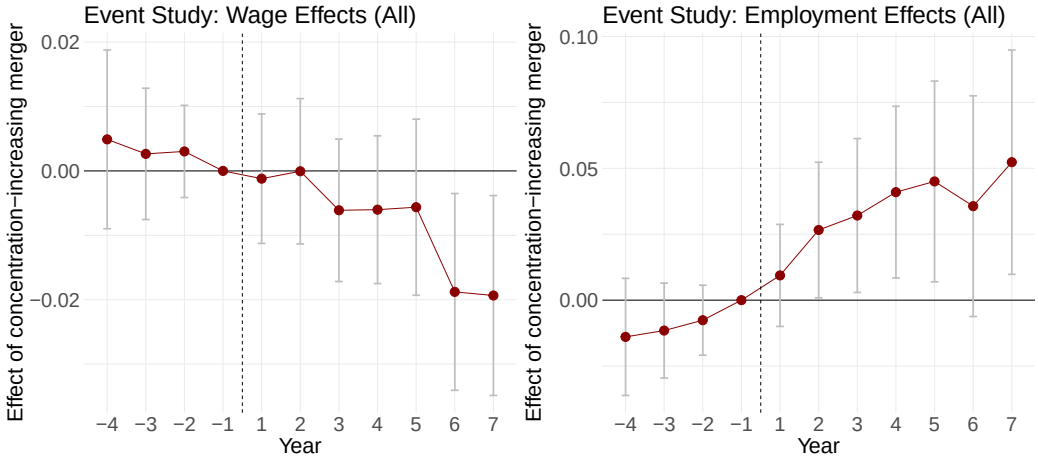
Figure 8: Direct Effects of Mergers on Labor and Product Outcomes in the Merging Hospitals

4.3 Spillover and Outside Option Effects of Local Mergers

Beyond the direct effects on merging hospitals, my theoretical model predicts that consolidation generates spillover effects on competitors in the same local markets. Figure 9 presents the estimates of these spillover effects, with estimates weighted by market share in accordance with Proposition 3. The results show that non-merging competitors experience decreased wages (by approximately 1.2% on average) while simultaneously increasing employment levels (by about 4.3%). This pattern is consistent with the labor market spillovers predicted by the model, as workers displaced from merging hospitals increase labor supply to competitor hospitals.



(a) Spillovers in the Product Market



(b) Spillovers in the Labor Market

Figure 9: Spillover Effects of Mergers on Local Competitors

In the product market, competitor hospitals show a small and statistically insignificant price effect, but a substantial increase in patient volume, with competitors treating approximately 6.2% more patients in the post-merger period. This pattern aligns with the prediction that patients who would have been treated at merging hospitals are diverted to competitor hospitals.

Finally, Figure A4 estimates the effects of mergers on the aggregate number of patients treated in the product market and the aggregate number of workers employed in the labor market. While statistical precision is limited, the estimates suggest that 2-3% of patients are no longer treated in the market during the first four years after

the merger, and 2-3% of workers are no longer employed in local hospitals.

4.4 Direct Effects of Mergers on Quality of Care

Figure 10 presents event study estimates for various measures of the quality of care provided to patients in the merging hospitals. The top-left panel shows the effects on the primary measure of quality—the staffing ratio (workers per patient). Following mergers, there is a substantial decline in staffing ratios of approximately 5-6% in event years +4 through +7 after the merger. This decline is statistically significant and aligns with the predictions.

The top-right and middle panels display effects on patient-reported satisfaction measures from HCAHPS surveys. Overall patient satisfaction declines by approximately 2% post-merger, with this effect becoming stronger and statistically significant over time. I observe similar patterns for specific dimensions of patient satisfaction: hospital cleanliness ratings decrease by 1.5-2% and doctor communication ratings decline by 0.5-1%. These consistent negative effects across multiple patient-reported measures provide compelling evidence that patients perceive deterioration in their care experience following hospital mergers.

The bottom panels show effects on patient outcome measures—specifically, risk-adjusted 30-day mortality rates for pneumonia and heart failure. Both measures show concerning increases following mergers. The pneumonia mortality rate increases by approximately 0.8-1 percentage points (relative to the national average mortality rate of 14%), while heart failure mortality increases by 0.5-0.6 percentage points (relative to the national average mortality rate of 12%). These effects emerge shortly after mergers occur and persist throughout the post-merger period. To place these estimates in context, Cooper et al. (2022) find that a one standard deviation increase in the hospital price distribution results in about a 0.5 percentage point decrease in the mortality rate, implying that the worse mortality rates after hospital mergers are large relative to the distribution.

In sum, I find a decline in quality of care across multiple dimensions—staffing ratios, patient satisfaction, and medical outcomes—indicating that the quality reductions are perceived by patients and manifested in worse healthcare.

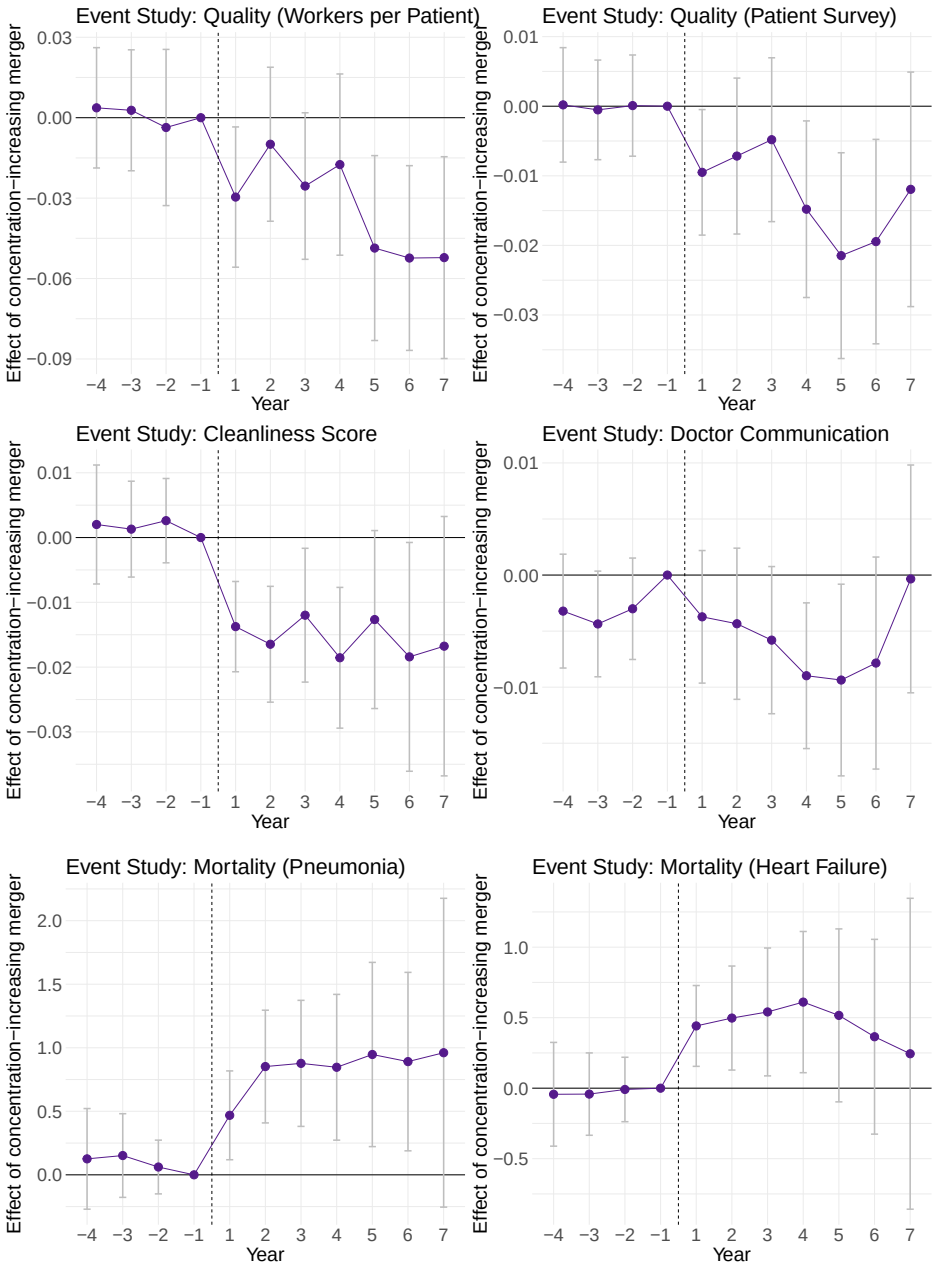


Figure 10: Event Studies: Effects of Mergers on Quality of Care

5 Welfare Measures and Counterfactual Exercises

In a future update to this working paper, I will estimate the model parameters. I will do so by simulating merger effects from the model for the hospitals observed in the data, and matching the predicted merger effects to the difference-in-differences estimates using the simulated method of moments. Then, I will use the estimated model for two purposes. First, I will examine the welfare effects of mergers on patients, workers, and hospitals using the compensating variation measures defined in Section 2. Second, I will examine how the predicted effects of mergers would change if we were to shut down labor market power or shut down quality adjustments. These are relatively simple but informative exercises to help quantify the importance of accounting for labor market power and endogenous quality in merger evaluation.

6 Conclusions

This paper analyzed, both theoretically and empirically, how hospitals leverage their simultaneous gains in market share over patients and workers through consolidation. I developed a framework for merger evaluation in which firms exploit both oligopoly power in the product market and oligopsony power in the labor market. The model allowed firms to endogenously choose product quality, and showed that optimal quality provision depends on labor market power. From the model, I predicted the effects of hospital mergers on patient and worker outcomes. Empirically, I combined several administrative panel data sources on the universe of hospitals over 1996-2022. Utilizing a propensity-score matched difference-in-differences design, I estimated the extent to which oligopoly and oligopsony power are exploited after merger events. Confirming the predictions of the model, I found that merging hospitals not only raise prices and lower wages after consolidating, but also reduce the number of patients treated, the number of workers employed, and the quality of care provided to each patient. Patients face worse staffing ratios, report lower satisfaction with their care, and experience greater mortality. Merger spillovers lead competitors in the local market to cut wages even as they increase employment, and the number of patients who fail to receive treatment and workers who fail to attain employment in the local market rises.

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A Additional Figures and Tables

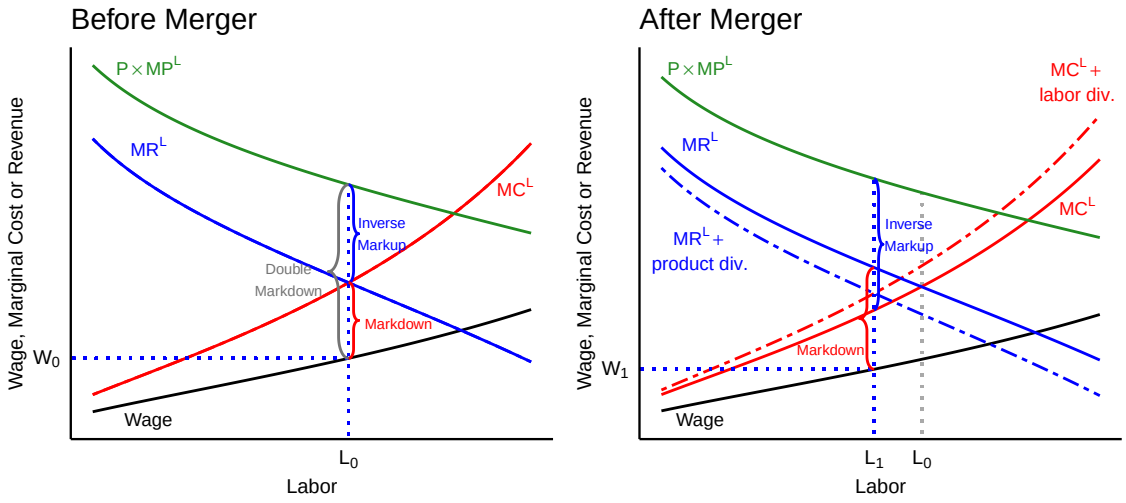


Figure A1: Direct Effects of Mergers on the Wages of the Merging Hospitals

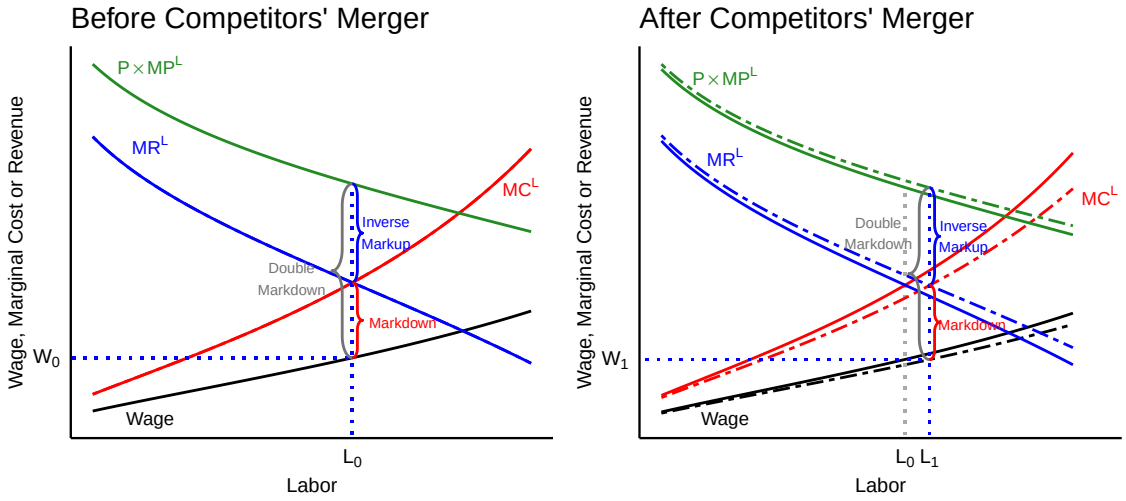
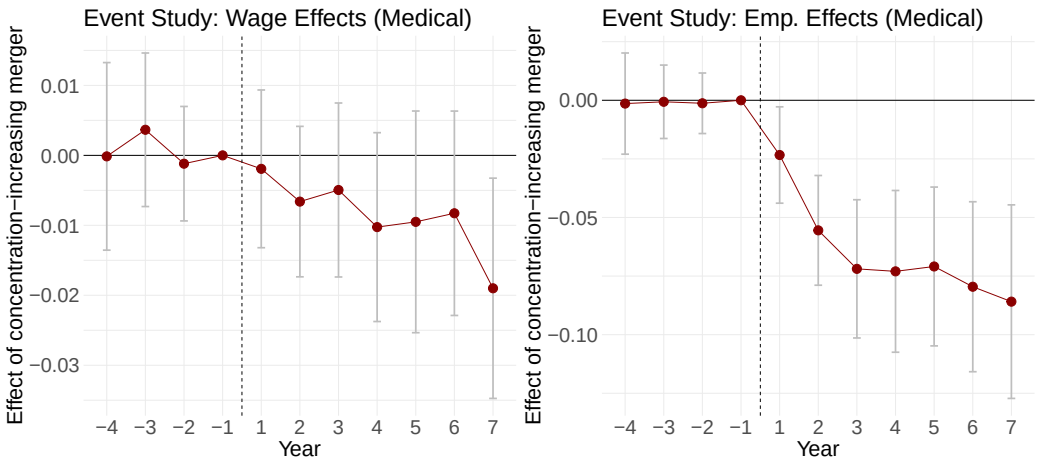
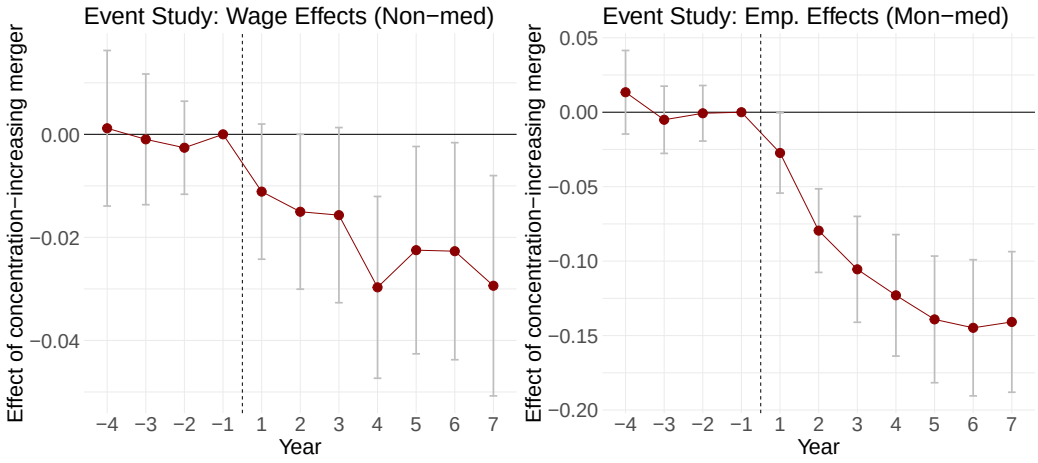


Figure A2: Spillover Effects of Mergers on Competitors in the Local Market on Wages

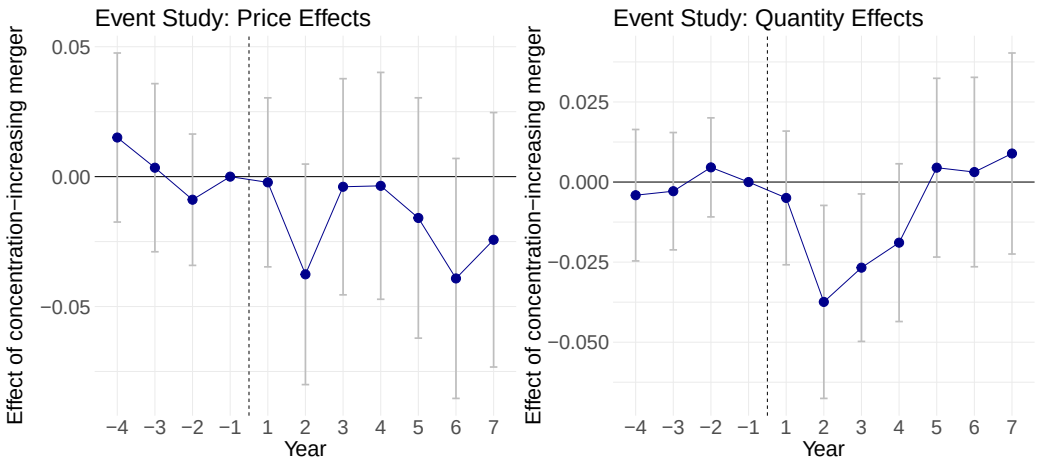


(a) Direct Effects for Patient Care Workers

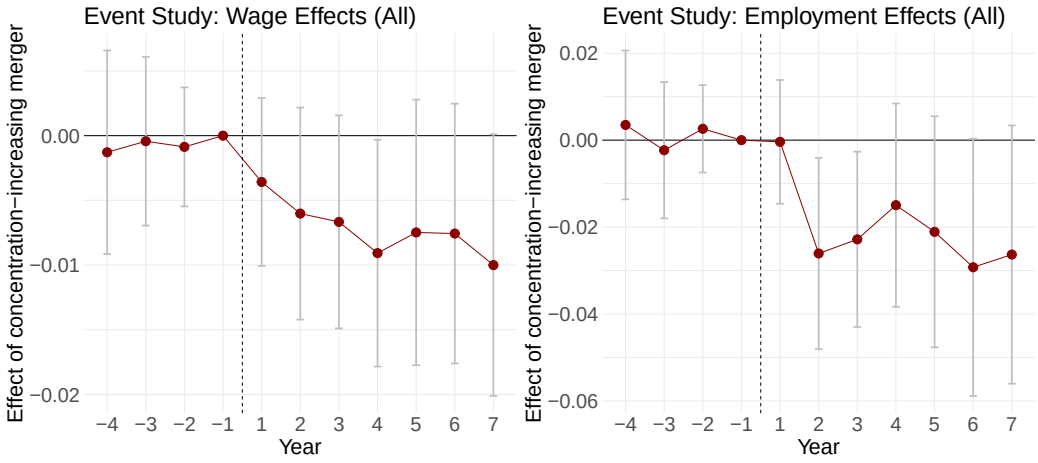


(b) Direct Effects for Non-patient Care Workers

Figure A3: Direct Effects in the Labor Market by Occupational Category



(a) Aggregate Outcomes in the Product Market



(b) Aggregate Outcomes in the Labor Market

Figure A4: Market Aggregate Effects of Mergers

B Mathematical Details

Details on product demand Suppose that quality is pre-determined. Recall,

$$s_{ht}^{Q} = \frac{\exp\left(-\beta_P P_{ht} + \beta_Y Y_{ht} + \xi_{ht}^{Q}\right)}{\mathcal{P}}, \quad \mathcal{P} \equiv 1 + \sum_{h'} \exp\left(-\beta_P P_{h't} + \beta_Y Y_{h't} + \xi_{h't}^{Q}\right).$$

Notice that,

$$\frac{\partial \mathcal{P}}{\partial P_{ht}} = -\beta_P \exp\left(-\beta_P P_{ht} + \beta_Y Y_{ht} + \xi_{ht}^{Q}\right).$$

Using the quotient rule, i.e.,

$$\frac{\partial s_{ht}^{Q}}{\partial P_{ht}} = \frac{\mathcal{P}\frac{\partial}{\partial P_{ht}} \exp\left(-\beta_P P_{ht} + \beta_Y Y_{ht} + \xi_{ht}^{Q}\right) - \exp\left(-\beta_P P_{ht} + \beta_Y Y_{ht} + \xi_{ht}^{Q}\right)\frac{\partial \mathcal{P}}{\partial P_{ht}}}{\mathcal{P}^2},$$

the effect of a price increase on hospital-specific product demand is,

$$\frac{\partial s_{ht}^{Q}}{\partial P_{ht}} = -\beta_P s_{ht}^{Q}\left(1 - s_{ht}^{Q}\right) < 0.$$

It follows that,

$$\theta_{ht}^{Q} \equiv \frac{P_{ht}}{s_{ht}^{Q}}\frac{\partial s_{ht}^{Q}}{\partial P_{ht}} = -\beta_P \frac{P_{ht}}{s_{ht}^{Q}} s_{ht}^{Q}\left(1 - s_{ht}^{Q}\right) = -\beta_P P_{ht}\left(1 - s_{ht}^{Q}\right) < 0.$$

Furthermore,

$$\frac{\partial \theta_{ht}^{Q}}{\partial P_{ht}} = -\beta_P\left(1 - s_{ht}^{Q}\right) - \beta_P P_{ht}\left(1 - \frac{\partial s_{ht}^{Q}}{\partial P_{ht}}\right) < 0$$

which implies demand becomes more elastic as prices increase. Given quality, higher prices imply lower output, so demand is more inelastic in higher output firms. The cross-price effect of the price at h on competitor j is,

$$\frac{\partial s_{jt}^{Q}}{\partial P_{ht}} = -\frac{-\beta_P \exp(\delta_h)\exp(\delta_j)}{\mathcal{P}} = \beta_P s_{ht}^{Q} s_{jt}^{Q} > 0$$

with corresponding cross-price elasticity,

$$\frac{P_{ht}}{s_{jt}^{Q}}\frac{\partial s_{jt}^{Q}}{\partial P_{ht}} = \beta_P P_{ht} s_{ht}^{Q} > 0,$$

which is greater when s_{ht}^{Q} is greater. Finally, denoting the outside option share by $s_{0t}^{Q} \equiv 1 - \sum_h s_{ht}^{Q}$, an increase in price leads to an increase in the outside option share:

$$\frac{\partial s_{0t}^{Q}}{\partial P_{ht}} = \beta_P s_{ht}^{Q}(1 - s_{ht}^{Q}) - \sum_{j \neq h} \beta_P s_{ht}^{Q} s_{jt}^{Q} = \beta_P s_{ht}^{Q}(1 - s_{ht}^{Q}) - \beta_P s_{ht}^{Q}\left(1 - s_{ht}^{Q} - s_{0t}^{Q}\right) = \beta_P s_{ht}^{Q} s_{0t}^{Q} > 0.$$

Details on labor supply Recall that,

$$s_{ht}^E = \frac{\exp\left(\gamma_E \log\left(W_{ht}^E\right) + \xi_{ht}^E\right)}{\mathcal{W}}, \quad \mathcal{W} \equiv 1 + \sum_{h'} \exp\left(\gamma_E \log\left(W_{h't}^E\right) + \xi_{h't}^E\right).$$

Notice that,

$$\frac{\partial \mathcal{W}}{\partial W_{ht}^E} = \frac{\gamma_E}{W_{ht}^E} \exp\left(\gamma_E \log\left(W_{ht}^E\right) + \xi_{ht}^E\right).$$

Using the quotient rule, i.e.,

$$\frac{\partial s_{ht}^E}{\partial W_{ht}^E} = \frac{\mathcal{W} \frac{\partial}{\partial W_{ht}^E} \exp\left(\gamma_E \log\left(W_{ht}^E\right) + \xi_{ht}^E\right) - \exp\left(\gamma_E \log\left(W_{ht}^E\right) + \xi_{ht}^E\right) \frac{\partial \mathcal{W}}{\partial W_{ht}^E}}{\mathcal{W}^2}$$

the effect of a wage increase on hospital-occupation-specific labor supply is,

$$\frac{\partial s_{ht}^E}{\partial W_{ht}^E} = \frac{\gamma_E}{W_{ht}^E} s_{ht}^E \left(1 - s_{ht}^E\right) > 0.$$

It follows that,

$$\theta_{ht}^E \equiv \frac{W_{ht}^E}{s_{ht}^E} \frac{\partial s_{ht}^E}{\partial W_{ht}^E} = \gamma_E \left(1 - s_{ht}^E\right).$$

Furthermore,

$$\frac{\partial \theta_{ht}^E}{\partial W_{ht}^E} = -\gamma_E \frac{\partial s_{ht}^E}{\partial W_{ht}^E} < 0$$

which implies supply becomes more inelastic as wages increase. Given quality, higher wages imply higher employment, so supply is more inelastic in higher employment firms. The cross-wage effect of the wage at h on competitor j is,

$$\frac{\partial s_{jt}^E}{\partial W_{ht}} = -\frac{\gamma_E \exp\left(\gamma_E \log\left(W_{ht}^E\right) + \xi_{ht}^E\right) \exp\left(\gamma_E \log\left(W_{jt}^E\right) + \xi_{jt}^E\right)}{\mathcal{W}} = -\frac{\gamma_E}{W_{ht}^E} s_{ht}^E s_{jt}^E < 0$$

with corresponding cross-wage elasticity,

$$\frac{W_{ht}^E}{s_{jt}^E} \frac{\partial s_{jt}^E}{\partial W_{ht}^E} = -\gamma_E s_{ht}^E < 0,$$

which is stronger when s_{ht}^E is greater. Finally, denoting the outside option share by $s_{0t}^E \equiv 1 - \sum_h s_{ht}^E$, an increase in the wage leads to a decrease in the outside option share:

$$\frac{\partial s_{0t}^E}{\partial W_{ht}} = -\frac{\gamma_E}{W_{ht}^E} s_{ht}^E (1 - s_{ht}^E) + \sum_{j \neq h} \frac{\gamma_P}{W_{ht}^E} s_{ht}^E s_{jt}^E = -\frac{\gamma_E}{W_{ht}^E} s_{ht}^E s_{0t}^E < 0.$$

Details on Lemma 1 and Proposition 1 For the single-establishment firm with pre-determined quality, the first-order condition is,

$$\underbrace{\frac{\partial P_{ht}}{\partial L_{ht}}}_{\frac{\partial P_{ht}}{\partial Q_{ht}}\frac{\partial Q_{ht}}{\partial L_{ht}}} Q_{ht} + P_{ht}\frac{\partial Q_{ht}}{\partial L_{ht}} - \frac{\partial W_{ht}^{L}}{\partial L_{ht}}L_{ht} - W_{ht}^{L} = 0$$

Notice that $\frac{\partial Q_{ht}}{\partial L_{ht}} = \frac{\partial \mathcal{T}_{ht}(\cdot)}{\partial L_{ht}}$ is the marginal product of patient care labor, MP_{ht}^{L}. Rearranging,

$$\left(\frac{\partial P_{ht}}{\partial Q_{ht}}\frac{Q_{ht}}{P_{ht}} + 1\right) P_{ht}\text{MP}_{ht}^{L} = \left(\frac{\partial W_{ht}^{L}}{\partial L_{ht}}\frac{L_{ht}}{W_{ht}^{L}} + 1\right) W_{ht}^{L}$$

which completes the proof of Lemma 1. Proposition 1(a) follows from rearranging Lemma 1. Proposition 1(b) follows from the own-price product demand and own-wage labor supply becoming more inelastic as the price and wage increase, respectively, all else equal.

Details on Lemma 2 and Propositions 2-3 For the two-establishment firm with pre-determined quality, the first-order condition with respect to L_{ht} is,

$$\text{MR}_{ht}^{L} + \underbrace{\frac{\partial P_{gt}}{\partial L_{ht}}}_{\frac{\partial P_{gt}}{\partial Q_{ht}}\frac{\partial Q_{ht}}{\partial L_{ht}}} Q_{gt} + P_{gt} \underbrace{\frac{\partial Q_{gt}}{\partial L_{ht}}}_{0 \text{ (Cournot)}} - \text{MC}_{ht}^{L} - \frac{\partial W_{gt}^{L}}{\partial L_{ht}}L_{gt} - W_{gt}^{L} \underbrace{\frac{\partial L_{gt}}{\partial L_{ht}}}_{0 \text{ (Cournot)}} = 0$$

which completes the proof of Lemma 2. Note that, by definition of Cournot competition, quantities of patients and labor are held fixed at other establishments when choosing quantities in the reference establishment. Propositions 2(a-b) follow trivially from Lemma 2. The first part of Proposition 2(c) follows from Proposition 2(a-b), marginal cost being an increasing function of labor, and marginal revenue being a decreasing function of patients. The second part of Proposition 2(c) follows from Proposition 2(a-b), marginal revenue being an decreasing function of patients, and the wage being an increasing function of labor. The first part of Proposition 2(d) follows from Proposition 2(a) and that $\frac{\partial P_{gt}^{L}}{\partial Q_{ht}}$ is increasing in s_{gt}^{Q}, and the second part of Proposition 2(d) follows from Proposition 2(b) and that $\frac{\partial W_{gt}^{L}}{\partial L_{ht}}$ is increasing in s_{gt}^{L}.

Details on Proposition 3 From Proposition 2, we have that P_{ht} increases and W_{ht}^{E} decreases after the merger. From the demand properties, an increase in P_{ht} has

a positive effect on $s^Q_{jt}, \forall j$, as well as on s^Q_{0t}, and these effects are stronger when s^Q_{ht} is greater. From the labor supply properties, a decrease in W_{ht} has a positive effect on $s^E_{jt}, \forall j$, as well as on s^E_{0t}, and these effects are stronger when s^E_{ht} is greater.

Details on Lemma 3 and Proposition 4 Lemma 3 follows trivially from Lemma 2. Since Lemma 4 implies that L_{ht} and N_{ht} decrease after a merger, and the staffing ratio is strictly increasing in N_{ht}, it follows that quality is decreasing after a merger if quality is non-decreasing in L_{ht}, holding N_{ht} fixed. Using the partial derivative,

$$\frac{\delta Y_{ht}}{\delta L_{ht}}|_{N_{ht}} = \frac{1}{Q_{ht}}\left(1 - \frac{L_{ht} + N_{ht}}{L_{ht}}\theta^T_{ht}\right)$$

which is non-negative if $\frac{L_{ht}}{L_{ht}+N_{ht}} \geq \theta^T_{ht}$.