CHAPTER NINE

Competition in Health Care Markets[1]

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Contents

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Abstract

This chapter reviews the literature devoted to studying markets for health care services and health insurance. There has been tremendous growth and progress in this field. A tremendous amount of new research has been done since the publication of the first volume of this Handbook. In addition, there has been increasing development and use of frontier industrial organization methods. We begin by examining research on the determinants of market structure, considering both static and dynamic models. We then model the strategic determination of prices between health insurers and providers where insurers market their products to consumers based, in part, on the quality and breadth of their provider network. We then review the large empirical literature on the strategic determination of hospital prices through the lens of this model. Variation in the quality of health care clearly can have large welfare consequences. We therefore also describe the theoretical and empirical literature on the impact of market structure on quality of health care. The chapter then moves on to consider competition in health insurance markets and physician services markets. We conclude by considering vertical restraints and monopsony power.

Keywords: health care; competition; markets; industrial organization; antitrust; competition policy; hospitals; health insurance; physicians

JEL Codes: I11; L13; L10; L40; I18; L30

1. INTRODUCTION

The incentives provided by the competitive interactions of health care providers are a central force that shapes their behavior, affecting the price, quantity and quality of health care services. This is particularly true in the US, where 56 percent of total health expenditures are privately financed (Martin et al., 2011), and hence prices, quantities, and qualities for those services are determined by market interactions of buyers and sellers. Even when prices are administratively set, as they are for most publicly financed care,[2] strategic interactions between providers affect quantity, quality and access to care. In this chapter our goal is to review the state of knowledge on competition in health care markets, focusing on the literature that has arisen since the first volume of the *Handbook of Health Economics* published in 2000.[3]

The organizing principle for this chapter is loosely based on the Structure–Conduct–Performance (SCP) paradigm originating with Joseph Bain and Edward Mason (see Schmalensee, 1989, for a review). From the 1950s to the 1970s this was the dominant framework through which industrial organization economists conducted their analyses. The rise of game theory and the new empirical industrial organization displaced the SCP approach (Bresnahan, 1989). Nevertheless, the SCP framework is a useful guide for structuring this chapter. First, in order to provide some context for our discussion, we present data on recent trends in provider market structure and some of the recent research on the underlying forces behind the trends. Section 2 then discusses the research on the determinants of health care provider market structure. This section examines the roles of entry, exit, mergers, and productivity. Section 3 turns to the analysis of the consequences of differential market structure, focusing on its impact on hospital prices. Section 4 examines the impacts of these forces on hospital quality of care. Section 5 examines evidence on competition in health insurance markets, while section 6 focuses on physician services markets. As will be seen, the majority of the empirical literature on competition in health care markets is on hospitals. This is due to the ready availability of hospital data, and the paucity of data on insurance and physician markets. We conclude in section 8.

1.1. Market Environment

In this section we consider the market environment in which health care firms operate. We document some facts about market structure, mainly for hospitals and mainly for the US, but also for insurance and physician markets in the US and for hospital

[2] This is true of the US Medicare program and most health systems outside the US.

[3] See the excellent chapters by Dranove and Satterthwaite (2000) and Gaynor and Vogt (2000) in that volume for reviews of the literature to that point and for initial sketches of modeling strategies that have guided many of the subsequent papers in the area.

Table 9.1 Hospital Market Concentration, US, 1987–2006[a]

Year	Mean HHI[b]	Change[c]
1987	2,340	–
1992	2,440	100
1997	2,983	543
2002	3,236	253
2006	3,261	25

[a]Source: American Hospital Association. Data are for US Metropolitan Statistical Areas with population < 3 million.
[b]Herfindahl–Hirschmann Index. Means weighted by MSA population.
[c]Total change from the previous year in the table.

markets in England and the Netherlands. We then proceed in section 2 to discuss models of market structure and empirical research evidence.

Hospital and physician services comprise a large component of US Gross Domestic Product (GDP). In 2009, hospital care alone accounted for 5.4 percent of GDP—roughly twice the size of automobile manufacturing, agriculture, or mining, and larger than all manufacturing sectors except food and beverage and tobacco products, which is approximately the same size. Physician services comprise 3.6 percent of GDP (Martin et al., 2011).[4] The share of the economy accounted for by these sectors has risen dramatically over the last 30 years. In 1980, hospitals and physicians accounted for 3.6 percent and 1.7 percent of US GDP, respectively (Martin et al., 2011).[5] The size of these industries and their long-run trends suggest that understanding their structure, conduct, and performance is not only important for the performance of the health care industry, it is also important for understanding the economy as a whole.

Not only are these sectors large, but they have been undergoing significant structural shifts over the last several decades. The 1990s saw dramatic changes in the structure of hospital markets in the US, and this increase will likely have long-term impacts on the behavior of hospitals. Table 9.1 presents numbers for the population-weighted, Herfindahl–Hirschmann Index (HHI) for selected years from 1987 to 2006.[6] Two things are clear from this table. US hospital markets are highly concentrated and have become even more concentrated over time. Figure 9.1 displays the trends in the hospital HHI, the number of within-market hospital mergers and acquisitions, and the percentage of the population enrolled in an HMO from 1990 to

[4] The net cost of health insurance—current year premiums minus current year medical benefits paid—was 1 percent of GDP in 2009.

[5] The net cost of health insurance in 1980 was 0.34 percent.

[6] The HHI is the sum of squared market shares in the market. It is the most commonly used measure of market structure. We present population weighted averages for Metropolitan Statistical Areas (MSAs) (based on admissions). We limit the sample of MSAs to those with a population less than 3 million in 1990. We do this because it is likely that in MSAs with more than 3 million, there are multiple hospital markets and the HHI of that MSA is likely mismeasured.

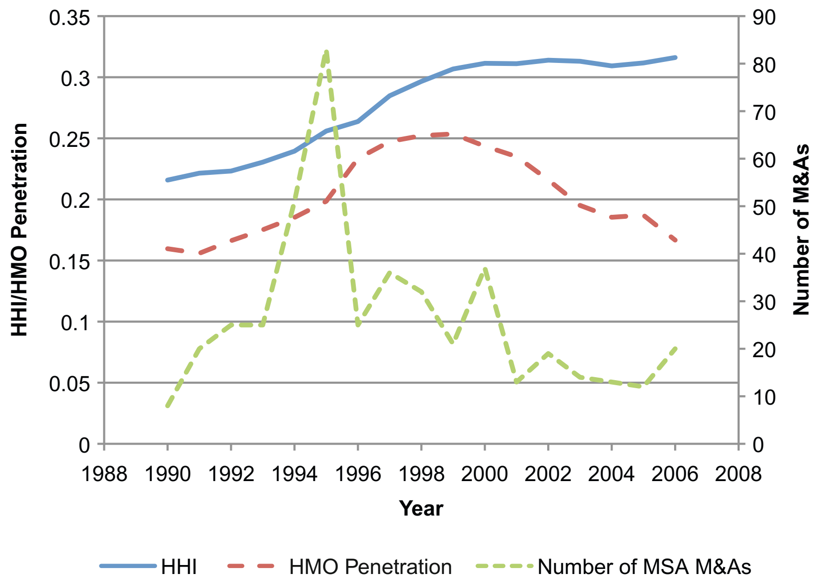

Figure 9.1 Trends in US hospital concentration, M&A activity and HMO penetration: 1990–2006.

2006. From the table and figure it is easily seen that hospital markets have become significantly more concentrated. In 1987, the mean HHI was 2,340 and by 2006 the HHI was 3,161—an increase of over 900 points.[7] In 1992, the mean hospital concentration levels (2,440) were (barely) below the recently updated Federal merger guidelines' (Federal Trade Commission and Department of Justice, 1992) cut-off point for classifying a market as "Highly Concentrated" (HHI ≥ 2,500), but by 2006 the mean concentration level (3,261) rose to well above this threshold. Town et al. (2006) note that mergers and acquisitions are the primary reason for the increase in hospital concentration over this period.

While hospital markets are highly concentrated on average, there is also wide variation in concentration. Figure 9.2 shows a scatterplot of the MSA level market concentration in 1990 and in 2006. This figure displays two phenomena. First, it shows the distribution of HHIs across MSAs. Most MSAs are "Highly Concentrated." In 2006, of the 332 MSAs in the US, 250 had HHIs greater than 2,500. Second, it is clear from Figure 9.2 that the increase in hospital concentration was a broad phenomenon—the vast majority of MSAs became more concentrated over this period. Particularly striking is the number of moderately concentrated MSAs in 1990 that by 2006 had become highly concentrated. By 2006, most health insurers now had to

[7] It is interesting that over roughly the same period of time the nursing home industry did not see significant increases in market concentration, even though it was also subject to a number of mergers and acquisitions.

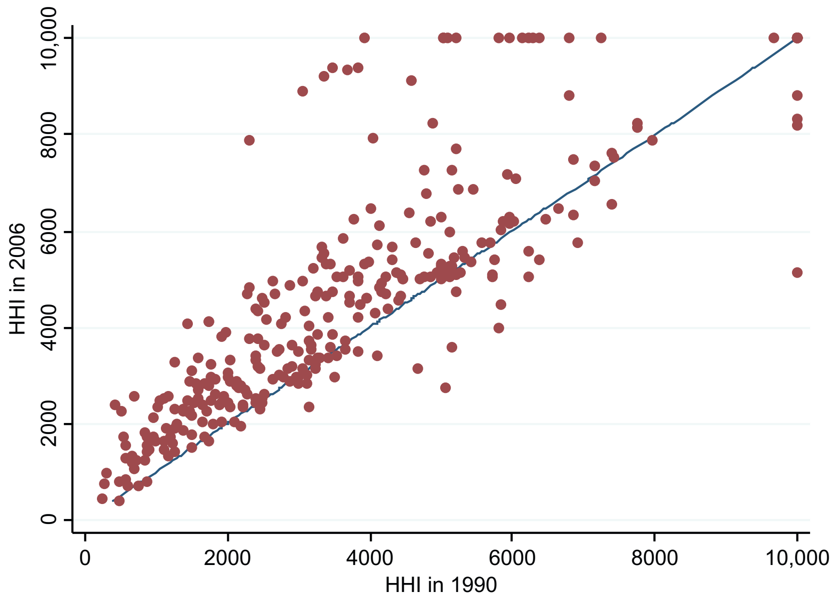

Figure 9.2 Scatterplot of US MSA HHI in 1990 and HHI in 2006.

negotiate with hospital systems in highly concentrated markets, which likely reduced their bargaining clout.[8]

An obvious question is why this wave of hospital consolidation occurred. Fuchs (2007) and others point to the rise of managed care as the principal factor driving this massive consolidation. A cursory glance at Figure 9.1 suggests this causal explanation. The idea is that the rise of HMOs introduced aggressive price negotiations between hospitals and health plans, thereby giving hospitals a strong incentive to acquire bargaining power through consolidation. The rise of HMOs during the 1990s is widely credited with significantly reducing health care cost growth, primarily through tough price negotiations (see, e.g., Cutler et al., 2000). Early suggestive evidence is provided by Chernew (1995), who finds that in the 1980s there is a relationship between HMO penetration and the number of hospitals operating in the market. Dranove et al. (2002) examine data from 1981 to 1994 and find a correlation between metropolitan area HMO penetration in 1994 and the change in market structure. However, Town et al. (2007) examine the change in hospital market structure and the change in HMO penetration and find little correlation, suggesting no direct causal link.

[8] Changes in Health Care Financing and Organization (http://www.hschange.com/index.cgi?func=pubs&what=5&order=date) present a number of market-by-market case studies that highlight the increase in hospital bargaining leverage over the last several decades.

These results present a puzzle. Anecdotal evidence suggests that HMOs were an important driver of the wave of hospital consolidation, yet the empirical evidence is mixed. Some have suggested that it was not the realization of the rise of managed care, but the anticipation (which in many cases was in error) that led hospitals to consolidate. Work in progress by Town and Park (2011) provides support for this hypothesis. They find that HMO exit, a measure of the exuberance of expectations regarding the demand for managed care in a location, is correlated with hospital consolidation.

The trend toward increasing concentration in hospital markets is not confined to the US. Tables 9.2 and 9.3 provide information on market structure levels and trends in England and the Netherlands. We see that the trends in these countries are very similar to the US—the total number of hospitals in both countries declined substantially over time. For England there are HHIs for local hospital markets for a number of years. Those reflect substantial concentration, although declining slightly over time. Figure 9.3 illustrates the change in the distribution of the HHI between 2003/04 and 2007/08 (fiscal years). It can be seen that there is a shift of the distribution from more concentrated to less concentrated markets. Most of the shift is in the middle of the distribution, as opposed to the tails. The decline in the hospital HHI in England documented here is most likely due to pro-competitive reforms of the English National Health Service that occurred in 2006 (see Gaynor et al., 2010).

Table 9.3 provides information on the total number of hospitals and independent outpatient treatment centers in the Netherlands by year. There is a clear downward

Table 9.2 Hospital Market Structure, England, National Health Service, 1997–2007

Year	# NHS Hospitals[a]	# Mergers	HHI	# Private Hospitals[b]
1997	227	26	–	–
1998	214	21	–	–
1999	202	17	–	–
2000	193	23	–	–
2001	188	25	–	–
2002	174	6	–	–
2003	171	0	5,573	–
2004	171	0	5,561	3
2005	171	3	5,513	21
2006	168	3	5,459	32
2007	167	0	5,461	–
Total	–	124	–	–

[a]Source: UK Department of Health. Hospitals with fewer than 5,000 consultant episodes per year are excluded.
[b]Independent Sector Treatment Centres. These are private hospitals with contracts with the NHS.

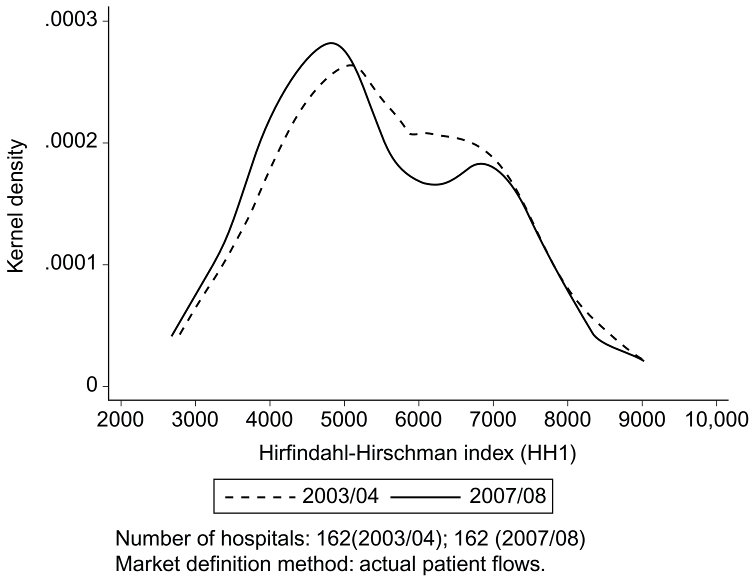

Figure 9.3 Kernel density estimates for the distribution of HHI (all elective services).

Table 9.3 Hospital Market Structure, The Netherlands, 1997–2010[a]

Year	# Hospitals[b]	Outpatient Treatment Centers[c]
1997	117	–
1998	117	–
1999	115	–
2000	111	–
2001	104	–
2002	102	–
2003	102	–
2004	101	–
2005	99	37
2006	98	57
2007	97	68
2008	97	89
2009	95	129
2010	94	184

[a]Source: Netherlands Healthcare Authority.
[b]Total number of hospitals, including general hospitals, specialty hospitals, and university medical centers. The vast majority are general hospitals.
[c]Independent Treatment Centers (ZBCs). These are freestanding outpatient treatment centers, not part of hospitals.

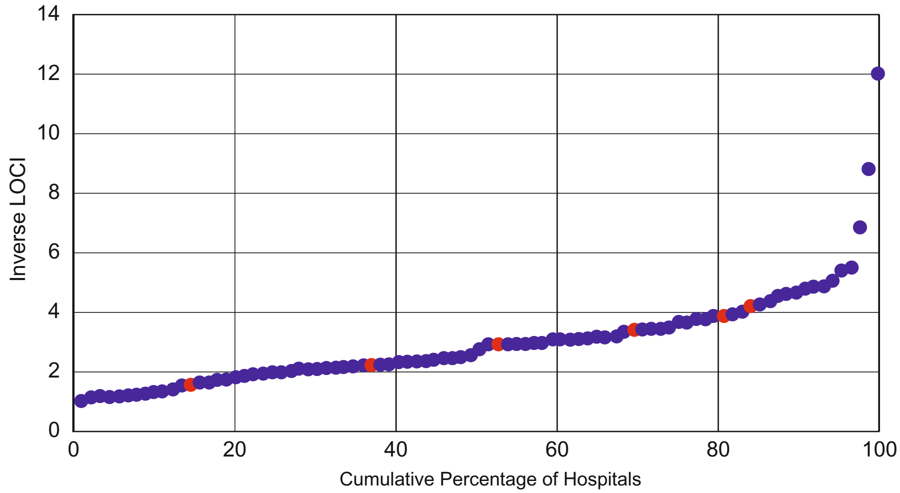

Figure 9.4 Cumulative distribution of LOCI, Netherlands, 2010.

trend in the number of hospitals—there were 23 fewer hospitals in 2010 than in 1997. More recently, there has been a large increase in the number of independent outpatient treatment centers. The number grew from 37 in 2005 to 184 by 2010.

Figure 9.4 shows the distribution of an alternative measure of market structure, LOCI (for Logit Competition Index),[9] for the Netherlands in 2010. LOCI is a measure of how much competition a firm faces in a differentiated products market. It varies between zero and one, where zero is pure monopoly and one is perfect competition. The graph shows the cumulative distribution of hospitals in the Netherlands by their values of the inverse of LOCI. As can be seen, approximately 20 percent of hospitals have values of inverse LOCI of 2 or below. A value of 2 implies the market is not very competitive—for example, a hospital in a duopoly that equally split the market with its rival would have a LOCI value of 1/2, i.e. an inverse LOCI of 2. One half of all hospitals have inverse LOCI values of 3 or less. This implies that half of Dutch hospitals operate in markets where they face competition from the equivalent of a triopoly or less.

Tables 9.4, 9.5, 9.6, and 9.7 provide information about health insurance market structures for the US and the Netherlands. The US information shows consistently high levels of concentration in health insurance markets. The levels of concentration in the Netherlands are substantially lower than in the US, but have grown substantially over time.

[9] This is a competition index for differentiated products Bertrand oligopoly with logit demand. See Akosa Antwi et al. (2006).

Table 9.4 Insurance Market Concentration, US, 2004–2008[a,b]

Year	Median HHI	Change	Mean HHI	Change
2004	3,544	–	3,939	–
2005	3,748	204	4,077	138
2006	2,986	−762	3,440	−637
2007	3,558	572	3,944	504
2008	3,276	−282	3,727	−217

[a]Source: These figures were graciously provided by David Emmons. See American Medical Association (2010) for more information on the data and calculations. American Medical Association (AMA) calculations for the combined HMO + PPO markets using January 1st enrollment data from HealthLeaders-InterStudy's (HLIS) Managed Market Surveyors HealthLeaders-Inter-Study.
[b]MSA-level HHIs for HMO + PPO markets.

Table 9.5 Large Employer Insurance Market Concentration, US, 1998–2009[a]

Self + Fully Insured			Fully Insured Only	
Year	Mean HHI[b]	Change	Mean HHI[b]	Change
1998	2,172	–	2,984	–
1999	1,997	−175	2,835	
2000	2,175	178	3,092	
2001	2,093	−82	3,006	
2002	2,280	187	3,158	
2003	2,343	63	3,432	
2004	2,519	176	3,706	
2005	2,609	90	3,951	
2006	2,740	131	4,072	
2007	2,873	133	4,056	
2008	2,916	43	4,201	
2009	2,956	40	4,126	

[a]Source: These figures were graciously provided by Leemore Dafny. The data are for large multisite employers and do not represent the totality of the insurance market. For more information on the data source, see Dafny (2010).
[b]Weighted by number of enrollees.

The measures of HHI for HMO plus PPO markets in the US in Table 9.4 come from reports from the American Medical Association (AMA). They show high levels of concentration (although lower than for hospitals). The numbers show insurance market concentration declining somewhat over time (although not monotonically). However, there are some concerns about the accuracy of these numbers (see Capps, 2009; Dafny et al., 2011a).

Dafny (2010) and Dafny et al. (2011b), using data on the large employer segment of the insurance market, also show increasing concentration in health insurance markets. Dafny (2010, Figure 9.5) documents an increase in the percentage of

Table 9.6 Small Group Insurance Market Structure, US, 2000–2003[a]

Year	Median Market Share, Largest Carrier	# of States with 5 Firm Concentration Ratio ≥75 Percent
2002	33 percent	19 (of 34; 56 percent)
2005	43 percent	26 (of 34; 77 percent)
2008	47 percent	34 (of 39; 87 percent)

[a]Source: Government Accountability Office (2009).

Table 9.7 Insurance Market Structure, The Netherlands, 2005–2010[a]

Year	Mean HHI
2005	1,346
2006	1,625
2007	1,630
2008	2,124
2009	2,119
2010	2,111

[a]Source: Netherlands Healthcare Authority.

markets with 1–4, 5–6, or 7–9 insurance carriers in the US from 1998 to 2005, and a decrease in the percentage of markets with 9–10 or more than 10 carriers. Dafny et al. (2011b) state that the mean HHI in their sample increased from 2,286 to 2,984 from 1998 to 2006, the median four-firm concentration ratio increased from 79 to 90 percent, and the mean number of carriers per market fell from 18.9 to 9.6. They show (Figure 9.1 in their paper) that 78 percent of the markets they study had increases in the HHI of 100 points or more from 2002 to 2006, and 53 percent experienced increases of 500 points or more. Table 9.5 lists mean HHIs by year from the data used in those papers. These numbers indicate that the large employer segment of the health insurance market is concentrated and has grown more so over time. These numbers are roughly similar in magnitude to those calculated by the AMA. However, they show concentration increasing over time (by about 400 points from 2004 to 2008), while the AMA numbers exhibit a slight decrease over time.

A recent report by the US Government Accountability Office (Government Accountability Office, 2009) compiled information on the market structure of the small group health insurance market in the US. Table 9.6 reproduces numbers from that report. As can be seen, those markets appear to be fairly heavily concentrated, and increasing in concentration. A recent paper by Schneider et al. (2008a) utilizes a unique data source for California to construct HHIs for insurance plans at the county level for 2001. They find an average insurance HHI for California counties of 2,592.

They report that 21 percent of counties have HHIs below 1,800,[10] 55 percent had HHIs between 1,800 and 3,600, and 24 percent had HHIs above 3,600. The information from these various data sources seems broadly consistent.

Table 9.7 contains information on the structure of the health insurance market in the Netherlands. The mean HHI is not very high in 2005, but increased by nearly 800 points by 2010. The mean HHI in 2010 is slightly higher than the HHI for an equally divided five-firm market (2,000). While not trivial, this is below the recently revised *Horizontal Merger Guidelines* cut-off for considering a market highly concentrated (HHI = 2,500). What is most notable is the large increase in concentration over the period, which may be a cause for concern.

There have also been substantial changes in market structure in US physician markets. Liebhaber and Grossman (2007) report that the percentage of physicians in solo or two-person practices declined from 40.7 percent in 1996–97 to 32.5 percent in 2004–05. Further, the proportion in practices of 3–5 physicians fell over the same period. The proportion of physicians practicing in groups of 6 or more grew from 15.9 to 21.8 percent. The number of physicians in other practice settings (primarily employed by others) grew from 31.2 to 36.0 percent over this period. Since the number of physicians per 1,000 persons has not really changed (~2.5) since 1997 (National Center for Health Statistics, 2011), this represents an increase in concentration.

There is no good systematic information on the structure of local physician markets. Those markets, especially for specialized services, may be very concentrated, but there is no information generally available at the national level. Schneider et al. (2008a) constructed HHIs for physician organizations in California at the county level for 2001. They find the average county HHI for physician organizations was 4,430, implying a high degree of concentration on average. They found that 17 percent of California counties had a physician organization HHI below 1,800, 33 percent had an HHI between 1,800 and 3,600, and 50 percent had an HHI above 3,600.

In addition to information on market structure, there is some information on trends in prices and the contribution of health care prices to overall health care cost growth. Akosa Antwi et al. (2009) document a 100 percent increase in hospital prices in California from 1999 to 2006, although they do not find market concentration to be a contributor to the increase. Martin et al. (2011) decompose US health spending growth into growth due to prices versus growth due to non-price factors (e.g. population, intensity of care). They find that prices account for 60 percent of the increase in overall spending from 2008 to 2009. The proportion of health spending growth due to prices varies over time (see Exhibit 6 in Martin et al., 2011), but has been growing steadily since 2001.

[10] The old Federal merger guidelines cut-off for considering a market highly concentrated (Federal Trade Commission and Department of Justice, 1992).

Some recent reports from state governments document growth or variation in health care prices. A report from the Massachusetts Attorney General's office (Massachusetts Attorney General, 2010) finds that price increases caused most of the increases in health care spending in the state in recent years. The report also finds significant variation in prices and that the variation is uncorrelated with quality of care, but is correlated with market leverage. A report on Pennsylvania hospitals found substantial variation in prices for heart surgery, but no correlation of prices with quality (Pennsylvania Health Care Cost Containment Council, 2007).

Overall, the statistics presented here paint a picture of health care and health insurance markets that are concentrated and becoming more so over time. There is also some evidence that prices are rising faster than quantities, and that price variation is not related to quality but may be due to market power. These statistics are not a complete picture, however. In particular, they do not take account of the ease or difficulty of market entry, nor of conduct in these markets. We discuss economic models for thinking about these issues, and what we know at present from research, in what follows as the main body of this chapter.

2. ENTRY, EXIT, AND TECHNOLOGY INVESTMENTS BY PROVIDERS

Health care policies, either through intent or as an unintended consequence, often affect the incentives of health care providers to enter, exit, invest, merge, and innovate. That is, health policy may affect provider market structure and thus change outcomes influenced by market structure, such as price, quantity, or quality, that were outside of the intent of the policy. These incentives may differ by ownership status and thus policies may change the mix of not-for-profit (NFP), for-profit (FP), and public organizations.

For example, the Hill—Burton program in the US provided subsidies to NFP and public hospitals for construction and expansion. That policy affected the number of hospitals, productive capacity, and ownership mix, and therefore also likely affected market outcome such as price, quantity, and quality. Another example is public payments to providers. Hospitals and most physicians earn a large percentage of their revenue from providing care to publicly insured patients (in some countries all, or nearly all, of their revenues) and those reimbursements are administratively determined. Changes in those payments affect the returns to these providers to enter, exit, invest, merge, and innovate. Thus, to fully understand the impact of a given policy often requires an understanding of how the policy will affect market structure through its impact on the behavior of providers. In this section, we briefly discuss recent developments in our understanding of evolution of provider market structure.

Over the last decade significant methodological and theoretical advances have occurred in the analysis of (dynamic) oligopoly models in which firms are making entry, exit, and investment decisions. These decisions are dynamic in the sense that they require upfront expenditures in which the organization will earn a return over a span of time or the decisions are difficult to reverse. As long noted by economists, understanding the dynamic implications of these models often requires estimating policy invariant parameters and the natural (albeit often challenging) way to do that is to specify and estimate parameters from a model that captures the essential features of the industry relevant for the question of interest. In this section we outline a basic framework for examining entry, exit, and investment decisions as well as review the small but growing literature devoted to understanding dynamic behavior of firms. Space limitations prevent us from discussing the details on solving and estimating fully dynamic models. However, there are several excellent summaries of this literature and the interested reader is referred to Ackerberg et al. (2007), Doraszelski and Pakes (2007), and the citations therein for a more complete presentation of these issues.

We present the outline of a simple model that is loosely based on the work of Gowrisankaran and Town (1997), which in turn is heavily influenced by the work of Ericson and Pakes (1995) and Pakes and McGuire (1994). Static returns to the organization are modeled as depending on the current state of the (potential) market participants, the actions they take in the period, and unobservables.[11] More formally, we denote the profits in period t, $\pi(s_t, a_t, \xi_t)$, that hospitals earn from the vector of state variables, one for each market participant, $s_t \in S$, and actions, $a_t \in A$ (actions can be investments, entry, exit, mergers, etc.), that affect the evolution of s_t.[12] The probability that a given action is successful is affected by i.i.d. shocks, ξ_t. Each hospital's shock is private information to the hospital. In this framework, s_t may represent the bargaining leverage of the hospital, a_t technological investments made by the hospital, and ξ_t is a shock that affects the successful implementation of the investments. There are a number of approaches to modeling state transitions, but in general they allow the state to evolve according to a first-order Markov process, where the actions of hospitals in period t affect the distribution of the states in period $t+1$. That is, $s_{t+1} = f(s_t, a_t, \xi_t)$ where f is a pdf of a distribution function that captures the relevant process through which states are updated.

So far, this set-up is generic and is not specific to a given provider setting or to a research question. However, we can incorporate a number of the institutional features of the hospital (or other provider) setting into this framework. For example, to

[11] There are many models of static firm behavior that are consistent with this representation, including the bargaining model presented in section 3.1.

[12] We suppress individual firm subscripts for clarity in notation.

endogenously account for the presence of NFP hospitals, the NFP hospital utility function can be posited as a function of profits and its state and actions, S_t and a_t (Newhouse, 1970).[13] NFP utility can operationalized as $U_t(s_t, a_t, \xi_t) = \pi(s_t, a_t, \xi_t) + (1-\gamma)q_t(s_t)$ where q_t is the number of patients treated and γ is the relative weight the hospital places on profits relative to the number of patients treated. In this framework it is also easy to allow FP hospitals to face income and property taxes (from which NFPs are exempt), which may differentially affect their investment decisions. The fact that most hospitals treat both private and public pay patients with variation in payment generosity can also be incorporated into this model.

The state evolves according to a Markov process that depends on the actions of the hospital and its competitors. Hospitals seek to maximize the present discounted value of utility. The equilibrium concept that is generally employed in these settings is Markov Perfect Equilibrium, which imposes that each hospital selects it actions in order to maximize the present value of utility given its rational beliefs of the strategies of the other hospitals and this simultaneously holds for all hospitals.

For each period, all hospitals solve:

$$\max_{a_t} E_t\left[\sum_t \beta^{t-1} U_t(s_t, a_t, \xi_t)\right] \qquad \text{s.t.} \quad s_{t+1} = f(s_t, a_t, \xi_t) \tag{9.1}$$

where E_t is the expectations operator given the information set available to the hospital in period t. The solution to this problem is a mapping from each state and realization of a hospital's shock to an action.

Entry is incorporated by allowing for a set of potential entrants who receive a random entry cost shock, while exit is incorporated by assigning hospitals a scrap value they receive if they exit. Hospitals will enter if the expected present discounted value of market participation exceeds the cost of entry, while exit occurs if the expected presented discounted value of continuing to participate in the market is less than the scrap value. If the return function is smooth and concave and if the evolution of the state variables is also well behaved, usually at least one equilibrium exists. In general, there is no closed form solution for these types of models. However, given the parameters of the model, there are well-established algorithms for solving these models.[14]

The model's economic and policy implications will depend upon the parameters chosen by the researcher. Thus, selection of "reasonable" parameter values is critical in order for these models to provide policy guidance. A natural choice of parameter values are those that are consistent with the patterns in the data. The static parameters—those that relate the states to the single period returns—can be estimated by

[13] Clearly, other objective functions of the hospital are possible and the appropriate one will depend on the question under consideration.

[14] See, e.g., Pakes and McGuire (1994), Gowrisankaran (1995), and Doraszelski and Satterthwaite (2010).

specifying a demand and supply system and solving for the static equilibrium for every possible state. Given estimates of the single period returns, the remaining parameters to estimate are the dynamic ones. These parameters typically capture sunk costs of entry, scrap values from exit, fixed costs of production, and parameters of the investment process. An important literature has arisen that develops econometric methods to estimate these parameters.

Gowrisankaran and Town (1997) is the first attempt to estimate the structural parameters from a dynamic oligopoly model of entry, exit, and quality investments. The goal of their work is to examine the impact of different policy initiatives on the structure of the hospital industry and patient welfare. In their model there are three types of patients: privately insured, Medicare beneficiaries, and uninsured; and two types of hospitals: NFP and FP. NFP hospitals seek to maximize the present discounted value of utility, which depends on profits and the number of treated patients. FP hospitals pay property taxes on their capital stock. To estimate the parameters they use a method of moments estimator in which for every trial parameter value they solve for the fixed point of the dynamic game. At the estimated parameter values, they find that NFP hospitals are longer lived (FPs are both more likely to enter and to exit), and have higher quality. Decreasing Medicare payment levels reduces the number of hospitals—this occurs principally because FP hospitals exit the market, and lead to higher quality adjusted prices for private pay patients. FP hospitals are more likely to be the marginal hospital, whose market participation is more sensitive to shifts in demand or government policy.

Several applied theoretical papers examine the entry and exit of health care providers in simpler settings than the dynamic context described above, thus allowing for the derivation of analytic results. Lakdawalla and Philipson (2006) examine a simple, traditional, perfectly competitive equilibrium model familiar to most economists, and add the ability of not-for-profit firms to enter and compete with for-profit firms. In their framework, for-profit hospitals maximize profits, while not-for-profit hospitals maximize utility, which has profits and output (and potentially inputs) as arguments. Lakadawalla and Philipson show that when NFP hospitals place positive weight on output they will behave as if they are profit maximizers with lower marginal costs, and in equilibrium will always earn negative profits. In general, NFP firms crowd out FP organizations. However, if the number of potential not-for-profit firms is limited, then for-profit firms participate in the market. In this case the market environment is determined by the response of for-profit firms, since they are the marginal organizations.

Hansmann et al. (2003) highlight that for-profit hospitals are the most responsive to reductions in demand, followed, in turn, by public hospitals and religiously affiliated non-profits, while secular non-profits are distinctly the least responsive of the four ownership types. Glaeser (2002) notes that the governance structures on the managers of NFP institutions are generally weak. He constructs a model of the NFP sector that examines the implications that governing boards of NFPs are not responsible to anyone outside of the organization. He further notes that the behavior of hospitals displays patterns consistent with capture by management and physicians.

2.1. Structural Estimates of the Dynamic Behavior of Providers

Over the last two decades there have been significant advances in econometric approaches to estimating parameters from dynamic models of oligopoly. Early approaches (e.g. as previously mentioned, Gowrisankaran and Town, 1997) solved for the equilibrium of the model for each trial parameter value. Recently, two-step approaches have been developed. These two-step methods alleviate the need to solve the model in order to recover the parameters, and thus significantly reduce the computational burden of estimation. Bajari et al. (2007), Aguirregabiria and Mira (2007), and Pakes et al. (2007) all develop approaches to estimate parameters from dynamic oligopoly.[15]

Schmidt-Dengler (2006) studies the adoption of nuclear magnetic resonance imaging (MRI) by US hospitals. Specifically, he examines the strategic incentives that hospitals have to adopt the technology. Adopting the technology allows the hospital to "steal" volume from their competitors and it may also deter or delay entry into this service line by competing hospitals. He estimates the parameters of a structural model of the timing of technology adoption (solving for equilibrium for each trial parameter vector) in order to disentangle these two effects. His simulations show that business stealing is the primary profit impact of MRI adoption, and that preemption has a small but significant impact on hospital profits.

Beauchamp (2010) estimates a dynamic model of the entry, exit, and service provision of abortion providers using the two-step method of Arcidiacono and Miller (2010). The goal of this work is to examine the reasons underlying the increasing concentration of abortion providers. He finds that high fixed costs explain the growth of large clinics and that increased provider regulation raised fixed entry costs for small providers. Interestingly, his simulations show that removing all regulations leads to increased entry by small providers into incumbent markets, increasing competition and the number of abortions.

Nursing homes are an extremely large industry where the federal and state governments are the primary payers. Two million US residents reside in 18,000 nursing homes. Because nursing homes do not set prices for most of their patients, competition is primarily along quality dimensions. However, it is well documented that the quality of care in nursing homes in the US is low. Seventy-three percent of nursing homes were cited for quality of care violations during routine

[15] Also see Arcidiacono and Miller (2010) and Pesendorfer and Schmidt-Dengler (2008).

inspections.[16] In order to study the dynamic response of the nursing home industry to different policy experiments, Lin (2008) estimates the parameters of an Ericson and Pakes (1995) type model. In the most interesting of her three policy experiments, she increases government payments for providing high-quality care by 40 percent. This leads to dramatic increases in both the percentage of high-quality homes and the total number of homes.

The Rural Hospital Flexibility Program that was passed in the Balanced Budget Amendment of 1997 has as its overarching goal maintaining access to quality hospital care for rural residents. To achieve this objective, the program created a new class of hospitals, Critical Access Hospitals (CAH). Participating hospitals opt out of Medicare's standard prospective payment system (PPS) and instead receive relatively generous cost-based reimbursements from Medicare. In return, they must comply with a number of restrictions, principally limits on their capacity to 25 beds or less and patient length-of-stay to 96 hours or less. By 2006, 25 percent of all general acute care US hospitals had converted to CAH status. Gowrisankaran et al. (2011) estimate the structural parameters of a dynamic oligopoly capacity game in order to assess the impact of this program on rural hospital infrastructure. They extend recent work on estimating dynamic oligopoly games by constructing a one-step ahead estimator that significantly reduces the computational burden of estimation. Preliminary results suggest that the program only had a modest impact on the likelihood of exit, while it dramatically changed the size distribution of rural hospitals. The estimates suggest that the reduction in the size of rural hospitals had a detrimental impact on rural residents and outweighs the benefits they received from keeping open a few hospitals that would otherwise close.

Dunne et al. (2009) estimate a dynamic, structural model of entry and exit for dentists and chiropractors using the method of Pakes et al. (2007). Their goal is to understand the roles of entry, fixed costs, and toughness of competition in determining market structure. They find that all three factors are important in determining market structure. To understand the role of entry costs in affecting market structure they simulate the impact of reducing entry costs and find that increased price competition offsets the reduction in entry costs.

As noted by Brenahan and Reiss (1990, 1991) (BR), market structure is endogenous and the relationship between market structure (i.e. the number of firms) and market size (e.g. population) speaks to the nature of static price competition. The BR method uses a simple, general entry condition to model market structure. The intuition is that if the population (per-firm) required to support a given number of firms in a market grows with the number of firms then competition must be getting tougher. The tougher competition shrinks profit margins and therefore requires a larger

[16] Office of the Inspector General, "Trends in Nursing Home Deficiencies and Complaints," OEI-02-08-00140.

population to generate the variable profits necessary to cover entry costs. For example, if the size of the market needs to triple in order to add an additional entrant, that suggests that the addition of that firm dramatically reduces firm profits. Thus, the key data required for this method are both minimal and commonly available: market structure and population.

Abraham et al. (2007) specify a static entry model modified from Bresnahan and Reiss (1991) to better understand the nature of hospital competition. Abraham et al. augment the BR approach by incorporating the use of quantity data. Their method allows the separate identification of changes in the fixed costs of entry and changes in the toughness of competition. Their estimates imply that the threshold per-firm population required to support one hospital is approximately 7,000, increases to 12,600 to support two hospitals, is approximately 19,000 for three hospitals, and just under 20,000 for four or more hospitals. They also find that increases in the number of hospitals in the market dramatically increases the number of patients up until there are three hospitals—by 23 percent with the entry of the second hospital and 15 percent with the entry of the third hospital. This implies substantial increases in the toughness of competition with the entry of a second or third firm, but not afterwards. These results point to substantial effects on competition even from having only a second firm in the market. However, the magnitude of the effects (23 percent increase in quantity associated with moving from a monopoly to a duopoly) seem extremely large.

Schaumans and Verboven (2008) specify a static entry model of pharmacy and physician entry in which pharmacies and physicians may be complementary services. Their model is in the spirit of Bresnahan and Reiss (1991) and Mazzeo (2002). In Europe, pharmacies have frequently received high, regulated markups over wholesale costs, and have been protected from additional competition through geographic entry restrictions. These restrictions may affect more than the market structure for pharmacies but may also spill over and affect entry of other complementary services. They estimate the parameters of the model using data from Belgium. They find that the entry decisions of pharmacies and physicians are strategic complements. Furthermore, the entry restrictions have directly reduced the number of pharmacies by more than 50 percent, and indirectly reduced the number of physicians by about 7 percent. Their model is discussed in more detail in section 6 on markets for physician services.

2.2. Reduced Form Studies of Dynamic Behavior of Providers

Understanding the patterns of the evolution of health care provider market structure can yield important insights into the underlying roles of policy and other factors that shape market structure. Towards that end, several papers examine the entry, exit, investment, and technology adoption patterns of providers using reduced form techniques. Given clean identification, these approaches can provide important insight into underlying relationships that affect the dynamic behavior of providers. A limitation of these approaches is that it is difficult to use these estimates to perform counterfactual policy experiments.

The most important change in US health care policy over the last century was the introduction of Medicare and Medicaid in the mid-1960s. Large portions of the population that were in poor health became insured under this program. That is, the introduction of Medicare and Medicaid constituted a large, positive shock to the demand for hospital and physician services which, in turn, had the potential to affect the entry, exit, and investment decisions of providers. Finkelstein (2007) examines the impact of this program on hospital dynamic behavior. She uses a long panel of American Hospital Association data and employs a difference-in-difference identification strategy. This strategy relies on geographic variation in the rates of hospital insurance prior to the introduction of Medicare/Medicaid to identify the impact of these programs. The idea is that areas in which large percentages of the population had insurance prior to the introduction of Medicare and Medicaid were less exposed to the treatment (the demand shock associated with the introduction of these programs) than areas of the country with lower insurance coverage. She finds that the Medicare program significantly increases the size of hospitals, increased admissions, increased hospital entry rates, and there is some evidence that it increased the rate of adoption of new technologies.

Not only does the presence of insurance affect hospital incentives, but the nature of the insurance market may affect reimbursement rates and thus affect the incentives of firms to invest in technology. In particular, managed care organizations negotiate lower payments and restrict utilization, and thus may affect technology adoption. In a series of papers, Laurence Baker and co-authors find evidence that managed care penetration affects technology adoption. Baker and Wheeler (1998) find that high HMO market share is associated with low levels of MRI availability and utilization. This suggests that managed care may be able to reduce health care costs by influencing the adoption and use of new medical equipment and technologies. Baker and Brown (1999) find evidence that increases in HMO activity are associated with reductions in the number of mammography providers and with increases in the number of services produced by the remaining providers. They also find that increases in HMO market share are associated with reductions in costs for mammography and with increases in waiting times for appointments, but not with worse health outcomes. Baker and Phibbs (2002) find that managed care slowed the adoption of neonatal intensive care units (NICUs) by hospitals, primarily by slowing the adoption of mid-level NICUs rather than advanced high-level units. Slowing the adoption of mid-level units would likely have generated savings. Moreover, contrary to the frequent supposition that slowing technology growth is harmful to patients, in this case reduced adoption of mid-level units could have benefited patients, since health outcomes for seriously ill newborns are better in high-level NICUs and reductions in the availability of mid-level units appear to increase the chance of receiving care in a high-level center.

The entry behavior of providers can be used to uncover the relative generosity of different payers. Chernew et al. (2002) use this insight to measure the relative payment generosity for coronary artery bypass graft (CABG) surgery. They examine the behavior of hospitals in California from 1985 to 1994—a period in which CABG was diffusing and hospitals were actively making decisions whether to provide this procedure. Chernew et al. (2002) use geographic variation in the distribution of patients with differing insurance arrangements to identify returns to CABG entry as a function of the expected volumes by payer class. They first estimate a hospital choice model for CABG and then use the predicted volumes by insurer type in a simple entry regression. They find that fee-for-service (FFS) insurance provides a high return throughout. Medicare reimbursements were initially generous but declined throughout the study period. HMOs pay at approximately average variable costs, and, interestingly, the return varies inversely with competition.

Chakravarty et al. (2006) examine hospital entry and exit rates through the lens of the model of Lakdawalla and Philipson (2006). They analyze the entry and exit behavior of hospitals from 1984 to 2000 and find higher exit and entry rates for FP hospitals than for NFPs. In addition, FP hospitals are more sensitive to shifts in demand. These results are all consistent with theoretical predictions—FPs are the marginal firm. Ciliberto and Lindrooth (2007) derive a random effects estimator of hospital exit and find that increases in Medicare reimbursements and improvements in efficiency reduced the probability of exit. Deily et al. (2000) find that during the late 1980s increases in relative inefficiency increased the probability that FP and NFP hospitals would exit, but not public hospitals.

Public policy can directly or indirectly affect hospital closure. The direct impact can occur by closing public hospitals, forcing existing private hospitals to close, or by bailing out failing hospitals. For example, in New York state, the recent Berger Commission Report (Commission on Health Care Facilities in the 21st Century, 2006) requires the reconfiguration and/or closure of 59 hospitals, or 25 percent of all hospitals in the state. Changes in payment or regulatory policy can indirectly affect the financial viability of hospitals and thus their probability of exit. The welfare impact of such closures will depend upon relative costs of the closed hospital and the value patients place upon having access to that hospital.

Lindrooth et al. (2003) examine the impact of hospital closure on the average cost of hospital care in the community. They find that the hospitals that closed were less efficient and that costs per discharge declined by 2−4 percent for all patients and 6−8 percent for patients at the closed hospital due to patients shifting to more efficient hospitals. Capps et al. (2010b) compare the loss in consumer surplus to patients from closing a hospital to the potential cost savings from closing inefficient hospitals. They examine five hospital closures in Arizona and Florida and conclude that, for the closures they study, the cost savings from closures more than offset the reduction in patient welfare. In contrast, Buchmueller et al. (2006) find that hospital closures in California had negative health consequences on the surrounding population. Specifically, they find that increases in the distance to the closest hospital increases deaths from heart attacks and unintentional injuries. These health effects are not captured in the consumer surplus analysis of Capps, Dranove, and Lindrooth.

Entry can significantly shape market structure and can have significant impacts on incumbent firms in the market. If firms can deter entry or if there are frictions that prevent the entry of organizations that might otherwise become market participants, it can have a significant impact on providers and health care consumers. In addition to the work of Schmidt-Dengler (2006), two other papers have addressed issues of entry deterrence and entry frictions: Ho (2009a) and Dafny (2005).

Kaiser Permanente is a vertically integrated, staff-model Managed Care Organization (MCO) based in California that owns hospitals and directly employs physicians and other health care providers. In California and Hawaii, Kaiser is quite successful, with large market shares in many California markets. However, outside of the West Coast of the US, Kaiser is not a significant factor. Much of Kaiser's success is attributable to its ability to provide reasonably high-quality care at low cost. Kaiser members generally do not receive care outside of the Kaiser provider network and thus they have limited provider choices. Given their comparative advantages and California success, an interesting question is why Kaiser is unable to replicate its California business model and enter in other markets. Kaiser has attempted to enter seven different markets and only successfully gained a foothold in three of these markets. Using simulation methods based on her previous work (Ho, 2006), Ho (2009a) examines the underlying reasons for Kaiser's lack of success outside of the West Coast. She finds that the premium reductions that Kaiser would have offered because of their limited provider network are large and not likely offset by any cost advantages they may possess. In addition, even in locations in which incumbent plan quality is low, customer informational asymmetry over plan quality implies that it will take Kaiser a long time to achieve the necessary scale economies to be profitable. Finally, she notes that Certificate of Need laws also raise the cost of entry for Kaiser, affecting their likely success rate.

As we discuss later in this chapter (section 4.4.3), there are significant volume-outcome effects in the provision of many hospital services, i.e. patients that go to hospitals that do larger volumes of a procedure typically have better health outcomes. Hospitals therefore may have an incentive to invest in building volume in the hopes of leaving insufficient patients for any potential entrants to attract if they were in fact to enter.[17] Dafny (2005) tests for this type of preemption for electrophysiological studies, a procedure to identify and correct cardiac arrhythmias. Building on the ideas of Ellison and Ellison (2007), she notes that entry preemption will most likely occur in markets where the entry probability is intermediate. In markets in which entry probabilities are high, entry will likely occur even with incumbent strategic behavior. In low entry probability markets, entry deterrence is unnecessary, because entry is unlikely even without preemption. Using Medicare claims data she tests this proposition and finds that incumbent volume growth for electrophysiological studies is largest in markets in which there is only one potential entrant (an intermediate entry probability case) and that the greater the number of entrants, the lower the incumbent volume growth. Thus, the evidence suggests that hospitals do engage in entry deterrence in accordance with the theory.

The analysis of entry and exit by providers other than hospitals is quite limited. Orsini (2010) examines the impact of changes in Medicare home health reimbursement rates that were passed in the Balanced Budget Act of 1997 on home health agency exits. Orsini finds that a decline in reimbursement of one visit per user increases the hazard of exit of a home health care agency by 1.13 percent with no differential response in exit by ownership type. Bowblis (2010) studies closures in the nursing home industry and finds that FP homes are slightly more likely to close than NFP homes. Also, homes that care for more publicly insured patients and those with poor financial performance were more likely to close.

2.2.1. The Impact of the Introduction of New Classes of Providers

The basic structure, roles, and segmentation of health care providers has remained relatively constant over the last half of the century. Hospitals provide a variety of inpatient and outpatient services and, depending on their specialty, physicians provide care in either their office and/or the hospital. Cutler (2010) comments on the lack of entrepreneurial vigor addressing the inefficiencies in the provision of health care. He cites two reasons for these inefficiencies. First, fee-for-service reimbursement schemes give providers little incentive to reduce the cost of the care they provide. Second, information on the cost and quality of care is generally not transparent. Thus, the returns to developing new care modalities that result in higher-quality and/or lower-cost care are likely to be modest. Cebul et al. (2008) also consider organizational issues in health care. They point to sociological factors, legal barriers, and issues with information (the compatibility and deployment of information technology specifically) as the key reasons for the inefficient organization of this sector. While Cutler and Cebul

[17] This can form a barrier due to fixed costs of entry or due to a volume-outcome effect. Insufficient volume may result in such poor quality that entry will not occur.

et al. are right to note the organization problems and lack of large entrepreneurial advances in health care provision, there are some important exceptions.

More broadly, the literature outside of health care generally finds that the introduction of new products can have large positive impacts on consumer welfare (e.g. Petrin, 2002; Gentzkow, 2007). However, this need not be the case in the health care sector. The large role of public programs where prices are set administratively, the importance of private third-party payers, and the presence of asymmetric information imply that new organizational forms can plausibly reduce consumer well-being. That is, these organizations could be designed to exploit administrative pricing irregularities, the inability of insurers to curtail patient utilization, or knowledge gaps between patients and providers over the quality and necessity of the care they receive. There are at least three types of new organization types that have been introduced over the last several decades, and we discuss them below.

There is a long history of hospitals that are devoted to specific conditions or populations—women's, children's, psychiatric, and tuberculosis hospitals have existed for over a century. However, in the early 1990s a new type of "specialty" hospital was born. Specialty hospitals are inpatient facilities that treat a limited range of conditions (e.g. cardiac and orthopedic). These hospitals are principally for-profit organizations, with physicians owning a significant stake in the hospital. Specialty hospitals are controversial. Critics argue that specialty hospitals are a mechanism to exploit asymmetric information by providing kickbacks to physicians for referrals, and they restrict the ability of general hospitals to internally cross-subsidize unprofitable services by skimming off high-margin patients. Proponents contend that there are important gains from specialization. Specialty hospitals may offer greater economic efficiency, higher quality, more consumer-responsive products and services, and provide beneficial competition to general hospitals.[18] Barro et al. (2006) study the impact of specialty hospitals and find that markets experiencing entry by a cardiac specialty hospital have lower spending for cardiac care without significantly worse clinical outcomes. In markets with a specialty hospital, however, specialty hospitals tend to attract healthier patients and provide higher levels of intensive procedures than general hospitals. Carey et al. (2008) find that orthopedic and surgical specialty hospitals appear to have significantly higher levels of cost inefficiency. Cardiac hospitals, however, do not appear to be different from competitors in this respect.

Chakravarty (2010) employs a number of analyses to assess the impact of specialty hospitals on general hospitals. In one, he uses propensity score matching and difference-in-difference analysis on a national dataset to estimate the effect of specialty hospitals on the profits of general hospitals. He finds no statistically significant impacts of the entry of specialty hospitals on general hospital profits. In this analysis

[18] See Schneider et al. (2008b) for an overview of the economics of specialty hospitals.

he is unable to control for the extent to which specialty hospitals may select healthier patients. He employs a dataset from the state of Texas with detailed clinical information to conduct an analysis controlling for the possibility that specialty hospitals skim healthier patients. He finds that there is heterogeneity in the effects of specialty hospital entry on general hospital profits: entry lowers general hospital profits in counties where specialty hospitals have healthier patients than the median (county), but not in other counties. He also looks at the impacts of specialty hospital entry on general hospital exit and merger. He finds no evidence of an impact on exit, but some evidence that specialty hospital entry increases the probability of general hospital mergers.

Ambulatory Surgical Centers (ASCs) were introduced in the US in the 1970s as more and more surgical procedures shifted to an outpatient setting, and have grown to become an important type of health care provider. There are 4,500 freestanding ASCs performing more than 15 million procedures annually (Cullen et al., 2009). ASCs provide non-emergent, outpatient surgical services, generally focusing on specific sets of procedures (e.g. cataract surgery, orthopedics). ASCs compete with each other and with the outpatient departments of general acute care hospitals for the provision of these services. Weber (2010) examines the welfare benefits of ambulatory surgical centers. She does this by estimating the demand for ASCs as a function of distance and patient and facility characteristics, using data from the state of Florida. Her estimates show that consumers place relatively little value on having access to an ASC. If all ASCs were closed, potential consumers of ASC services would conservatively lose approximately $1.50 of surplus per episode for the least valued procedure and about $27 per episode for the most valued procedure. Approximately two-thirds of the welfare loss comes from the loss of ASCs and their unique attributes, while the remaining one-third stems from consumers facing smaller choice sets and greater travel times.

Retail clinics (or convenience clinics) are a relatively new type of health care provider that compete with physician clinics for the diagnosis and treatment of several common, low acuity conditions. The first retail clinic opened in a Cub grocery store in St. Paul, MN, in 2000. Retail clinic patients do not need an appointment, and care is provided by nurses with advanced training (usually nurse practitioners) who are overseen by a physician (often remotely). Currently, there are over 1,200 clinics operating in the US. The prices for each service are typically posted at the clinic as well as online, making the patient financial obligation transparent. These fees are much lower than most physician office visit charges, making retail clinics a more attractive option for the uninsured. The clinics also are usually located in a retail establishment (drug store, grocery store, big box retailer) and have extensive evening and weekend hours. Using a large, national database of private insurer claims, Parente and Town (2011) examine the impact of these clinics on the cost and quality of care. They find that the cost of care at these clinics is significantly lower relative to the care provided in a physician's office, with no obvious quality differences. As a consequence, these results suggest that the introduction of retail clinics resulted in significant consumer welfare gains. Some recent results by Ashwood et al. (2011), using data from a different large national insurer, find increased utilization and cost associated with retail clinics, however. Retail clinics are associated with reductions in utilization and costs for physician office visits and emergency room visits. However, the increase in retail clinic visits is larger than the reductions in other types of utilization.

3. HOSPITAL MARKET STRUCTURE, COMPETITION, AND PRICES

3.1. A Model of Hospital Insurer Negotiation

As mentioned in the introduction, the hospital industry is one of the largest industries in the US economy. Not only is the hospital industry large, but it operates in a very unique institutional setting. Over the last decade a series of papers have been written that model the price setting behavior of hospitals. These models recognize that institutional features of the hospital market in the United States are unique and these features have ramifications for the role of competition in affecting prices and the quality of care. There are at least four key distinguishing features of hospital markets that play an important role in affecting competitive interactions between hospitals.

First, privately insured patients primarily access hospital care through their health insurance, therefore the set of available hospitals will depend on the health plan's provider network structure. Health insurers often contract with a subset of hospitals in a given location. The effective hospital choice set for a patient when they need to be treated will therefore depend upon their health insurance plan (Ho, 2006). Second, patients do not pay directly for inpatient care. Most of the cost of an inpatient episode is covered under the patient's insurance and hence any price differential between hospitals is not generally reflected in the patient's out-of-pocket cost. Third, the health insurance choice of the patient is generally made prior to the need for inpatient treatment. In this sense, hospitals are an option demand market. Fourth, hospitals negotiate with private insurers over inclusion in their provider network and the reimbursement rates the hospital will receive from treating the insurer's enrollees. These negotiations also determine how hospital utilization will be monitored and controlled as well as details of the billing arrangements. Health insurers, in turn, compete with each other based on premiums (which are a function of the prices they pay hospitals) on the breadth and quality of their provider networks. Employers, through whom most private insurance is acquired, have preferences over hospitals which are an aggregation of their employees' preferences, and select the set of health plans they offer to their workers based on expected costs, benefit structure, and provider networks.[19]

Below, we outline a simple model of hospital—insurer bargaining. There are several goals we wish to accomplish with this model. First, we wish to understand the role of market power and its source in affecting the price of hospital care. Second, a related goal is to understand how hospital mergers affect the price of inpatient care and the impact on welfare. Third, we provide guidance to empirical modelers so that one can estimate parameters that can be linked, either directly or indirectly, to the underlying theory of hospital price determination. We also note that this model, while faithful to key institutional details specific to health care, is generic enough that it can be applied to other health care providers besides hospitals, most prominently physicians. It also could be expanded in the direction of encompassing a richer model of the insurer market, although one for pragmatic purposes one would then have to simplify the insurer-provider part of the model.

The model combines the insights of research on hospital competition by Gal-Or (1997), Town and Vistnes (2001), Capps et al. (2003), Gaynor and Vogt (2003), Ho (2009b), Haas-Wilson and Garmon (2011), and Lewis and Pflum (2011). The structure of this model is also similar to the bargaining models of Crawford and Yurukoglu (2010) and Grennan (2010), who study cable television distribution and the negotiations between hospital and medical device suppliers over the price of stents, respectively. Our formulation most closely follows the exposition in Brand et al. (2011) (BGGNT).

Hospitals differ from most products in that the vast majority of consumers obtain their hospital services through their health plan. In order for health insurers to offer products that are viable in the marketplace, insurers must construct networks of hospitals from which enrollees can receive health care services. The breadth and depth of the provider network is a large determinant of the desirability of the different health plans, as consumers value access to a variety of hospitals in the event of adverse illness shocks. At the same time, consumers value income and so health insurance plans with lower premiums are also more attractive. As will be seen, there is a trade-off between the inclusiveness of an insurer's network and insurer premiums. Health plans with more inclusive networks will *ceteris paribus* have less bargaining power with hospitals and thus pay higher prices, resulting in higher premiums.

We model hospital competition as taking part in three stages. First, health plans and hospitals bargain to determine both the set of hospitals to include in the plan networks and the payment from the health plan to the hospital for each admitted patient. Second, patients choose health plans. Finally, patients realize illness shocks, and choose a hospital based on their illness shock and the hospitals in their network. Hospitals

[19] Most large employers are self-insured and thus changes in negotiated prices between providers and health plans are directly passed on to the employer.

and health plans are assumed to have "passive beliefs," i.e. if a plan or hospital gets an alternative offer in the negotiating process, this will not change their beliefs about the offers made or received by its competitors. We describe each of the three stages of the game in turn, starting from the final stage.

There are H health plans and N hospitals operating in the market. A set of patients, denoted $i = 1, \ldots, I$, live in the market area and may enroll in a health insurance plan and, after they have enrolled, they may become ill enough to require inpatient treatment. In the final stage of the game, each patient takes her health plan h and associated set J_h of in-network hospitals as given. At the beginning of the third stage, each patient learns her illness shock. Denote these shocks $m = 1, \ldots, M$, where each m corresponds to a particular illness, or no illness, $m = 0$. Let $\rho_{i1}, \ldots, \rho_{iM}$ denote the *ex-ante* probability of each shock. Each diagnosis has an accompanying weight $w_1, \ldots, w_M$. The weights describe the relative importance of each diagnosis in both the cost and utility function, as we discuss below. In empirical implementations, the m values would generally correspond to Diagnosis Related Groups (DRGs) or some other disease classification system.

Given diagnosis m, patients choose a hospital at which to obtain treatment. Patients are assumed not to pay an out-of-pocket differential price based on which hospital they select, provided the hospital is in-network. The utility that patients receive depends on the characteristics of the hospital (e.g. the services offered and the perceived quality of care), characteristics of the patients (e.g. demographics and diagnosis), the travel time to the hospital, and an idiosyncratic error term.[20] We let the *ex-post* utility for patient i from hospital $j \in J_h$ with illness shock m_i be given by:

$$u_{ij,m} = w_m[f(x_j, z_i, d_{ij}, m_i; \theta) + e_{ij}] \tag{9.2}$$

where x_j is a vector of hospital characteristics including a hospital indicator, z_i is a vector of patient characteristics including age, sex, and race, d_{ij} is the distance to the hospital from the patient's home, m_i is diagnosis, θ is a parameter vector to be estimated, and e_{ij} is an i.i.d. error term that is a distributed Type I extreme value, which is revealed to the patient at the same time as her illness shock. In practice, u_{ij} is parameterized to be a linear function of a hospital fixed effect, travel time and interactions between hospital characteristics (such as bed size, ownership type, teaching status, service offerings), patient characteristics, diagnosis, diagnosis weight, and travel time.

[20] In our formulation of utility, we assume that patients do not face any price differential across hospitals. We make this assumption primarily for expositional ease. There is some evidence that hospital prices do in fact affect hospital choice (e.g. Gaynor and Vogt, 2003). This could be a consequence of patient cost-sharing arrangements, insurers negotiating on their enrollees' behalves, or because physicians are incentivized to use lower-cost hospitals (Ho and Pakes, 2011). The advantage of allowing prices to enter patient utility is that recovering the utility parameter on price allows for the monetization of the patient's surplus from a given hospital network.

In addition to the J_h hospitals, the patient can also choose the outside option 0, which corresponds to going to an out-of-network or out-of-area hospital or no hospital. We normalize the utility from the outside option to have zero base utility, so $u_{i0} = e_{i0}$. We assume that if the health shock $m = 0$ then the utility of hospital treatment is sufficiently low that the patient always chooses the outside option 0.

Given the logit assumption, the probability that an individual i with illness m will seek care at hospital j is

$$s_{ijm} = \frac{\exp(f(x_j, z_i, d_{ij}, m; \theta))}{1 + \sum_{k \in J_j} \exp(f(x_k, z_i, d_{ik}, m; \theta))}$$

In turn, the *ex-ante* expected utility that a patient receives from a given hospital choice set J_h is given by:[21]

$$W_i(J_h) = \sum_{m=1 \ldots m} \left(\rho_{im} w_m \ln \left(1 + \sum_{j \in J_j} \exp(f(x_j, z_i, d_{ij}, m; \theta) \right) \right) \qquad (9.3)$$

Conditional on illness severities and probabilities, the distribution of x_j and the geographic distribution of hospitals, the welfare a patient receives from a health plan's network is a function of the identities of the hospitals in the plan's network.

Turning now to the second stage, each enrollee (and potential patient) is faced with a set of health plans, $h = 1, \ldots, H$, from which they select. Each plan has a set of hospitals in its network, J_h, and each plan simultaneously chooses its premium for its customers.[22] Plan attributes are given by a set of characteristics, c_h. We posit that the expected utility for consumer i of plan h is given by:[23]

$$v_{ij} = W_i(J_h; \theta) + \gamma c_h + \xi_h + \alpha^P \ln(income_i - Prem_h) + \varepsilon_{ih}$$

where $Prem_h$ is the insurance premium for plan h, ξ_h captures differences in the unmeasured (by the econometrician) desirability of the plan, γ and α^P are parameters, and where ε_{ih} is distributed i.i.d. Type I extreme value.[24] Let $\tilde{v}_{ih}$ denote the unconditional expected value of v_{ih} and let W_i and $Prem$ denote the vectors of the plan values

[21] To ease the notational burden, we index $W_i(J_h)$ only by J_h but it is understood that it is a function of patient and hospital characteristics and θ.

[22] BGNGT model the health plan as a cooperative whose objective is to maximize enrollee surplus. The advantage of this approach is that it allows for an explicit solution to the hospital/insurer bargaining game without modeling health plan competition. In that approach, consumer surplus directly enters the bargaining solution.

[23] For expositional ease we treat health plan enrollees as homogeneous conditional on their z_i and e. However, in an empirical implementation it may be desirable to allow for random coefficients over the preference parameters, as in Berry et al. (1995).

[24] In this parameterization of utility the pre-tax benefit treatment of health insurance is captured, in a reduced form way, in α^P.

for these variables for all plans in the market. The probability that individual i enrolls in plan h is:

$$\gamma_{ih}(J, \xi, Prem; \theta, \gamma, \alpha) = \frac{\exp(\tilde{v}_{ih})}{\sum_l \exp(\tilde{v}_{il})}$$

where J is an $H \times N$ matrix of ones and zeros which denote the hospital networks of all the H plans and ξ is the $H \times 1$ vector of ξ_h values. The market share for plan h is then the summation of the probabilities of selecting the plan across the population: $Y_h(J, \xi, Prem) = \sum_i \gamma_{ih}(J_1, \ldots, J_H, Prem)$.[25] The profits the health plan earns from a given network are then:

$$\pi_h(J, \xi, Prem) = \left(Prem_h - ac_h - \sum_j p_{jh} q_{jh} \right) Y_h(J, \xi_h, Prem) - Fixed_h$$

where ac_h is the other variable costs incurred by the plan outside of hospital expenditures, e.g. administrative and marketing costs. We assume that the plan's cost structures are known to all the other plans. Health plans are assumed to select a single premium to maximize profit. That is, treating their own and the competitors' hospital networks as fixed, the first-order conditions are:

$$Y_h(J, \xi, Prem) + \left(Prem_h - ac_h - \sum_j p_{jh} q_{jh} \right) \frac{dY_h(J, \xi, Prem)}{dPrem_h} = 0 \tag{9.4}$$

The equilibrium of the premium setting game is one in which all of the plans' premiums satisfy (9.4) simultaneously. Caplin and Nalebuff (1991) prove that there is a unique equilibrium in the premium setting game given the set of health plan hospital networks. The premiums and thus the profits of all the health plans will depend upon the structure of all the competing plans' hospital networks, their costs, and the distribution of patients across geography and incomes.

Finally, at the first stage of the game, we assume that hospitals and health plans bargain over the price of inpatient care. The outcome of this bargaining game determines which hospitals and health plans will agree to a contract and the prices health plans will pay hospitals for caring for their enrollees. Although the contract terms between hospitals and health plans are complex, we assume that health plans and hospitals are constrained to negotiate a base price for each patient. The actual price paid by the health plan to the hospital will be the base price multiplied by the disease weight, w_m. Since the weights are effectively meant to capture costs, one could implement this by using DRG weights, which have roughly the same purpose. With the interpretation of the w terms as DRG weights, we believe that this structure for a

[25] We ease the notational burden by subsuming the parameter index into Y_h.

contract between a health plan and hospital is a reasonable approximation of actual contracts.

We consider a model of bargaining and competition similar to Horn and Wolinsky (1988).[26] There are JH pairs of hospitals and health plans which are negotiating over a price (p_{jh}) the health plan pays to the hospital for each patient the hospital treats. The hospital's marginal cost of treating the patient is C_j.[27] Nature chooses a random ordering among each of these pairs and assigns an initial offerer to each pair. The parties then engage in a bargaining process over prices. Prior to the match, the health plan receives an i.i.d. synergistic cost term from the match, cm_{jh}, that is common knowledge to both firms and which will generate randomness to the *ex-ante* outcomes. A natural starting point for analyzing the bargaining game is to focus on the Nash bargaining solution.[28] This solution takes each insurer–hospital pair in isolation, holding the other hospital–insurer prices fixed. The Nash bargaining solution we consider ignores the strategic interactions that a given insurer–hospital price might have on other insurer–hospital prices. Importantly, this framework is an approximation to the game in which prices and the entire provider networks are determined.[29] Clearly, allowing a richer set of strategic interactions would be a welcome advance.

To calculate the Nash bargaining outcome we need to specify the agreement and disagreement values for the hospital and the insurer. The agreement value for the hospital is the net revenues they earn from the insurer's flow of patients to the hospital. Under the disagreement outcome the hospital is assumed to receive a fixed net revenue, r_h. For the insurer, the agreement value is the gross revenue they earn from having hospital network J_h in place less the expenditures on inpatient care at the hospital. Holding the other plans' hospital networks fixed, we denote the gross revenue as:

$$F_h(J_h) = Prem_h^*(J_h, J_{-h})Y_h(J_h, J_{-h}, \xi, Prem_h^*) \tag{9.5}$$

where $Prem_h^*$ is the vector of premiums that solves (9.4), and we decompose the matrix of hospital networks into two components, plan h's network and the networks of the other plans, J_{-h}. Denote the hospital network that excludes hospital j as J_{h-j}. The gross revenue from the network that excludes hospital j is then:

$$F_h(J_{h-j}) = Prem_h^*(J_{h-j}, J_{-h})Y_h(J_{h-j}, J_{-h}, \xi, Prem_h^*) \tag{9.6}$$

The insurer's disagreement value is then $F_h(J_{h-j}) - \sum_k pk_j q_{kh}^{J_h - j}$, where $q_{kh}^{J_h - j}$ is the flow of patients to network hospitals given network J_{h-j}. If the net surplus

[26] More recent analyses of bargaining games in supplier network contexts include Stole and Zwiebel (1996), Inderst and Wey (2003), and de Fontenay and Gans (2007).

[27] We assume costs do not vary by health plan.

[28] See Dranove et al. (2007) for an examination of the "levels" of rationality that hospitals possess in the bargaining game.

[29] Ho (2009b) and Pakes (2010) consider a game of hospital network formation which endogenizes the network structure.

from the hospital–insurer match is not greater than zero, then bargaining does not take place and the hospital is not in the insurer's network. That is, bargaining only takes place if $F_h(J_h) - F_h(J_{h-j}) - c_{jh}q_{jh} - \Sigma_{l \neq j} p_{lh} d_{jlh} - cm_{jh} > 0$, where $d_{jk} = (q_{kh}^{J-j} - q_{kh})$.

Summarizing the agreement and disagreement values we have:

$$H_{\text{agree}} = (p_{jh} - c_j) q_{jh}(J_h)$$

$$H_{\text{disagree}} = r_j$$

$$M_{\text{agree}} = F_h(J_h) - p_{jh} q_{jh}(J_h) - \sum\nolimits_{l \neq j} p_{lh} q_{lh}(J_h) - cm_{jh}$$

$$M_{\text{disagree}} = F_h(J_{h-j}) - \sum\nolimits_{l \neq j} p_{lh} q_{lh}(J_{h-j})$$

Under Nash bargaining each bilateral price maximizes the Nash product of hospital net profits and the net insurer surplus from agreement, taking the other prices as given, solving

$$\max_p [H_{\text{agree}} - H_{\text{disagree}}]^{\beta} [M_{\text{agree}} - M_{\text{disagree}}]^{1-\beta}$$

where $\beta \in [0,1]$ is the relative bargaining ability or non-modeled bargaining power of the hospital relative to the insurer. Differentiating and solving for p_{jh} yields:[30]

$$p_{jh} = (1-\beta)\left(c_j - \frac{r_j}{q_{jh}}\right) + \frac{\beta}{q_{jh}}(F_h(J_h) - F_h(J_{h-j}) - cm_{jh}) + \beta \sum_{l \neq j} p_{lh} d_{jlh} \tag{9.7}$$

where we refine d as a share so $d_{jk} = (q_{kh}^{J-j} - q_{kh})/q_{jh}$ and q_{kh}^{J-j} is the number of patients that flow to hospital k if the network is J_{h-j}. That is, d_{jk} is the diversion share from hospital j to hospital k when hospital j is no longer available.

The Nash bargaining solution predicts that, quite intuitively, a hospital's price will be increasing in its costs, bargaining ability, the prices of other competing hospitals, and, importantly, the net value that the hospital brings to the insurer's network. In this framework, we have left the insurer few tools to affect their bargaining position. There are circumstances in which if the health plan can steer patients to lower priced hospitals it can significantly affect the bargaining outcome. This is true theoretically as well as empirically. Sorensen (2003) and Wu (2009) find that health plans which are better able to channel patients can extract greater discounts from hospitals.

Part of the goal of this analysis is to provide a framework for the analysis of hospital mergers. To start this analysis assume that the hospitals negotiate separately while under joint control but take into account the impact of disagreement on the

[30] Note that $\frac{\partial F(V_{J_h}, p_{jh})}{\partial p_{jh}} = 0$ by the envelope theorem.

flow of patients to the other hospital in the system.[31] This changes the threat points and thus the Nash bargaining solution. The agreement and disagreement outcomes are now:

$$H^{j+k}_{\text{agree}} = (p_{jh} - c_j)q_{jh} + (p_{kh} - c_k)q_{kh}(J_h)$$

$$H^{j+k}_{\text{disagree}} = (p_{kh} - c_k)q_{kh}(J_{h-j}) + r_j$$

$$M^{j+k}_{\text{agree}} = F_h(J_h) - p_{jh}q_{jh} - \sum\nolimits_{l \neq j,k} p_{kj}q_{lh}(J_h) - cm_{jh}$$

$$M^{j+k}_{\text{disagree}} = F_h(J_{h-j}) - \sum\nolimits_{l \neq j} p_{kh}\tilde{q}_{lh}(J_{h-j})$$

Solving the first-order conditions for this bargaining game yields the following Nash bargaining solution:

$$p^{j+k}_{jh} = (1-\beta)\left(c_j + \frac{r_h + d_{jkh}p_{kh}}{q_{jh}}\right) + \frac{\beta}{q_{jh}}(F_h(J_h) - F_h(J_{h-j}) - cm_{jh}) + \beta \sum_{l \neq j} p_{lh}d_{jlh} \quad (9.8)$$

Assuming that hospital costs are not affected by the merger and holding β constant, the change in price caused by the merger is given by:

$$\Delta p^{j+k}_{jh} = (1-\beta)d_{jkh}p_{kh} - c_j \quad (9.9)$$

The impact of the merger on hospital *k*'s price is symmetric. Intuitively, the increase in price is a function of the diversion share between *j* and *k*. If no patients view hospital *k* as the closest substitute for *j* when *j* is not available, then the merger will have no effect on price. The impact of the merger on hospital *j*'s price is increasing in *k*'s price and the bargaining leverage of hospitals.

Now let the hospitals negotiate jointly. Specifically, assume that the hospitals make an all-or-nothing offer. That is, the insurer can either have all of the hospitals in the system or none of the hospitals in the system in their network. Here we assume that hospitals *j* and *k* merge to form a system and they will commit to charging one price for both hospitals in the system. The post-merger agreement and disagreement values are now:

$$H^{j+k}_{\text{agree}} = (p_{jh} - c_{j+k})(q_{kh}(J_k) + q_{kh}(J_h))$$

$$H^{j+k}_{\text{disagree}} = r_j + r_k$$

$$M^{j+k}_{\text{agree}} = F_h((J_j) - p_{jk}(q_{jh}(J_h) + q_{kh}(J_h)) - \sum\nolimits_{l \neq j,k} p_{lh}q_{lh}(J_h)$$

[31] Balan and Brand (2009) perform similar analysis in their simulation analysis of hospital merger simulations.

$$M^{j+k}_{\text{disagree}} = F_h(J_{h-j-k}) - \sum\nolimits_{l \neq j,k} p_{lh} q_{lh}(J_{h-j-k})$$

where c_{j+k} is the volume weighted average cost of the newly merged system.

Solving as before yields the solution:

$$p_{jh} = (1-\beta)\left(c_{j+k} + \frac{r_{j+k}}{q_{jh}+q_{kh}}\right) + \frac{\beta(F_h(J_h) - F_h(J_{h-j-k}) - cm_{j+kh})}{q_{jh}+q_{kh}} + \beta \sum_{l \neq j} p_{lh} d_{(j+k)lh} \tag{9.10}$$

The diversion shares, $d_{(j+k)lh}$, are now relative to the merged entity and $d_{(j+k)kh} = 0$. The impact of a given hospital merger will depend on the changes in the relative threat points. However, if the hospitals are viewed as substitutes by potential patients, then post-merger prices will increase. To see this, let hospitals j and k be symmetric in the sense that they have the same pre-merger prices, average costs and volumes, and assume that the match value terms are unaffected by the merger.[32] Let $\Delta^{J_{h-j}} = \frac{1}{q_{jh}}(F_h(J_h) - F_h(J_{h-j}))$, which is the average loss in net revenue to the insurer per patient if no agreement is reached. The corresponding value for the merged hospital is $\Delta^{J_{-j-k}} = \frac{1}{q_{jh}+q_{kh}}(F_h(J_h) - F_h(J_{h-j-k}))$. The change in the price of hospital j is then:

$$\Delta p_{jh} = \Delta^{J_{-j-k}} - \Delta^{J_{-j}} + \sum_{l \neq j,k} p_{lh}(d_{j+klh} - d_{jlh}) \tag{9.11}$$

The merger will increase price as long as the additional loss in per-patient welfare (relative to network J) from hospital network J_{h-j-k} is greater than the loss in welfare from hospital network J_{h-j}. This will be the case if and only if patients view hospitals j and k as substitutes. To see this, assume that hospitals j and k are not substitutes in the sense that $\frac{d_{jkh}}{q_{jk}} < a$ where a is a sufficiently small (say 0.05), so that $F_h(J_h) - F_h(J_{h-j-k}) \approx 2F_h(J_h) - F_k(J_{h-j}) - F_h(J_{h-k})$. Then $\Delta^{J_{-j-k}} \approx \Delta^{J_{-j}}$ and $\Delta p_{jh} \approx 0$.[33]

In order to assess the welfare impact of a change in hospital market structure, we need to trace out the pass-through from changes in hospital prices to changes in health insurance premiums. In this framework, hospitals are an input into the production of health insurance, thus any change in hospital prices will only affect consumer surplus if those changes are passed through to consumers. Given parameters on health plan utility and the appropriate data, it is possible to quantify the impact of the hospital merger on welfare. Suppose competing hospitals j and k successfully merge and in

32 It is straightforward but notationally cumbersome to let prices differ by hospital for this exercise.

33 In the random utility hospital choice model there will always be some non-zero substitution between hospitals in the choice set and thus there is no two-hospital pair for which $d_{jkh} = 0$.

their new negotiations with health insurers change hospital prices by Δp_{j+k}, where Δp_{j+k} is an $H \times 1$ vector. We assume the merger does not affect the structure of any health plan's hospital network or any other health plan attributes.[34]

To calculate the impact of the merger on premiums at the new hospital prices, resolve the health plan's first-order conditions (9.4) for the new post-merger premiums. Denote the post-merger premiums as $Prem^{j+k}$. Let $v^*_{ih}(Prem_j, W_i, c_h, \xi_h; \alpha^p, \gamma) = v_{ih} - \varepsilon_{ih}$. The consumer surplus from health insurance for individual i is:

$$CS_i(Prem, W_i, c_h, \xi_h; \alpha^p, \gamma) = \frac{1}{\alpha^p} \ln\left[1 + \sum_{h+1...H} \exp(v^*_{ih})\right] \tag{9.12}$$

The impact of the hospital merger on consumer welfare through its impact on hospital prices is then:

$$\Delta CS_i = CS_i(Prem^{j+k}) - CS_i(Prem) \tag{9.13}$$

The aggregate impact is then the summation of ΔCS_i across the affected population (e.g. those not enrolled in public health insurance).

3.2. Estimating the Impact of Hospital Market Power on Price

The most active area of research in the industrial organization of health care is the analysis of the impact of hospital concentration on hospital prices. There are several different approaches to estimating the role of bargaining leverage on hospital prices. The approaches differ in the nature of identification, data quality, the structure imposed on the data generating process, and complexity of the econometrics. Nevertheless, virtually all the approaches implicitly or explicitly rely on a version of the insurer—hospital bargaining framework. The basic strategy (with some important exceptions) is to estimate the parameters in equation (9.7) or, more commonly, to approximate the functional relationship in (9.7). With those parameter estimates in hand it is relatively straightforward to calculate merger counterfactuals by computing the predicted post-merger price using (9.11). We discuss three broad classes of empirical strategies used to estimate the impact of changes in market structure on prices: (1) reduced form; (2) merger case studies; and (3) structural and semi-structural approaches.

Examining the distribution of realized hospital prices alone is informative about the functioning of hospital markets. Ginsburg (2010) uses administrative claims data for eight geographic areas from four large insurers to construct inpatient hospital prices. He finds that there is significant variation both within and across regions in

[34] If they are quantifiable and measurable, it is straightforward to incorporate any other changes to health plan attributes into this analysis. For example, see Petrin (2002).

hospital prices. For example, San Francisco has the highest average hospital prices in 2008 with prices equal to 210 percent of the Medicare reimbursement rate. The lowest rate is Miami-South Florida with mean prices that are 147 percent of Medicare rates—the mean price in San Francisco is 43 percent higher than Miami. Within San Francisco, the interquartile range is 116 percent of the Medicare price. Of course, there are a number of possible reasons for this variation. Cost, quality, and demand differences will generally imply price differences. However, it seems unlikely that there is enough variation across those factors to generate such wide variation in price. It is important to note that in the bargaining framework outlined above, it is easy to generate large variations in price both across and within markets by simply varying the ownership structure of hospitals, suggesting to us that the variation in prices is likely related to variation in hospital bargaining leverage.

3.2.1. Reduced-form Estimates

Reduced-form approaches to estimating price concentration have a long history in the industrial organization and health economics literature. In this approach, researchers construct measures of market concentration, usually some form of the Herfindahl–Hirschmann Index (HHI),[35] and regress it on the variable of interest (e.g. prices) controlling for observable confounding variables. Reduced-form approaches allow researchers to be somewhat agnostic about the underlying theoretical model and thereby let the data speak directly to the relationships between the variables of interest.[36] While the broader industrial organization literature has largely moved away from employing reduced-form approaches, it nevertheless remains a popular research approach in the health economics and health services research literatures.

There are several reasons underlying the movement away from reduced-form strategies. First, in most applied settings it is difficult to square a strict functional relationship between price and the HHI with economic theory. Basic oligopoly theory posits a functional relationship between HHI and prices only with Cournot behavior—quantity setting with homogeneous products. Homogeneous product, quantity setting models are inconsistent with the institutional facts of hospital markets, as we have previously indicated.

Some alternative models generate pricing power as a function of market shares, and are thus related to the HHI. Akosa Antwi et al. (2006) develop a competition index for differentiated product oligopoly with logit demand and Bertrand pricing.

[35] The HHI is the sum of squared market shares.

[36] See Gaynor and Vogt (2000) and Dranove and Satterthwaite (2000) for summaries of early portions of this literature.

They call the index "LOCI" for Logit Competition Index. LOCI takes the following form:

$$\Lambda_j = \sum_{t=1}^{T} \frac{N_t \bar{q}_t s_{tj}}{\sum_{t=1}^{T} N_t \bar{q}_t s_{tj}} (1 - s_{tj}) \quad (9.14)$$

where Λ_j is LOCI, hospitals are indexed by j, consumers are of differing types indexed by t, N_t is the number of type t consumers, $\bar{q}_t$ is the average quantity consumed by type t, and s_{tj} is the proportion of type t consumers going to hospital j. The pricing equation for this model is:

$$p_j = c_j + \frac{1}{\alpha} \frac{1}{\Lambda_j} \quad (9.15)$$

where c_j are hospital marginal costs and α is the marginal utility of income from the underlying utility function. This is a coherent economic model that generates an equation with price as a function of market shares.

In another approach, which also utilizes logit demand, Capps et al. (2003) show that

$$W_i(J_h) - W_i(J_h - j) = \ln\left(\frac{1}{1 - s_{ij}}\right) \quad (9.16)$$

and thus a hospital system's bargaining leverage is an aggregation of a non-linear function of the individual hospital choice probabilities. A common approach to calculating the HHIs is to construct an HHI at the zip code level and then aggregate up to the hospital level. That gives the following measure of concentration: $HHI_j = \sum_z \bar{s}_z^j \sum_k s_{zk}^2$, where $\bar{s}_z^j$ is the hospital's share of its patients it culls from zip code z. This formulation of the HHI is functionally related to WTP below and thus will be imperfectly correlated with the WTP. One might more broadly think of the HHI as a proxy for the expected toughness of competition based on market structure. The HHI is not explicitly derived from an underlying theoretical framework, but is intended to capture the potential for competition. This has some appeal, but it is important to realize that while the HHI can be constructed to imperfectly capture geographic and product differentiation, nonetheless it likely contains meaningful measurement error. Many analysts who have estimated equations using the HHI have been sensitive to this and have attempted to deal with the problem, usually through the use of instrumental variables. As always, the resulting estimates will be as good as the instruments.

The second concern regarding the reduced-form approaches is that market structure is endogenous.[37] There likely are unobservables, such as the quality of the services

[37] The problem of endogenous market structure is not unique to reduced-form methods. Structural approaches generally simply assume fixed market structure, and so they also face the challenge of estimating models when market structure is endogenous.

provided, or unobserved cost differences, that will be correlated with price and market structure. For example, if price is not appropriately adjusted for quality, then standard regression analysis of concentration on hospital price will yield biased coefficients. Some of this concern can be mitigated by estimating a multinomial model of hospital choice and using the estimates to construct hospital-specific measures of market concentration. Kessler and McClellan (2000) and Gowrisankaran and Town (2003) develop such an approach to construct measures of market concentration and much of the recent literature has moved to constructing hospital-specific versions of the HHI. These HHI measures are generally the weighted (by hospital patient shares) zip code HHIs. More generally, instrumental variable approaches can be employed to deal with the endogeneity problem, including the approach just described.

The third issue is that hospitals sell differentiated products, and traditional approaches to calculating the HHI do not account for this differentiation. The hospital-specific measures described above constitute an ad hoc approach to dealing with this problem. The LOCI measure described above is a competition index explicitly derived for differentiated products oligopoly.

Fourth, reduced-form approaches generally require specifying a geographic market. This often relies on geopolitical boundaries (e.g. counties or Primary Metropolitan Statistical Areas (PMSAs)) to define the market. Geopolitical boundaries are unlikely to correspond to market definitions, and thus this approach will generate measurement error. As mentioned above, many recent SCP approaches construct a hospital-specific measure of the HHI by measuring the HHI at the zip code level and taking a share weighted average across zip codes to construct the hospital's HHI. This approach to calculating the HHI mitigates, at least to some degree, the third and fourth criticisms listed above.

The principal challenge in estimating models of hospital price competition is constructing an accurate measure of hospital price. Hospital contracts with insurers are generally complicated and have numerous prices for different services. In general, there are three classes of contracts: DRG-based, per-diem, and percent of charges. It is common for hospital contracts to contain combinations of these approaches. For example, a hospital/insurer contract might have a DRG structure for general medical/surgical services and "carve-out" obstetrics using a per-diem formulation. These contracts give hospitals different incentives for resource use. Anecdotally, bargaining leverage appears to play a significant role in the determination of the contract form, with hospitals preferring contracts with lower-powered incentives and insurers preferring higher-powered contracts.

There is little work that considers the role of competition in determining insurer—hospital contract structure.[38] In their analysis of insurer contracts for transplant

[38] Town et al. (2011) examine the degree of physician risk-bearing in their contracts with health insurers. They find that physicians facing less competition are more likely to have fee-for-service contracts.

services, Bajari et al. (2010) find that the majority of hospital contracts rely on a non-linear, percent of charges structure. Because of the complexity of insurer–hospital contracts, in most circumstances actual administrative claims data used to adjudicate payments between hospitals and insurers will provide the best measure of price. Constructing price using administrative claims requires adjusting for differential severity and types of services. Unfortunately, administrative claims data from payers and hospitals are not widely available. Researchers more commonly use measures of price constructed from state mandated hospital financial reports. Capps and Dranove (2004), Tenn (2011), Haas-Wilson and Garmon (2011), Thompson (2011), Ginsburg (2010), and Brand et al. (2011) are a subset of the papers that use insurer claims data to construct prices in this way.

Table 9.8 presents a summary of the reduced form papers published since 2000. This literature has moved away from primarily using data from California which, because of data availability issues, was the primary data source for prior work. All but one of the papers listed in this table finds a positive relationship between hospital concentration and price. Not surprisingly, this relationship appears to be a function of the structure of the health plan. Specifically, during the rise of MCOs during the 1990s, this relationship strengthened and the growth in the correlation appears to wane during the managed care backlash. In addition, the correlation is stronger in markets with high MCO penetration or in areas with a large number of managed care organizations. The relationship between price and measures of market structure also holds in other countries. Halbersma et al. (2010) find hospital–insurer prices are positively correlated with hospital concentration and negatively correlated with insurer concentration after the introduction of market-based health care reforms in the Netherlands in 2004.

3.2.2. Estimates of the Impact of Consummated Mergers on Price

The second popular approach to the analysis of the impact of hospital mergers is to study the impact of consummated mergers. The analysis of actual mergers has obvious appeal. The variation in market structure is driven by the phenomenon of primary interest. Understanding the outcomes of past hospital mergers speaks directly to the role of competition and the impact of consolidation on hospital prices, and ultimately downstream health care consumers. Studying consummated mergers also suggests a natural estimation strategy. Most of the papers in this literature rely on a difference-in-difference research design in which the merging hospitals (or sometimes their close rivals) are the treatment group and researchers locate other hospitals to use as controls. In an effort to better understand the appropriate merger enforcement strategy, the Federal Trade Commission has embarked on a program to retrospectively study consummated mergers. The results of these studies are published in a recent issue of *International Journal of the Business of Economics*.

Table 9.8 Summary of Hospital Price-Concentration Literature

Study	Primary Data Source, Services, Location and Time Period	Measures of Market Structure/Price	Empirical Approach	Results
Akosa Antwi et al. (2009)	OSHPD; Inpatient; CA; 1999—20025	County-level HHI; average net revenue per discharge	Graphical analysis of price growth trends	Prices increased 2-fold over period and growth is highest in monopoly markets; however, changes in market structure are not associated with differential price growth
Burgess et al. (2005)	AHA, OSHPD, inpatient; CA; 1994—1998	Average net private revenue per private discharge; hospital system HHI is weighted average zip code HHI	Estimate GEE to account for within-hospital correlations	Hospital system HHI is positively correlated with price
Dranove et al. (2008)	OSHPD, Florida State Center for Health Statistics; AHA; inpatient; CA and FL; 1990—2003	Hospital system HHI based on actual and predicted patient flows	OLS and IV regression of price on concentration and measure of MC intensity	The association between concentration and price increased during the 1990s and leveled off during the 2000s
Melnick and Keeler (2007)	OSHPD, AHA; inpatient; CA; 1999—2003	Average net private revenue per private discharge; hospital system HHI is weighted average zip code HHI	Linear regression of log price on concentration indexes and system indicators	System HHI is positively associated with price growth; hospitals in large systems experienced higher price growth
Moriya et al. (2010)	MedStat insurance claims, AHA data; all inpatient; US; 2001—2003	HHI calculated using AHA data, DRG-adjusted prices from claims data	Estimate the relationship between insurer/hospital concentration and price using OLS w/market FE	Insurer concentration is negatively associated with hospital prices; hospital

(*Continued*)

Table 9.8 (Continued)

Study	Primary Data Source, Services, Location and Time Period	Measures of Market Structure/Price	Empirical Approach	Results
				price/concentration relationship is insignificant
Wu (2008)	Medicare cost reports, AHA; inpatient; MA; 1990–2002	Outcome of interest is change in private payments per admission	Examines impact of hospital closures on prices using DDD approach	Hospitals in which a rival closed experienced a price increase relative to controls
Zwanziger et al. (2000)	OSHPD; inpatient; CA; 1980–1997	Outcome of interest is hospital revenue and expenditures, HHI is weighted average zip code HHI	Estimate the impact of hospital concentration allowing for the impact to vary by year; estimate with hospital FE	The association between market concentration and hospital revenue is monotonically increasing from 1983 to 1997
Zwanziger and Mooney (2005)	HMO annual reports, SPARCS, NY cost reports; inpatient; NY; 1995–1999	Price is HMO payments/risk-adjusted discharges; hospital/system HHI is weighted average zip code HHI	Estimate the relationship between hospital concentration and price leveraging NY deregulation of hospital pricing in 1997 w/hospital FE	The relationship between system HHI and prices became large and significant after reform

Note: Lists only those studies published after 2000.

Despite its appeal, there are a number of challenges to implementing merger case study analysis. Principal among these challenges is defining a sensible set of control group hospitals. Over the last decade hospital inflation has been significant and persistent—the producer price index for hospitals increased on average 3.8 percent per year. Thus, simply examining pre-post-hospital prices may lead to misleading inferences regarding the underlying change in the competitive environment induced by the merger. In addition, a merger may change the quality or the set of services provided by the merging hospitals, which may also affect inference. The set of control hospitals should have cost and demand shocks that mimic what would have happened to the merging hospitals under the counterfactual that the merger did not take place.

In their study of the impact of the Evanston Northwestern Healthcare and Highland Park Hospital merger and the St. Therese Medical Center and Victory Memorial Hospital, Haas-Wilson and Garmon (2011) used the non-federal general acute-care hospitals in the Chicago Primary Metropolitan Statistical Area that were not involved in mergers over the relevant time period. However, as is clear from the pricing equation (9.7) from our bargaining model, hospital mergers will affect the prices of competitors. That is, a hospital merger that leads to increased bargaining power will also spill over and increase the prices of competing hospitals that are not party to the merger. Using a set of control group hospitals that are geographically proximate to the merging hospital will control for local demand and cost shocks, but risks inducing a downward bias in the estimated impact due to the spillover effect. Using hospitals that are not proximate as a control group reduces the bias from spillovers, but increases the likelihood that demand and costs shocks will not be adequately controlled.

Table 9.9 provides a summary of the papers examining the impact of consummated mergers on estimated prices. There are several patterns worth noting. Because of the size of this literature, we do not have the space to discuss in detail all of the papers, and therefore highlight the patterns and the papers that are particularly noteworthy. First, the large number of hospital mergers in concentrated markets provides many opportunities for the examination of price effects of mergers. This is reflected in the numbers of papers (nine in total) that estimate merger price effects. In the broad industrial organization literature, the number of papers devoted to examining pricing behavior post-merger is rather limited.[39] Second, on average, the impact of consolidation on prices is positive and large. Third, while the average impact is large, there does seem to be heterogeneity across health plans in the change in the post-merger negotiated price. The model presented above can account for this heterogeneity in a limited way through changes in the bargaining leverage parameters that occur

[39] This literature has focused primarily on mergers in the airline and banking industries.

Table 9.9 Summary of Hospital Merger Literature

Study	Primary Data Source and Time Period	Location/Merger	Services	Price Measure	Empirical Approach	Results
Capps and Dranove (2004)	Insurer claims 1997–2001	Analysis of 12 inpatient hospitals involved in mergers	Inpatient	Inpatient prices from claims	Difference-in-difference (DID)	Nine of the 12 hospitals had price increases exceeding the median
Dafny (2009)	AHA, Medicare reports 1989–1996	Analyzes 97 hospital mergers US	Inpatient	CMI-adjusted inpatient revenue per discharge	Instrumental variables	Merging hospitals had 40 percent higher prices than non-merging hospitals
Haas-Wilson and Garmon (2011)	Insurer claims 1997–2003	Evanston, mergers of Evanston NW and Highland Park and St. Therese and Victory Memorial	Inpatient	Inpatient prices from claims	DID	Post-merger, Evanston-NW hospital had 20 percent higher prices than control group; no price effect at St. Therese–Victory
Krishnan (2001)	Ohio Dept. of Health and OSHPD 1994–1995	OH and CA analysis of 37 different hospital mergers	Inpatient	DRG prices based on charge to revenue information	DID	Merging hospitals increased price 16.5 and 11.8 percent in OH and CA, respectively
Spang et al. (2001)	AHA, Medicare cost reports 1989–1997	Analyzes 204 hospital mergers across US	Inpatient	Adjusted inpatient revenue per admission	OLS	Merging hospitals experienced a 5 percentage point lower price growth relative to rivals

(*Continued*)

Table 9.9 (Continued)

Study	Primary Data Source and Time Period	Location/Merger	Services	Price Measure	Empirical Approach	Results
Tenn (2011)	Insurer claims 1997–2002	SF Bay Area, CA Sutter/Summit merger	Inpatient	Risk-adjusted inpatient price from claims	DID	Summit prices increased 28.4 to 44.2 percent compared to control group
Thompson (2011)	Insurer claims 1997–98 and 2001–02	Wilmington, NC New Hanover-Cape Fear 1998 merger	Inpatient	Risk-adjusted inpatient price from claims	DID	Three of 4 insurers experienced a large price increase; one insurer experience a decrease in prices
Town et al. (2006)	CPS, AHA and InterStudy, 1991–2003	Entire US	Not applicable	Rate of uninsurance	DID	Aggregate merger activity increased the uninsured rate by 0.3 percentage points
Sacher and Vita (2001)	OSHPD data, 1986–1996	Santa Cruz, CA merger of Dominican and Watsonville hospitals	Inpatient	Average net revenue received per inpatient acute-care admission	DID	Average net revenue from private payers Dominican hospital prices were 22 percent higher after the merger relative to controls

Note: Lists only those studies published after 2000.

post-merger. Nevertheless, it is a puzzle why the post-merger price effects are not more homogeneous across markets and across insurers within markets.

All but one of the studies find that, for the majority of the mergers they analyzed, prices increased (or increased faster relative to trend) for hospitals that consolidated relative to the control group hospitals.[40] These studies can be classified into two categories: those that use aggregated measures of price (usually from reported accounting data) and those that use insurer claims data to construct prices. The pricing information constructed from claims likely contains significantly less measurement error. Focusing on those studies, for 17 of the 23 hospital merger/MCO combinations, hospital prices increased significantly relative to the control group.[41] The typical increase in price is often quite large. For example, Tenn (2011) finds that the prices at Sutter hospital increased between 28 and 44 percent after its merger with Alta-Bates hospital, relative to the control group.[42]

The pattern that mergers between competing hospitals in concentrated markets often leads to significant price increases also holds in international settings. While most non-US OECD countries rely on administered prices, the health reforms implemented in 2004 in the Netherlands allow insurers and hospitals to negotiate over prices. Two hospital mergers between competing hospitals were consummated just prior to the reforms. Kemp and Severijnen (2010) estimate the impacts of the mergers on the price of hip surgery and find that the hospitals involved in the most controversial merger experienced a significant increase in price relative to the control hospitals.

One concern in studies that use a difference-in-difference approach is that the merger is endogenous. That is, there are unobservables (to the econometrician) that affect the returns to merger and the prices that would have occurred absent the merger. For example, a hospital that is in decline might be more likely to merge, and it is likely that its future prices are likely to be lower than one would expect given observables.[43] In this case, the estimating merger effect would be biased towards zero. Dafny (2009) addresses the endogeneity issue by constructing an indicator of whether hospitals are co-located (located within 0.3 miles of one another) as an instrument. The underlying idea is if distance is predictive of mergers (which it should be as the gains from merger are a function of the distance between hospitals), but is

[40] The one study that did not find a price increase at merging hospitals, Spang et al. (2001), is the oldest paper in the review and uses relatively poor measures of price and costs and the study design is not well suited to identify hospital merger effects.

[41] We exclude St. Therese—Victory hospital merger from this calculation.

[42] Since the price increase at Alta-Bates was comparable to the control group, this suggests that the hospital system used their bargaining leverage after the merger only for higher rates at Sutter hospital.

[43] The are other possible sources of bias. For example, a hospital that is a poor negotiator with MCOs may be more likely to be acquired or the hospital may change its post-merger characteristics (e.g. quality), which may affect its post-merger price. See discussion by Gowrisankaran (2011) and Leonard and Olley (2011) regarding the potential biases of difference-in-difference estimates of merger price effects.

uncorrelated with these unobservables, then it should correct for the selection into merger. She then examines the impact of a hospital's rivals merging on that hospital's price using this IV strategy and finds that OLS analyses lead to lower estimated merger effects relative to IV, consistent with the idea that hospitals select into merger. Her analysis crucially relies on the linear separability of the unobservable. That is, in order for the instrument to be valid, the unobservable's impact on profits cannot be a function of the distance between rivals.

Finally, while the literature clearly shows that mergers between rivals in concentrated settings is likely to increase prices for insurers, it is unclear how those increased prices affect consumers. In the framework outlined above, as is clear from equations (9.12) and (9.13), the welfare impact of a hospital merger depends on the pass-through from increased hospital prices to insurance premiums. Two companion papers examine this pass-through, albeit in an indirect way. Town et al. (2006) examine how changes in hospital market structure affect rates of uninsurance. If increases in hospital prices are not passed on to consumers, then there should be little association between hospital mergers and insurance take-up. They find that, in fact, hospital mergers lead to declines in the rates of insurance and the more competitive the insurance market (measured by the number of HMOs), the larger the impact of hospital mergers. There is little work on the equity and access consequences of provider consolidation. Town et al. (2007) find that the declines in health insurance take-up caused by hospital consolidation were most pronounced for low-income and minority populations.

In sum, there is a clear message from this literature. Mergers between rival hospitals are likely to raise the price of inpatient care in concentrated markets. While the direction of the impact of hospital mergers is clear, the estimated magnitudes are heterogeneous and differ across market settings, hospitals, and insurers. The difference-in-difference approach does not lend itself to uncovering the reasons for the wide range of price responses. Employing methodological approaches that address the limitations of difference-in-difference analysis and forming a better understanding of the diversity of price responses to hospital mergers are areas that deserve future research attention.

3.2.3. Results from Structural and Semi-structural Approaches

More recently, researchers have placed greater emphasis on estimating the price impact of hospital mergers using structural and semi-structural techniques. The advantages of structural approaches are clear. Structural approaches estimate the primitives of a specific economic model and thus can predict counterfactual outcomes in an internally consistent manner. However, there are also important disadvantages to structural estimation. It requires the specification of a specific economic model that is unlikely to perfectly correspond to the actual data generating process. Thus, there is likely to be some bias from model misspecification, and the importance of that bias is difficult to quantify.

Semi-structural estimation approaches also have advantages and disadvantages. They have a foundation in economic theory and estimate some of the primitives of an economic model but do not impose a specific economic model on the estimation. However, this flexibility has consequences, as the estimated parameters may not be invariant to changes in costs, demand, or market structure and thus might lead to inaccurate counterfactual predictions. It should be noted that reduced-form methods also impose a specific data generating process: however, that data generating process is often ad hoc and might not be consistent with any economic model. As the reduced-form approaches do not estimate economic primitives, the coefficients may be functions of factors that might be affected by changes in the market environment. Thus, reduced-form approaches may also lead to poor counterfactual predictions.

The inherent limitations of any empirical approach should not deter researchers from applying these methods—empirical nihilism is not an attractive option. In particular, policy makers will continue to make policies that affect the outcomes of provider markets and it is important for economists to produce the best evidence they can on the likely impact of these policies. That will require economists to use the best empirical tools to make inferences from the available data, understanding and probing the limitations of their chosen empirical strategy.

Town and Vistnes (2001) and Capps et al. (2003) (CDS) are papers that first developed semi-structural approaches consistent with the institutional framework in which hospitals compete to estimate the price effects of hospital mergers. Let

$$V_h(J_h) = \sum_{i \in I_h} W_i(J_h) \tag{9.17}$$

where $W_i(J_h)$ is defined in (9.3) and I_h is the relevant health plan population to aggregate over. Equation (9.17) is the gross value to health plan enrollees of having access to hospital network J_h. The basic idea is to structurally estimate what CDS call the willingness-to-pay (WTP) for each hospital, $WTP_j = V(J_h) - V(J_{h-j})$, using patient discharge data. From (9.7), hospital prices are a function of $F_h(J_h) - F_h(J_{h-j})$, divided by the expected number of patients from that payer.[44] The key assumption is that the WTP measure well approximates $F_h(J_h) - F_h(J_{h-j})$ or rather the functional relationship between price and $F_h(J_h) - F_h(J_{h-j})$ is well approximated by the functional relationship between price (or profits) and the WTP.

With the WTP measure in hand the researcher can then regress WTP on prices or hospital profits. This is done by first estimating a multinomial logit hospital choice

[44] If price is the dependent variable then the appropriate measure of WTP will be normalized by the expected volume of patients. The dependent variable in CDS is profits and thus their WTP measure is based on the aggregate gross value of the network.

model using patient discharge data. These data contain information on the hospital where the patient was admitted, home zip code, diagnosis, and patient demographics, which allow the estimation of θ in equation (9.2). With an estimate of θ and illness severity weights, it is straightforward to calculate WTP using (9.3). Given the estimates from this model, the values of $W_i(J_h) - W_i(J_{h-j})$ are calculated and then the WTP is calculated by integrating over the probability of each illness for each individual, using the empirical distribution of illnesses in the data. The fundamental assumption is that the hospital system threatens to pull all of the hospitals from the insurer's system if an agreement is not reached at any of its hospitals.

To calculate the price impact of a merger between hospitals j and k one can simply compute the new value of $WTP_{j+k} = V(J_h) - V(J_{h-(j+k)})$ and use the regression estimates to compute the post-merger price increase. Let θ be the coefficient on WTP. The impact of the merger is determined by the net increase in bargaining leverage: $\theta(\Sigma_i V(J_{h-j}) + V(J_{h-k}) - V(J_{h-(j+k)}))$. Compared to pure reduced form approaches, the primary advantage of this approach is that it is more closely grounded in the underlying theory.

While the semi-structural approach is better grounded in the theory, and can be thought of as a reduced-form approximation to a number of different bargaining games, the estimation is nevertheless not tied to a specific theory that predicts this particular functional relationship. Thus, the residuals from the regression have no structural interpretation. The residuals capture all factors that affect price but are not included in the observables, which could include bargaining ability, unobserved costs, or complementary organizational assets (e.g. the ownership of physician groups, or health plans).

In calculating the expected post-merger price increase of a merger between hospitals j and k, one needs to make assumptions regarding the appropriate treatment of the residuals. One possible approach is to calculate the change in the fitted prices and use that change as the predicted price change from the merger. Another approach would be to take the average of j and k's residuals and apply them to the newly formed hospital. Finally, if there are important asymmetries between hospitals j and k (e.g. one hospital is part of an existing large system and one hospital is a stand-alone community hospital), one might reasonably apply the residual from the large system to all hospitals in calculating the price increase. Here the price increase would then account for both increases in the bargaining leverage due to the merger, as well as the impact of organizational-specific attributes that affect price (e.g. better bargaining skill, the ownership of complementary assets). In addition, another important limitation to this approach is that it assumes that there is no spillover effect of the merger on the pricing behavior of other hospitals in the market (i.e. it only allows for unilateral effects).

Town and Vistnes (2001) acquired data on negotiated price between two MCOs and hospitals in Southern California to estimate the relationship between the net value that a hospital brings to the network and price. One of the challenges in estimating bargaining models is specifying the counterfactual outcome that would occur if the hospital and MCO fail to reach an agreement. In the bargaining framework outlined above, the disagreement outcomes are quite simple and only consider the possibility that the hospital is dropped from the network without replacement. However, there are other possible counterfactual networks that could arise under a disagreement.

Town and Vistnes consider two counterfactual disagreement outcomes to estimate the parameters. The first counterfactual is that absent an agreement, the MCO will simply exclude the hospital from the network. The second counterfactual they consider is that MCOs will contract with the closest hospital not currently in the network. They then estimate a switching regression model in which one of these two counterfactuals determines the bargaining leverage of the hospital, and hence will determine the negotiated price. They find that hospitals with higher bargaining power (as measured by these two counterfactuals) negotiate higher prices. They also run merger counterfactuals, and their results indicate that mergers between neighboring hospitals can lead to significant increases in hospital prices, even in an urban environment with many other competing hospitals.

CDS use data from San Diego, CA, to estimate the relationship between WTP and hospital bargaining leverage. They calculate WTP as described above and regress it against hospital profits. Rearranging (9.7) and aggregating over MCOs, hospital profits will be a complicated function of the WTP. They find a strong positive correlation between WTP and hospital profits—a one unit increase in WTP increases hospital profits by \$2,233. This implies that hospitals that are more attractive to consumers have greater bargaining power, and hence earn substantially higher profits. Lewis and Pflum (2011) expand upon the CDS framework. They estimate a hospital cost function and specify a simple bargaining model and find that WTP is correlated with market power. They also find that systems operating in multiple markets have higher bargaining power, indicating that focusing only on local markets in evaluating the potential effect of a merger may be insufficient. A hospital's physician arrangements and other characteristics can also have a significant effect on its bargaining power.

Several papers take a significantly more structural approach to examining hospital competition. Gaynor and Vogt (2003) take a different approach to structurally estimating the impact of hospital mergers. They adapt the structural models of Berry et al. (1995) (BLP), who developed an estimation framework for differentiated products consumer goods to the hospital industry. In both cases the products are differentiated, but individuals pay directly for consumer goods, without the intermediate step of health plans. The Gaynor and Vogt (2003) approach modifies the utility model in equation (9.2) so that total price paid by the insurer is an argument in the utility function, and thus affects hospital choices. The interpretation is that this is a reduced-form choice function incorporating the objectives of consumers and insurers.[45] They specify a supply side, allowing for differences between NFP and FP hospitals.

Gaynor and Vogt use data from hospital discharge and financial data from California. They use the discharge data to estimate a multinomial logit model of hospital choice, and use data on hospital revenues to construct a measure of prices. They estimate the average elasticity of demand faced by a hospital to be −4.85, and find that hospitals are highly spatially differentiated—cross-price elasticities fall sharply with the distance between two hospitals. NFP hospitals set lower prices than FPs, but mark up prices over marginal costs by the same amount. They then go on to simulate the impact of a hospital merger in San Luis Obispo, California, and predict that hospital prices would increase by up to 53 percent, with no significant difference in merger effects if the merging hospitals are NFP or FP. The advantage of using this approach is that it allows for a rich model of consumer demand, direct information on hospital costs is not necessary, and given the data and the parameter estimates, it is straightforward and transparent to calculate the impact of a merger of prices.

This posted price BLP model is fairly different from a bargaining model. BLP-style models have been widely applied to examine mergers for many other industries.[46] There are two issues with adapting BLP-style estimation to the hospital industry. First, using a BLP approach requires obtaining an accurate estimate of the price elasticity of demand from the choices of consumers. Yet consumers rarely pay different out-of-pocket prices for different hospitals in-network so it is not entirely clear how the variation in hospital prices affects consumer choice. Second, in general, BLP models assume a Bertrand price equilibrium. However, as noted by Grennan (2010), the Bertrand price equilibrium is a special case of the Nash bargaining equilibrium with $\beta = 1$ and no price discrimination. If $\beta < 1$, imposing a Bertrand equilibrium will lead to misspecification. Of course, all models are simplifications and thus are necessarily misspecified, so it is unclear how important this misspecification is for merger analysis. Given that bargaining models can be complicated and also subject to misspecification, one way to think about the posted price model is that it is a reduced-form way of capturing a complicated underlying bargaining relationship.

Ho (2009b) represents a significant breakthrough in the modeling of hospital competition. The key insight she develops is that given consumer preferences over MCO characteristics (including the structure of its hospital network), and the realized hospital network, one can estimate the parameters of the hospital profit function. She

[45] Gaynor and Vogt prove that, under fairly general conditions, insurers, in effect, act on behalf of consumers. In this case the demand function they estimate recovers consumer preferences. Consumers may not pay differential prices at the point of choosing a hospital, but they do pay higher premiums if hospital prices are higher. Insurers' objectives are not affected by hospital characteristics, but they must attract consumers who do care about these factors.

[46] For example, see Nevo (2000).

estimates a hospital choice model and uses those parameter estimates to construct $V(J_m)$ (where the m subscripts insurers) for each hospital and each insurer for the large metropolitan areas in the US. She also uses the parameters to construct counterfactual $V(K_m)$, where $J_m \neq K_m$: the values associated with alternative hospital networks. With the measures of $V(J_m)$ in hand, she then posits that insurers compete in static Nash equilibrium in prices and estimates the utility parameters of insurer choice using the approach of BLP, where $V(J_m)$ is included as an argument in the consumer's utility function.

In Ho's model, all hospitals make simultaneous take-it-or-leave-it offers to all plans in the market. Then, all plans simultaneously respond. MCOs select the hospital network that maximizes profits relative to counterfactual network configurations. That is, $E(\pi_m(V(J_m)) \geq E(\pi_m(V(K_m)) \quad \forall K_m \neq J_m$ where π denotes the profits for MCO m. These profits are the revenues the MCO earns, given its hospital network, less the payments made to the hospitals in its network.

This observation suggests the use of an inequality method of moments estimator developed by Ho and co-authors (Pakes et al., 2006). While the underlying econometric theory is non-trivial, the basic idea behind this estimator is straightforward. Given a set of instruments which help address measurement error, the estimator finds the set of parameters that result in the observed network producing the highest expected profits relative to other counterfactual hospital networks.[47] The challenge is to construct profit functions for counterfactual networks that are consistent with the underlying bargaining model. Ho assumes "passive beliefs"—the hospital believes that the MCO will not change its beliefs about the offers the hospital makes to other MCOs were it to receive the counterfactual offer. Instead of positing a structural approach to hospital profits, she specifies a reduced-form hospital profit function where a hospital's profits are a function of the number of expected admissions, market and hospital characteristics. Ho does not have access to hospital pricing information, which limits the ability to directly estimate the bargaining model.

Ho finds that hospitals in systems take a larger fraction of the surplus and also penalize plans that do not contract with all members. Hospitals that are attractive to consumers also capture high markups, and hospitals with higher costs per patient receive lower markups per patient than other providers. The limitation of Ho's approach is that it is not directly applicable to analyzing the impact of hospital mergers or other changes in hospital market structure. For example, in her framework, two hospital systems that merge would not affect the equilibrium surplus division, and thus would not have an impact on prices. In related work, Ho (2006) notes that the realized equilibrium selective network may be inefficient. Under selective contracting,

[47] The parameters are only set identified.

hospitals contract with a subset of the hospitals in the market, thus limiting the choice set of the patient when they select an MCO.

Brand et al. (2011) use both semi-structural and structural approaches to estimate the impact of a proposed hospital merger in Northern Virginia between the large 1,800-bed INOVA hospital system and Prince William Hospital, a 170-bed facility in Manassas, VA. The FTC challenged this merger in 2006 and the parties abandoned the transaction. In their structural work, Brand et al. (2011) manipulate an equation similar to (9.7) to recover bargaining and cost parameters and then use pricing relationships similar to those in equations (9.8) and (9.10) to calculate the impact of the merger.

Pakes (2010) furthers the ideas in Ho (2009b) and Pakes et al. (2006) by examining the MCO/hospital network formation decision, allowing for richer error structures. Again, the underlying idea is that the revealed choice of the insurer network can be used to infer deeper parameters of the hospital profit function. While the focus of Pakes's work is methods development, the estimation and simulation results reveal interesting patterns. In the simulation results he computes the full in formation Nash equilibrium for the game in which hospitals make take-it-or-leave-it offers to insurers and insurers decide whether to accept or reject the offers. The equilibrium margins for hospitals are decreasing in the excess capacity and costs relative to the other hospitals in the market. The hospital's margins are increasing in the insurer's margins.

The structural analysis of buyer—seller networks is a young and quickly evolving literature. While this literature is relatively new, the underlying policy implications of these papers is similar to the other strands of the literature. Hospitals (particularly those in systems) can acquire and exercise market power. The availability of high-quality data sets combined with recent theoretic and econometric advances point to this line of work leading to important findings in the near future.

3.2.4. Not-for-profit Firm Behavior

The hospital sector is characterized by the fact that there is a mixture of firms with different ownership types. Not-for-profits are the most common, but there are substantial numbers of for-profit hospitals and public hospitals. Interesting questions arise in this context about differences in behavior between for-profit and not-for-profit firms (and publics), and the impact of the mixture of different types of firms in a market on firm conduct.

Some of the studies we have already reviewed (e.g. Capps et al., 2003; Gaynor and Vogt, 2003) have addressed the issue of not-for-profit/for-profit differences in competitive conduct. Those studies do not find any significant differences in pricing behavior. A recent study by Capps et al. (2010a) examines whether not-for-profit hospitals are more likely than for-profit hospitals to offer more charity care or unprofitable services in response to an increase in market power. The implication is that, if there were such a difference, not-for-profits would be spending their profits from market power on socially beneficial activities. Capps et al. examine seven years of data on California hospitals and find no evidence of any such differences—not-for-profits do not engage in any more socially beneficial activities than do for-profits when they possess market power.

Dafny (2005) asks whether hospitals engage in "upcoding," choosing more profitable diagnosis codes for patients when the profitability of doing so increases. She uses a 1988 policy reform that generated large price increases for many, but not all, Medicare admissions and finds evidence of substantial upcoding by hospitals. This is much more pronounced among for-profit hospitals than among not-for-profits.

Duggan (2000) uses an increase in government reimbursements for treating indigent patients to test for differences in behavior between for-profit, not-for-profit, and public hospitals. He finds that both for-profit and not-for-profit hospitals responded strongly to the financial incentives in the policy. Both types of private hospitals treated the most profitable indigent patients and avoided unprofitable ones. Public hospitals' behavior did not change. In addition, both for-profit and not-for-profit hospitals used the revenues from the indigent care program to increase financial assets, as opposed to improve medical care for the poor.

Duggan (2002) uses the same government policy as in his previous paper to identify behavior. In this paper he is concerned with the mix of hospital ownership types and impacts on behavior. He finds that not-for-profit hospitals located in areas with many for-profit hospitals were substantially more responsive to the changed financial incentives than not-for-profit hospitals located in areas with few for-profits. A fruitful area for future research may be to further examine the determinants of the mix of ownership types and impacts on other types of conduct.

3.2.5. Impact of Hospital Mergers on Costs

It is clear that mergers can result in efficiencies because of economies of scale, increased purchasing power, the ability to consolidate services, or the transfer of managerial techniques and skill to the acquired hospital. Williamson (1968) noted that mergers that result in significant market power but also lead to meaningful reductions in marginal costs can be welfare improving. However, mergers also have the potential to increase costs. Larger systems imply larger bureaucracies. In addition, hospital costs are not necessarily exogenous to market structure. Hospitals that are able to bargain for higher prices may have the incentive to use the resulting profits for the benefit of physicians and hospital executives (e.g., through capital expenditures that benefit physicians or increases in executive compensation or perks). This is particularly likely if there is no residual claimant (as is the case for not-for-profit organizations) or monitoring by the residual claimant is costly. Thus, the analysis of the cost impacts is central to understanding the impact of hospital mergers. The evidence presented above suggests that, on average, hospital mergers result in increases in price. Consequently if there are significant cost reductions associated with mergers they are not passed onto the purchasers of hospital services in the form of lower prices.

The analysis of the impact of hospital mergers and acquisitions on cost faces a notable challenge in finding accurate and reliable measures of costs. Medicare Cost Reports and state financial data are the primary source of cost data, but these data generally lump inpatient and outpatient expenditures into one category, are not easily adjusted for changes in patient severity, and are subject to the vagaries of accounting methodologies. Dranove and Lindrooth (2003) is the most convincing analysis. Using data on mergers of previously independent hospitals that consolidate financial reporting and operate under a single license post-merger, they find that, on average, these hospitals experience post-merger cost decreases of 14 percent. System mergers in which the hospitals were not as fully integrated (as measured by the use of multiple licenses) did not realize cost savings. These findings suggest that integration of merging hospitals is necessary to achieve meaningful efficiencies. Harrison (2010) uses AHA data to examine differences in expected hospital costs, and finds that immediately following a merger costs declined, but eventually rose to pre-merger levels. This finding is difficult to reconcile with the view that mergers require significant upfront costs but have benefits that accrue in later years. In sum, the evidence discussed above suggests that mergers between competitors in concentrated markets lead to hospital price increases. That is, on average hospital mergers in these circumstances do not appear to generate enough efficiencies to offset the gains in market power. The circumstances in which mergers are most likely to result in meaningful cost decreases are those in which the merging facilities operate as a more fully integrated entity.

3.3. Recent Developments in Antitrust Enforcement and Competition Policy in Health Care

3.3.1. Antitrust Developments in the US

Traditionally, the hospital sector has been one of the most active areas of antitrust enforcement.[48] However, the decade of the 2000s saw a significant slowdown in the number of US antitrust cases in the health care sector. While there were not as many significant cases as the previous decades, there nonetheless were at least two cases that went to trial that were important.

In a separate development, the DOJ and FTC recently revised the *Horizontal Merger Guidelines* (Federal Trade Commission and Department of Justice, 1992) to

[48] In this segment we review the recent case developments and refer the reader to Whinston (2007) for a more complete discussion of recent developments in the economics of antitrust. The Department of Justice (DOJ) and Federal Trade Commission's (FTC) report *Improving Health Care: A Dose of Competition* (2004) also provides an excellent overview of the competition policy issues in health care markets.

more accurately reflect the agencies' approach to mergers. Relative to the previously issued versions, the revised *Merger Guidelines* take a more conservative and more flexible approach to merger analysis, increasing the HHI cut-off for defining "Highly Concentrated" markets to 2,500. The *Merger Guidelines* also make clear that the agencies use econometric and economic theory-based approaches to merger analysis, in addition to using the traditional methodologies.

In this section we discuss these two significant antitrust developments since the 1990s as well as discussing other cases that affect the current implementation of competition policy. The 1990s saw a string of losses by the US federal antitrust agencies. As discussed in Gaynor and Vogt (2000), the federal antitrust agencies lost these cases for two broad reasons. First, the courts sometimes have viewed the not-for-profit status of hospitals as mitigating the anticompetitive impact of increased market power that might accrue to hospitals because of the merger.[49] Second, the courts have tended to side with plaintiffs in accepting broad geographic market definitions or viewing the presence of other possible competitors as sufficient to constrain the exercise of market power.[50]

While each case brings a different set of facts, the courts' decisions on both of these issues run counter to the general findings from the health economics literature. The evidence consistently shows that not-for-profit status does not affect static hospital behavior in significant ways—not-for-profit hospitals are just as willing as for-profits to exercise market power should they possess it. Second, hospitals are differentiated products, where patient distance plays a major role in differentiating hospitals. Hospital competition occurs locally, and thus mergers involving two closely located competitors in a large urban area may result in the ability of the merged hospitals to negotiate substantially higher prices.

The most important case in the 2000s for merger enforcement towards health care providers is *FTC v. Evanston Northwestern Healthcare Corp.*[51] In 2000, Evanston Northwestern Healthcare Corporation merged with Highland Park Hospital. Both hospitals are located in Evanston, IL, an affluent suburb of Chicago. The case was initiated as part of the FTC's post-merger retrospective, in which they reviewed a number of hospital mergers that occurred in the late 1990s to the early 2000s. The FTC filed suit in 2004, alleging that the merger violated Section 7 of the Clayton Act. The Administrative Law Judge (ALJ) issued an Initial Decision finding that, "[FTC] proved that the Challenged merger has substantially lessened competition in the product market of general acute inpatient services [sold to managed care organizations] and in the geographic market of the seven hospitals described above."

[49] *FTC v. Butterworth Health Corp.*, 946 F. Supp. 1285, 1300–1301 (W.D. Mich. 1996).

[50] For example, see *United States v. Mercy Health Services*, 902 F. Supp. 968 (N.D. Iowa 1995).

[51] Evanston Northwestern Healthcare Corp., FTC Docket No. 9315, Initial Decision (Oct. 20, 2005), available at http://www.ftc.gov/os/adjpro/d9315/051021idtextversion.pdf.

The initial relief of Evanston Northwestern was to divest Highland Park hospital and essentially re-create the market structure that existed prior to the merger. The parties appealed the case (which is referred to the Commissioners under the FTC administrative law process) and the Commissioners upheld the ALJ's initial ruling but significantly altered the relief. The Commissioners feared that the hospitals were already too integrated to effectively de-merge and thus ruled that hospitals could remain as a merged entity but had to maintain separate negotiating functions that would independently negotiate with MCOs.

This case is notable for a number of reasons. First, the merger was already consummated and the hospital operations had been integrated prior to the FTC's challenge. Because many of the functions (including insurer negotiations) had been integrated, the impact of the merger on prices could be directly analyzed, as pre- and post-merger insurer claims data were available to analyze. In most merger investigations, post-merger price increases must be inferred and predicted from the available evidence. In this case, the post-merger prices were available to study. Both testifying economic experts found there was a significant post-acquisition price increase (with the hospital's expert finding a post-merger increase of approximately 10 percent for inpatient services and the FTC expert finding significantly higher post-merger price increases).

Second, the ALJ found that the merger increased Evanston Northwestern's market power in a suburban market with a number of other competing hospitals.[52] Previously, the federal antitrust enforcement agencies have lost cases where, under very plausible geographic market definitions, the merger was a two-to-one consolidation. Thus, the implication is that mergers in hospital markets with several competitors can lead to significant increases in price. Of course, this is consistent with the framework outlined above, but the courts have traditionally been hesitant to embrace the basic premise that market power can be exercised in settings with more than one competitor. Finally, the ALJ and the Commissioners outlined an approach to analyzing hospital mergers that explicitly accounts for the institutional features of the industry—specifically, that hospitals and insurers engage in negotiations that determine prices, and that an increase in market power from a given merger will be determined by the increase in bargaining leverage.

Since the Evanston Northwestern case, the FTC has been more aggressive in challenging hospital mergers in urban and suburban settings. In 2008, the FTC challenged INOVA's acquisition of Prince William hospital. INOVA is a large, five-hospital system in Northern Virginia and they sought to acquire the community hospital in Mannasas, VA. The FTC sued to enjoin the transaction and the parties abandoned the

[52] The ALJ determined the pre-merger HHI as 2,739 with an increase of 384 (assuming the shares are unchanged, post-merger).

merger soon after the FTC filed its case. In 2009, Scott and White merged with King's Daughter hospital—both hospitals are located in Temple, TX. The FTC staff viewed the merger as anticompetitive; however, King's Daughter hospital was in very poor financial shape and would likely close soon without a merger with another hospital. The FTC did not challenge the merger, as they determined that there was not another, less anticompetitive purchaser for King's Daughter. More recently, the FTC has sued to stop ProMedica's acquisition of St. Luke's hospital. ProMedica is a large hospital system with three hospitals in and around Toledo, OH, and St. Luke's hospital is located in the adjacent suburb of Maumee, OH. At this writing that case is still being adjudicated; however, at the initial preliminary injunction hearing in the Federal District Court the judge ruled in the FTC's favor.[53] In analyzing the competitive impact of hospital mergers, the FTC has looked to the recent literature on hospital competition and is incorporating the recent approaches in its analysis.

There has been very limited enforcement regarding consolidation in outpatient and physician services. While some of these transactions may well result in increases in bargaining leverage and thus increases in prices, most of these transactions likely fall below the Hart–Scott–Rodino thresholds which specify the value of the transaction that is necessary for the parties to notify the federal antitrust agencies. However, in 2008, the FTC issued an administrative complaint challenging Carilion Clinic's 2008 acquisition of two outpatient clinics in the Roanoke, VA, area.[54] Carilion is a large integrated health system and they had acquired an outpatient surgery center and an imaging center. The FTC secured a consent decree from Carilion which divested the two clinics.

Market power need not only be exercised by selling a product but can also be used to gain lower prices on the purchase of inputs. In health care markets this can occur when insurers have significant upstream market share and use this leverage to secure lower provider prices. Hospitals may also be able to leverage their market power in the labor market by offering nurses lower wages.[55] In the consent decree in *United States v. UnitedHealth Group Incorporated and PacifiCare Health Systems, Inc.* the US Department of Justice clearly states that they will prosecute cases in which the merger leads to increases in monopsony power. In this case, United Health Group acquired PacifiCare, a large health insurer on the West Coast of the US. One of the relevant product markets where the DOJ alleged competitive harm was the purchase of physician services. The DOJ required divesture in order to preserve competition in this market. *United States and the State of Arizona v. Arizona Hospital and Healthcare Association and AzHHA Service Corporation* is a case regarding the

[53] *FTC v. ProMedica Health System*, Docket No. 215, Case No. 3:11 CV 47, Findings and Conclusions available at http://www.ftc.gov/os/caselist/1010167/110329promedicafindings.pdf.

[54] See http://www.ftc.gov/os/adjpro/d9338/index.shtm.

[55] Unlike on the selling side of the market, the welfare impact of lower input prices is less clear.

exercise of monopsony power in the nurses market.[56] AzHHA Registry Program is a hospital group purchasing organization which contracts with nursing agencies to provide temporary nursing services for most Arizona hospitals. The DOJ defined the relevant market as the "hospitals' purchases of per diem nursing services in the Phoenix and Tucson metropolitan areas" and claimed that the hospitals participating in AzHHA were able to obtain rates for temporary nursing services below competitive levels. The consent decree prevented AzHHA from jointly negotiating nurses' wages for its member hospitals.

Hospitals and other integrated providers offer a number of different services and, importantly, the services they offer (e.g. primary, secondary, and tertiary care) may differ from their competitors.[57] The fact that hospitals offer a variety of services implies that they may have an incentive to bundle those services for exclusionary purposes when they negotiate with insurers. In *Cascade Health Solutions v. Peace Health* the plaintiffs argued that Peace Health, a three-hospital system in Lane County, OR, with a large hospital, Sacred Heart, that offers primary, secondary, and tertiary care, bundled and tied their products in an attempt to monopolize primary and secondary services. Cascade Health Solutions is a 114-bed hospital that does not offer tertiary services. Specifically, Peace Health offered insurers substantial discounts on their entire range of services if they did not contract with Cascade Health Solutions. The Ninth Circuit Court of Appeals ruled that when the party has monopoly power, bundling is legal unless the discounts result in prices that are below an appropriate measure of costs.[58] This standard is in conflict with the Third Circuit standard of anticompetitive harm which does not consider the relationship between price and the appropriate measure of costs.[59]

The second antitrust case of importance that occurred during the 2000s is *In the Matter of North Texas Specialty Physicians (NTSP)*.[60] NTSP is an organization of independent physicians and physician groups that was formed, managed, and operated by physicians. Many of the physicians in NTSP directly compete with one another. NTSP's main functions are to negotiate and review contract proposals for member services that are submitted by payers, including insurance companies and health plans; to review payment issues; and to act as a lobbyist for its members' interests.

[56] See http://www.justice.gov/atr/cases/azhha.htm.

[57] "Tertiary" refers to complex services like invasive cardiovascular surgery and intensive neonatal care, whereas "primary" and "secondary" acute hospital services are more common medical services like bone-setting and tonsillectomies.

[58] The parties later settled the case once it was remanded back to the District Court.

[59] See *LePages, Inc. v. 3M*. "Bundled price discounts may be anti-competitive if they are offered by a monopolist and substantially foreclose portions of the market to a competitor who does not provide an equally diverse group of services and who therefore cannot make a comparable offer."

[60] *In the Matter of North Texas Specialty Physicians*, Docket No. 9312. The initial decision can be found at http://www.ftc.gov/os/adjpro/d9312/041116initialdecision.pdf.

The fundamental issue in this case was whether NTSP served as a price fixing agent for its member physicians or if the facilitation of setting premiums was an ancillary activity and their primary function was to enable the setting of risk contracts between it and its member physicians. Previously, the courts have found that physician organizations that set rates for the group can be illegal under a rule of reason analysis.[61] Organizations like NTSP can serve as a conduit for establishing risk contracts that can allow the implementation of high-powered incentives for physicians and these high-powered incentives can induce more efficient behavior than standard, fee-for-service reimbursement. However, the use of risk-bearing contracts by insurers has declined since the 1990s, and thus the purpose of organizations like NTSP for such purposes is unclear.

NTSP negotiates both risk-sharing contracts and non-risk-sharing contracts for its members; however, the vast majority of the contracts were non-risk-sharing contracts. NTSP's physicians enter into an agreement with NTSP that grants NTSP the right to receive all payer offers and imposes on the physicians a duty to forward payer offers to NTSP promptly. The physicians agree that they will not individually pursue a payer offer unless and until they are notified by NTSP that it has permanently discontinued negotiations with the payer. NTSP surveys members, uses the information to calculate the mean, median, and mode of the minimum acceptable fees identified by its physicians, and then uses these measures to establish its minimum contract prices.

The ALJ ruled (and the Commission later affirmed) that the activities of NTSP were "inherently suspect" and, taken as a whole, amounted to horizontal price fixing which is unrelated to any pro-competitive efficiencies. NTSP's conduct could be characterized as *per se* unlawful under the antitrust laws. The broad lessons from this ruling are: (1) activities by physician organizations that look inherently suspect and are likely price fixing will be treated under a *per se* standard; (2) if a physician organization intends to argue that efficiencies justify collection and dissemination of reimbursement rates, the organization needs to be ready to explain why those efficiencies could not be achieved without price fixing. Going forward, as physicians form accountable care organizations (ACOs) under the recently passed health reform legislation, those activities should be limited to the implementation of the ACO and behavior among those physicians that resembles collective negotiations of MCO contracts will be examined closely. Unless those activities can be viewed as necessary to the implementation of the ACO, they will likely be treated harshly by the federal antitrust enforcement agencies.[62]

[61] See *Arizona v. Maricopa Co. Med. Soc'y*, 457 US 332, 356–357 (1982).

[62] In contrast to the NTSP case, the FTC's review of "TriState Health Partners" lays out an example of where joint contracting by a collection of physicians is subordinate to the efficiencies the organization may yield. See http://www.ftc.gov/os/closings/staff/090413tristateaoletter.pdf.

As of this writing there is at least one antitrust case that was recently initiated and has yet to be resolved that may significantly affect competition policy once decided. In *United States and State of Michigan v. Blue Cross Blue Shield of Michigan* the DOJ alleges that BCBS used its monopsony power to secure most-favored nation contracts with hospitals in which the hospitals were contractually obligated to charge competing MCOs 25 percent higher rates. The apparent purpose of such contracts is to increase BCBS's rivals' marginal costs as well as increasing entry costs. In a differentiated products setting higher rival costs allow a firm to charge higher prices and earn higher profits.

While the decade of the 2000s was a relatively quiet one for health care provider antitrust policy, it seems likely that the courts will have to address important issues in the near future. In particular, providers are becoming more integrated—hospitals are acquiring more physician groups and other outpatient services (e.g. imaging, rehabilitation, outpatient surgery). As these "integrated" organizations become more common the likelihood is that they will attempt to use bargaining leverage in some services to other services (or that their behavior will be interpreted as attempting to leverage market power) through the use of tying, bundling or other means. The recently passed health care reform provides incentives for increased provider integration and will likely only increase the number of integrated organizations. Thus, it seems likely that it is only a matter of time before the courts will have to examine the legality of such behavior by integrated hospital systems.

3.3.2. Competition Policy towards Health Care in OECD Countries

There has not been nearly as much antitrust activity towards health care outside of the US. This is mostly due to health care systems in other countries being more centrally controlled and heavily regulated. However, a number of countries have pursued decentralization and competition in reforms of their health systems. The Netherlands, Germany, and the United Kingdom (England in particular) are notable in this regard. Varkevisser and Schut (2009) review antitrust policy towards hospital mergers in the Netherlands, Germany, and the US.

The Netherlands has a competition agency, the Netherlands Competition Authority (NMa), for general competition policy. They oversee cartel, dominance abuse, and merger cases including health care. They closely cooperate with the Netherlands Healthcare Authority (NZa) for oversight of the functioning of health insurance and health care markets. The NZa has become the primary government agency entrusted with regulation and dominance abuse in health care markets, although they do work closely with the NMa.[63] The Netherlands has had a few antitrust matters arise over the past few years. They have had concerns about hospital mergers, as in the US, and also have

[63] The NZa plays an advisory role to the NMa in hospital merger cases, for example.

had concerns about vertical restraints, including vertical integration, between insurers, hospitals, and doctors. As Canoy and Sauter (2009) note, there was an uptick in merger activity following market liberalization, and a consequent need for greater merger control. The NMa has reviewed nine hospital mergers. All were approved, although some were subject to extensive review. A notable development has been the adoption of a market definition methodology for hospitals based on a structural model (the model of Gaynor and Vogt, 2003, estimated for the Netherlands).

Competition policy enforcement in Germany is under the control of the Federal Cartel Office (Bundeskartellamt, BKA). Most of the concern in health care has been with the acquisition of public hospitals by private hospital systems. With many local and regional governments facing large budget deficits, there has been a wave of take-overs of public hospitals by private chains. The BKA has examined over 100 hospital mergers and acquisitions. Relatively few of these have been challenged, but some have been blocked, and there was one merger which was allowed subject to divestiture. At this point economic and econometric modeling have not played a large role in these decisions.

In 2009 the UK established an agency charged with oversight of competition in the NHS, following their reforms (in England) in 2006 designed to promote competition. The establishment of a new agency was necessary, because the conduct of NHS entities was exempt by fiat from oversight by the UK's competition authority (the Office of Fair Trading). The Cooperation and Competition Panel (CCP) is the agency that has been established for the oversight of competition in health care and has fairly broad authority to regulate mergers and general conduct. Since beginning operations in 2009, the CCP has reviewed over 50 merger cases and a number of conduct cases.

4. HOSPITAL COMPETITION AND QUALITY

Thus far (in section 3) we have focused on hospital competition over prices. The product is differentiated, but product characteristics are not subject to choice by hospitals. As we have seen, this is an extremely useful framework for analyzing hospital price competition. Nonetheless, quality[64] is subject to hospital control, and can be an important instrument for competition. In what follows, we first lay out approaches to

[64] At this point we use quality in a very generic sense. In particular, this encompasses both horizontal and vertical differentiation. To be clear, horizontal differentiation is sometimes alternatively referred to as "product variety," while vertical differentiation is alternatively referred to as "product quality." Our use of the term quality should be understood to encompass both of these except where we specifically indicate otherwise.

modeling quality competition, then review the relevant literature.[65] The models differ substantially depending on whether price is set administratively (e.g. by a regulator) or if it is a strategic variable. As a consequence, we cover these as separate cases, beginning first with administratively set prices and then progressing to market determined prices.

4.1. Hospital Choice of Quality

In what follows, we write down models in which hospitals directly choose the quality of service they provide. This is convenient for writing down a parsimonious model. There are some potentially important ways, however, in which this model may not conform precisely to empirical phenomena. One reason is that hospitals may not directly choose the quality of care they provide. Hospitals may not explicitly choose a quality level that maximizes profits (or some other objective). Hospitals may instead choose overall effort, or slack, based on the incentives they face. Quality of care for a given patient(s) may then be determined (in part, perhaps stochastically) by effort. This distinction is immaterial for the purposes of modeling. A model where quality is chosen directly is isomorphic to one where it is determined indirectly by effort.

In empirical modeling, the most commonly used measure of quality is patient mortality. It is important to note that mortality is not a measure of quality of service *per se*, but an outcome determined (in part) by quality of service. Hospitals are thus not choosing mortality, but choosing a quality of service level that has an impact on mortality. Patients are heterogeneous in their responsiveness to treatment. The most common reason for this is severity of illness. Severely ill patients are more likely to die, *ceteris paribus*, than healthier ones.[66] In addition, the relationship between quality of service and mortality is stochastic. A patient's outcome cannot be predicted with certainty based on a certain quality of care, even given patient and hospital observables. Nonetheless, a given service level generates an expected level of mortality. As a consequence, it is immaterial whether a model is written down in which hospitals choose service quality or expected mortality.

Last, consider the fact that hospitals do not compete for all kinds of cases. In particular, patients in urgent situations do not usually choose their hospital. A prominent example of this which has been extensively studied in the empirical literature is AMI (acute myocardial infarction, or "heart attack"). Heart attack patients do not choose the hospital they are taken to, yet empirical studies (Kessler and McClellan, 2000) find that heart attack mortality is lower in less concentrated (and presumably

[65] For prior reviews of hospital quality competition see Gaynor (2006b), Pauly (2004), or Vogt and Town (2006).

[66] See Gowrisankaran and Town (1999) and Geweke et al. (2003) for an econometric approach to correcting measured mortality for this problem, and others.

more competitive) hospital markets. How can hospitals be competing for patients who do not choose where they go?[67] The story is that hospitals choose a general level of effort for the hospital as a whole, which affects quality of service, and thus mortality, as described above. Hospitals that are subject to tougher competition in general choose greater effort, thus increasing the chances of survival of heart attack patients, even though they are not competing for heart attack patients. Again, this can be described using a model in which hospitals choose quality directly. Here, however, hospitals choose quality of service for the entire hospital based on a sector where choice is possible. This hospital-wide level of quality then determines patient outcomes, including those for services where there is not competition, like AMI.

4.2. Administratively Set Prices

In many situations, prices are set administratively, rather than being market determined. This is true of entire health systems (e.g. the British National Health Service), or sectors of health systems (e.g. the Medicare program in the US). In this situation, when competition among firms occurs it will be via non-price means. We call any non-price output characteristic(s) quality. In what follows, we will treat this as vertical differentiation,[68] i.e. we will treat quality as uni-dimensional. This is for ease of exposition. The basic intuition that follows from such a treatment carries over to a horizontally differentiated world, although this is not truly general. We refer to literature which models horizontal differentiation where relevant.

The model we present here follows Gaynor (2006b). Let quality have only a vertical dimension, i.e. "more is better." For simplicity in exposition, assume that the demand that any firm j faces is separable in its market share, s_j, and the level of market demand, D. Firm j thus faces a demand of:

$$q_j = s_j(z_j, \mathbf{z}_{-j})D(\overline{p}, z_j, \mathbf{z}_{-j}) \tag{9.18}$$

where s_j is firm j's market share, z_j is firm j's quality, $\mathbf{z}_{-j}$ is a vector of all other firms' qualities, D is market demand, and $\overline{p}$ is the regulated price.[69] Assume that j's market share is increasing in own quality, decreasing in the number of firms, and that the responsiveness of market share to own quality is also increasing in the number of firms.

[67] Even if patients do not choose where they go, emergency crews may choose among hospitals based on quality, especially in urban areas with a number of hospitals within a short distance of each other.

[68] Alternatively referred to as product quality.

[69] Note that for consumers insulated from the cost of consumption, as in health care, the price they face will be less than the price received by the firm. We ignore this in order to keep this sketch of a model simple. It would not affect the conclusions in any event.

Assume that firms all use the same technology and face the same input prices. Then they each have costs described by:

$$c_j = c(q_j,\ z_j) + F \tag{9.19}$$

where c(·) is variable cost and F is a fixed cost of entry.

Further assume that there is free entry and exit, so that all firms earn zero profits in equilibrium. Then, assuming Nash behavior, equilibrium is described by the solutions to the following across all firms j:[70]

$$\begin{aligned} \frac{\partial \pi_j}{\partial z_j} &= \left[\overline{p} - \frac{\partial c_j}{\partial q_j}\right]\left\{\frac{\partial s_j}{\partial z_j} D(\cdot) + s_j \frac{\partial D(\cdot)}{\partial z_j}\right\} \\ &- \frac{\partial c_j}{\partial z_j} = 0 \end{aligned} \tag{9.20}$$

and

$$\pi_j = \overline{p} \cdot q_j - c_j = 0 \tag{9.21}$$

Inspection of (9.20) yields some immediate insights. First, compare equilibrium quality under monopoly to that with multiple firms. Notice that, since a monopolist faces market demand, the first term in curly brackets in 9.20 vanishes and $s_j = 1$. Since $\frac{\partial s_j}{\partial z_j}$ is positive by assumption, the term in curly brackets will be larger in most cases with multiple firms than with a monopolist, so equilibrium quality is higher with competition. This is definitely the case if competition is only over market share, which is ofter the case in health in health care markets

In markets for normal consumer goods, whether welfare is higher depends on the relative magnitudes of $\frac{\partial s_j}{\partial z_j}$ and $\frac{\partial D}{\partial z_j}$. In particular, if $\frac{\partial D}{\partial z_j}$ equals zero, then increases in quality do not shift market demand, and quality competition is simply over market share, and hence wasteful. In health care markets that is not likely to be the case. Consumers who are ill may not respond to changes in quality by changing the aggregate quantity consumed. Nonetheless, increased quality may result in substantial gains in welfare if it results in improved health.

Since $\frac{\partial s_j}{\partial z_j}$ increases with the number of firms (i.e. the firm's demand becomes more elastic with respect to own quality the more alternatives there are for consumers), quality competition will be more intense with entry and equilibrium quality will increase with the number of firms in the market. This benefits consumers, but may not increase social welfare. In particular, the increase in consumer surplus from increased quality may be outweighed by the increased costs (recall that there is a fixed cost of entry for every firm in the market), particularly if there is diminishing marginal utility from quality and diminishing returns in quality production. As indicated previously, this may result in excessive quality levels. In the case of health care it is

[70] We assume here that firms maximize profits. We relax that assumption below. See section 4.2.2.

most likely that quality will be excessive if it has little effect on health. Quality that substantially improves a patient's chance of survival will be very valuable, and such benefits are more likely to outweigh costs. We can do a simple back of the envelope calculation to illustrate this. For example, the typical estimate of the value of one life-year is $100,000. If an increase in quality leads to one additional life-year for every sick person and there are 1,000 sick people in the market, then costs would have to increase by more $100 million for the increase in quality to be inefficient.

The positive predictions of this model are clear. Quality is increasing in the number of firms in the market, i.e. competition leads to more quality. Further, quality is increasing in the regulated price. One may write down a firm's equilibrium quality function as the (implicit) solution to equations (9.20) and (9.21),

$$z^e = z(\overline{p}, c_q, c_z, s_j, D) \tag{9.22}$$

where c_q and c_z denote first derivatives. The firm's level of quality depends on the level of the regulated price, the marginal cost of quantity, the marginal cost of quality, the level of demand, market share, and the quality elasticities of market share and market demand. This can be seen informally by manipulating (9.20) to obtain the following expression:

$$z = \frac{(\overline{p} - c_q)[\eta_z^s + \eta_z^D](s_j \cdot D)}{c_z} \tag{9.23}$$

where η_z^s and η_z^D are the quality elasticities of market share and market demand, respectively. Quality is increasing in price, the elasticity of demand with respect to quality, and the firm's total demand. Quality is decreasing in the marginal costs of quantity or quality.

This has implications for econometric specifications for empirical analysis. The equation to be estimated is (9.22). However, measures of marginal cost, market share, and demand are likely to be endogenous in an econometric equation. One would employ exogenous determinants of these factors, such as cost shifters (W), demand shifters (X_D), and the number of firms (N). A reduced form econometric specification would thus look something like the following:

$$z^e = Z(\overline{p}, W, X_D, N, \varepsilon) \tag{9.24}$$

where ε is a random error term.

The normative implications of the model are somewhat less clear than the positive ones. Depending on how valuable quality is (specifically how responsive health is to quality), competition may lead to excessive quality provision. Since every firm pays a fixed cost of entry, but does not consider the effects of demand stealing, there can be too many firms in a free entry competitive equilibrium. Similarly, a higher regulated price may reduce welfare by leading to excessive quality. This is less likely to be the case where quality leads to highly effective treatment, and that treatment has a large impact on consumer well-being. It is important to note, however, that consumers are never made worse off by competition. If competition leads only to demand stealing they are no better off as a result, but if it leads to any increase in market demand then consumers are unequivocally better off.

4.2.1. Spillovers

Now let health outcomes, H, be determined by the following equation:

$$H_{itj} = h_t(z_j, \xi_{it}) \tag{9.25}$$

where H_{itj} is the health outcome of patient i of type t treated in hospital j, h_t is the health production function for type t, z_j is quality of service in hospital j, and ξ_{it} is a vector of unobservable patient-type specific factors, with a known distribution.[71]

Let there be patients of two types, $t = 1{,}2$. Type 1 patients choose their hospital based on the expected health outcome at that hospital, $\overline{H}_j = E_{it}[H_{itj}]$. Type 2 patients simply arrive at the hospital. For example, type 1s may be maternity or orthopedic patients, and type 2s heart attack patients. To start, assume, without loss of generality, that there is one (fixed) price the hospital receives for treating either patient type, and that costs do not depend on patient type.[72] In this case, the hospital's profits are as follows:

$$\pi_j = \overline{p}\cdot[s_{j1}(\overline{H}_j, \overline{H}_{-j})D_1(\overline{p}, \overline{H}_j, \overline{H}_{-j})] + \overline{p}\cdot[s_{j2}D_2(\overline{p})] - c(s_{j1}D_1 + s_{j2}D_2, z_j) - F \tag{9.26}$$

Equilibrium here is the solution to the following first-order conditions across all firms:

$$\frac{\partial \pi_j}{\partial z_j} = \left[\overline{p} - \frac{\partial c_j}{\partial q_{1j}}\right]\left\{\frac{\partial s_{1j}}{\partial \overline{H}_j}\frac{\partial \overline{H}_j}{\partial z_j}D_1(\cdot) + s_{1j}\frac{\partial D_1(\cdot)}{\partial \overline{H}_j}\frac{\partial \overline{H}_j}{\partial z_j}\right\} - \frac{\partial c_j}{\partial z_j} = 0 \tag{9.27}$$

and

$$\pi_j = 0 \tag{9.28}$$

Notice that the first-order condition for the choice of quality is unaffected by type 2s. They simply show up at the hospital, regardless of the level of service quality, so they have no impact on the hospital's choice of quality. Quality is chosen to maximize

[71] We could make some of the patient-type specific factors observable, but we omit that detail to avoid additional notation.

[72] The only assumption that matters here is that there is one quality level for both patient types.

profits from type 1s. This then determines expected health outcomes for type 1s and type 2s.

The comparative statics of this model are the same as the previous model (with a single type). Quality is increasing in the number of firms. As competition gets tougher, firms choose higher quality in order to attract more type 1 patients. Since quality is hospital-wide, this spills over into higher quality for type 2s. Thus competition leads to higher quality for type 2s, even though there is no direct competition for type 2 patients. This is also true with regard to the regulated price. In the model above, there is a single regulated price for both type 1s and type 2s. If we relax this assumption so there are different prices for each type, then quality will be increasing in the price for type 1s, but not for type 2s.[73]

4.2.2. Non-profit Maximizing Behavior

The model outlined above is not specific to health care. In particular, the majority of firms in the hospital industry are not-for-profit or public. Let us now write down a simple model that captures this aspect of the health care industry. There have been many models of not-for-profit hospitals (Pauly and Redisch, 1973; Newhouse, 1970; Lee, 1971; Lakdawalla and Philipson, 1998; Capps et al., 2010a) While there is no agreement on a general model, most models posit an objective function which includes profits and some other argument, such as quantity or quality. Therefore, let us assume that not-for-profit hospitals have an objective function which includes quality and profits (as a shorthand for everything else they care about). Further, for simplicity, let this function be additively separable in quality and profits and linear in profits:

$$U_j = u(z_j, \pi_j) = v(z_j) + \pi_j \tag{9.29}$$

We can now revisit the first-order conditions for quality choice (9.20), modified to take account of this objective function:

$$\begin{aligned}\frac{\partial U_j}{\partial z_j} = &\left[\overline{p} - \frac{\partial c_j}{\partial q_j}\right]\left\{\frac{\partial s_j}{\partial z_j}D(\cdot) + s_j\frac{\partial D(\cdot)}{\partial z_j}\right\} \\ &- \frac{\partial c_j}{\partial z_j} + \frac{\partial v}{\partial z_j} = 0\end{aligned} \tag{9.30}$$

Notice that the only difference with the first-order conditions for an industry of profit maximizing firms is the presence of the last term, $\frac{\partial u}{\partial z_j}$. Since this term is positive, the value that not-for-profit firms put on quality acts like a reduction in the marginal cost of producing quality, i.e. not-for-profit firms will act like for-profit firms

[73] This is a testable hypothesis.

with a lower marginal cost of quality.[74] This implies that quality will be higher in equilibrium. The comparative statics, however, are identical with an industry of profit maximizing firms. Quality is increasing in the number of firms and the regulated price, as before.

In the case of the spillover model with two patient types, we might imagine that a not-for-profit or public hospital may care directly about the health outcomes of each patient type. In that case, the hospital's first-order condition looks like this:

$$\begin{aligned} \frac{\partial \pi_j}{\partial z_j} &= \left[\overline{p} - \frac{\partial c_j}{\partial q_{1j}}\right]\left\{\frac{\partial s_{1j}}{\partial \overline{H}_j}\frac{\partial \overline{H}_j}{\partial z_j}D_1(\cdot) + s_{1j}\frac{\partial D_1(\cdot)}{\partial \overline{H}_j}\frac{\partial \overline{H}_j}{\partial z_j}\right\} \\ &- \frac{\partial c_j}{\partial z_j} + \frac{\partial v}{\partial \overline{H}_{1j}}\frac{\partial \overline{H}_{1j}}{\partial z_j} + \frac{\partial v}{\partial \overline{H}_{2j}}\frac{\partial \overline{H}_{2j}}{\partial z_j} = 0 \end{aligned} \tag{9.31}$$

As before, this implies that quality will be higher for non-profit maximizers than for profit maximizers, but that the comparative statics are unchanged.

4.3. Market Determined Prices

We now turn to examining quality determination in an environment where prices are market determined. We expand the model of a bargaining game in prices among hospitals previously described in section 3.1 to allow for hospital choice of quality. In that game hospitals are differentiated, but that differentiation is not a strategic choice. Here we relax that assumption to allow hospitals to choose quality. As before, we treat quality as vertically differentiated. Hospitals choose their qualities in a (new) first stage, then the price bargaining game in section 3.1 ensues, treating qualities as fixed. The other two stages in the model, patient choice of health plan and patient choice of hospital, then ensue, as before. This expanded model now has four stages, with the quality game among hospitals being the first stage.

Let demand be determined by underlying utility functions, as in the model of the price bargaining game in section 3.1. These aggregate up to demand functions facing each hospital.

Let each hospital j choose quality z_j to maximize utility, as follows:

$$\max_{z_j} \; U_j = p_j(z_j)\cdot D_j(p_j(z_j), z_j, X_{ij}) - c(D_j(p_j(z_j), z_j, X_{ij}), z_j, W_j) + v(z_j) \tag{9.32}$$

X_{ij} is a vector of firm and consumer characteristics. W_j is a vector of input prices. Both are regarded as fixed by the firm. The price p_j is determined in the bargaining game in the next stage. In this stage hospitals take account of the effects of their quality choices on price through the pricing equation from the next stage, equation (9.7):

[74] This is the same specification and result as for not-for-profit firms that care about quantity, as opposed to quality. See Lakdawalla and Philipson (1998); Gaynor and Vogt (2003).

$$p_{jh}=(1-\beta)\left(c_j(z_j)+\frac{r_h}{q_{jh}}\right)+\frac{\beta}{q_{jh}}(F(V_{J_h}(z_j,\mathbf{z}_{-j},p_{jh})-F(V_{J_h-j}(\mathbf{z}_{-j})-cm_{jh})+\beta\sum_{l\neq j}p_{lh}d_{jlh} \tag{9.7}$$

Our goal here is to understand the effect of competition on quality (in this stage) and subsequently on price, in the continuation game. We can obtain the basic intuition about impacts on price by employing the equation derived in the previous section that describes the effect of a merger of two hospitals on price:

$$\Delta p_{jh}^{j+k}=(1-\beta)d_{jkh}\cdot p_{kh}-c_j$$

The impact on price is determined by the diversion ratio (holding β and hospital *k*'s price constant). The diversion ratio is larger the more that consumers view hospitals *j* and *k* as substitutes. If hospital *j*'s quality is higher than hospital *k*'s, then consumers will view them as less close substitutes than if they had the same levels of quality. As a consequence, a merger would not have a large impact on prices. If, however, hospitals are symmetric, so *j* and *k* choose the same quality levels, then there is (at least to a first approximation) no impact of quality on the change in prices due to merger.

We now turn to the impact of competition on quality. Treating the pricing equation (9.7) as a function of quality and differentiating the objective function with respect to z_j we get the first-order condition for hospital *j:*

$$p\cdot\frac{\partial D}{\partial z}+D(\cdot)\frac{\partial p_j}{\partial z_j}+p_j\cdot\frac{\partial D_j}{\partial p_j}\frac{\partial p_j}{\partial z_j}-\frac{\partial c}{\partial D}\cdot\frac{\partial D}{\partial z}-\frac{\partial c}{\partial D}\cdot\frac{\partial D}{\partial p}\frac{\partial p_j}{\partial z_j}-\frac{\partial c}{\partial z}+\frac{\partial v}{\partial z_j}=0 \tag{9.33}$$

Now consider the impact of competition. Assume that competition increases the quality responsiveness of demand since there are closer substitutes for hospital *j* (e.g. a hospital enters nearby). We assume that competition has no impact on costs or the hospital's marginal utility from quality $\left(\frac{\partial u}{\partial z_j}\right)$. With regard to the first-order condition for price, competition will increase the terms $\frac{\partial D}{\partial z}$ and $\frac{\partial D_i}{\partial p_j}$. The effect on $\frac{\partial p_j}{\partial z_j}$ is indeterminate in general. If, however, we focus only on the effects on price through the net value a hospital brings to an insurer's network (the terms $F_h(J_h)-F_h(J_h-j)$), then the effect of quality on price is positive.[75]

The overall effect is as follows (where *n* represents the number of firms):

$$\left(p_j-\frac{\partial c}{\partial D}\right)\cdot\frac{\partial^2 D}{\partial z\partial n}+D(\cdot)\frac{\partial^2 p_j}{\partial z_j\partial n}+\left(p_j-\frac{\partial c}{\partial D}\right)\cdot\frac{\partial^2 D_j}{\partial p_j\partial n}\frac{\partial p_j}{\partial z_j}+\left(p_j-\frac{\partial c}{\partial D}\right)\cdot\frac{\partial D_j}{\partial p_j}\frac{\partial^2 p_j}{\partial z_j\partial n} \tag{9.34}$$

[75] The impact on an insurer's revenue of having a higher-quality hospital in its network is higher when there is more hospital competition. With more competition a hospital's demand is more responsive to quantity, so a higher-quality hospital will garner more patients.

In general, this derivative cannot be signed. Assuming price is greater than marginal cost, the first two terms are positive, while the second two terms are negative.[76] If we assume, however, that demand is not responsive to price (which can be reasonable for hospital care where consumers are largely insulated from prices by the presence of health insurance) then the derivative is positive, i.e. competition will lead hospitals to optimally increase their quality. Assuming symmetry and Nash behavior, all hospitals will increase their qualities.

In equilibrium this may not actually lead to increased prices. It may be that hospitals increase quality, but do not change their relative attractiveness to insurers. In that case, hospitals' bargaining positions haven't changed, so in equilibrium there is no effect on price. It may be, however, that this is not the case. Suppose that hospitals have different costs of producing quality. In this situation, some hospitals will choose higher quality than others and their relative values to an insurer's network will change. This will lead to some hospitals (those with lower marginal costs of quality) having more bargaining power with insurers and commanding higher prices.

4.4. Econometric Studies of Hospital Competition and Quality

There is a rapidly growing empirical literature on competition and quality in health care. At present the evidence from this literature is entirely on hospital markets. In what follows we review this literature. We first review the results from econometric studies of markets with administered prices, and then market determined prices.[77]

The studies reviewed here employ a variety of econometric approaches. The modal approach is what we call a "Structure–Conduct–Performance" (SCP) specification. These econometric models are derived from a conceptual model that hypothesizes a causal link from market structure to firm conduct and then to industry performance.[78] Most SCP models applied to health care focus on the link between market structure and firm conduct, and omit industry performance. The typical conduct measure in the general industrial organization literature is price or price–cost margin. The typical measure of market structure is the Herfindahl–Hirschmann Index (HHI), which is the sum of the squares of all firms' market shares.[79] The equation usually estimated has roughly the following appearance:

$$p = \beta_0 + \beta_{1_q} + \beta_2 X_D + \beta_3 W + \beta_4 \text{HHI} + \varepsilon \quad (9.35)$$

[76] $\frac{\partial D_i}{\partial p_i}$ and $\frac{\partial^2 D_i}{\partial p_i \partial n}$ are negative—demand slopes down and even more so in the presence of more firms.

[77] We focus on work that occurred after the publication of the first volume of the *Handbook of Health Economics* in 2000. Most of the empirical literature on quality is relatively recent, and so occurs after that date.

[78] See Carlton and Perloff (2005).

[79] That is, HHI $= \sum_{i=1}^{N} s_i^2$, where s_i is firm i's market share, and there are N firms in the market.

where X_D represents demand shifters and W captures cost shifters. The SCP studies of quality simply employ a measure of quality as the dependent variable in this equation, rather than price.

The SCP approach has a number of well-recognized problems when price is the dependent variable (see Bresnahan, 1989; Schmalensee, 1989, on these issues). These problems also apply when quality is the dependent variable, and there are some additional issues. First, the use of the HHI in a pricing equation can be explicitly derived only from a homogeneous goods Cournot model of conduct.[80] Obviously an SCP regression with quality as the dependent variable does not derive from this framework. In the case of administered prices, theory does point to an econometric model with a measure of market structure on the right-hand side (see equation (9.24)). Even in this case, or even if one thinks of a quality SCP regression as deriving from a broad conceptual framework as opposed to a specific theoretical model, a number of issues remain. The HHI (or any market structure measure) is usually regarded as endogenous. Unmeasured variation in demand and cost factors affect both quality and market structure. For example, a firm with low costs is likely to have both a high market share (leading to a high HHI) and choose high-quality.

Two additional specification issues arise in regard to SCP studies of markets with administered prices. When firms set prices it is clear that price and quality are determined simultaneously, so an SCP model might either include price and treat it as endogenous, or simply include exogenous determinants of price. Typically price is not included in the studies reviewed here, although it is not clear whether the authors were explicitly trying to include exogenous determinants of price. When price is regulated, however, price (or the price—cost margin) should appear as an exogenous determinant of quality (again, see equation (9.24)). In some studies price is omitted based on the argument that, since price is regulated, price does not affect demand (e.g. for Medicare beneficiaries). The regulated price should be included, however, because it is a determinant of supply, not demand. In addition, it is possible that the regulated price may be correlated both with quality and concentration. For example, firms in unconcentrated markets may produce higher quality due to tougher competition. They may also have higher costs due to producing higher quality, and therefore receive higher regulated prices. Therefore, omitting price may lead one to overestimate the effect of concentration on quality.

There is another complication due to the nature of hospitals. The major purchasers of hospital services in the US are Medicare and private health insurers. Medicare sets regulated prices. Prices from private health insurers are determined in the market. Since hospitals generally sell in both markets, one must either account for this or

[80] In that case, the coefficient on the HHI in an SCP regression captures the elasticity of demand, not firm conduct (which is already assumed to be Cournot).

presume that there are no complementarities between the two (e.g. demand and cost are completely separable in Medicare and private output). Many of the studies that focus on Medicare seemingly make the implicit assumption of separability. This is not generally an issue in other countries, where there is essentially a single payer for health care services.[81]

While the majority of the studies we review here employ an SCP framework, some employ different approaches. Some studies evaluate the impact of mergers, some evaluate the impact of regulatory changes (e.g. price deregulation), and a number estimate the relationship between hospital volume of a surgical procedure and patient health outcomes. In addition, there are a small number of studies that take a structural approach: there are some that estimate demand, and some that examine the determinants/impacts of the number of firms. Each of these approaches has its advantages and disadvantages. We discuss these in the context of evaluating the various studies.

Before proceeding, however, we want to note that the results of the majority of these studies provide evidence only on positive questions, e.g. "Does competition increase quality?" Few of these studies allow for normative analysis. This first wave of studies consists for the most part of policy evaluation and reduced-form studies.[82] It is not generally possible to evaluate effects on welfare with these kinds of studies. This should not be taken as a criticism of these studies, but simply a recognition of what sorts of inferences can be drawn from them.

4.4.1. Studies with Administered Prices

There are a number of studies of the impact of competition on hospital quality under an administered price regime. These derive from the US Medicare program and from the English NHS, which made a transition to administered prices in a reform in 2006. The amount a Medicare beneficiary pays is the same, regardless of where she obtains care (again, in a given area at a given point in time). As a consequence, price is not a strategic variable for hospitals serving Medicare patients. Patients in the NHS pay nothing, so price plays no strategic role in that system either. Table 9.10 presents a summary of these studies and their findings. The entry in the column labeled "Effect of competition on quality" indicates the direction of the relationship between the competition measure and the quality measure. For example, in the first row, the entry "Increase" in that column indicates that the quality is higher in more competitive markets. For the study cited in the first row (Kessler and McClellan, 2000), quality is measured by mortality and competition is measured by the HHI. Quality is inversely related to mortality—lower mortality is higher quality. Competition is inversely

[81] Most countries do have some private insurers, but they are generally so small that their roles can be safely ignored.

[82] By policy evaluation studies, we mean econometric specifications that evaluate the impact of some policy or (economic) environmental factor, but are not derived from an explicit economic model. By reduced form, we mean an econometric specification that is the reduced form of a specific economic model.

Table 9.10 Health Care Quality and Competition Empirical Studies: Regulated Prices

Study	Time Period	Geographic Area	Medical Condition	Payers	Quality Measure	Competition Measure	Effect of Competition on Quality
Kessler and McClellan (2000)	1985, 1988, 1991, 1994	US	Heart attack	Medicare	Mortality	HHI	Increase (*mortality* ↓)
Gowrisankaran and Town (2003)	1991–1993 (Heart attack), 1989–1992 (pneumonia)	Los Angeles	Heart attack, pnemonia	Medicare	Mortality	HHI	Decrease (*mortality* ↓)
Kessler and Geppert (2005)	1985–1996	US (non-rural)	Heart attack	Medicare	Readmission, mortality	HHI	Increase (*mortality* ↓, *readmissions* ↓)
Mukamel et al. (2001)	1990	US (134 MSAs)	All	Medicare	Mortality	HHI	No effect
Shen (2003)	1985–1990, 1990–1994	US (non-rural)	AMI	Medicare	Mortality	# of hospitals interacted with Medicare payment, HMO penetration	Interacted with Medicare payment: 1985–90—no effect, 1990–94—increase (*mortality* ↓); interacted with HMO penetration: 1985–90—decrease (*mortality* ↑), 1990–94—no Effect
Tay (2003)	1994	California, Oregon, Washington	Heart attack	Medicare	Mortality	Demand elasticity	Increase (*mortality* ↓)
Gaynor et al. 2010	2003/04, 2007/08	England	Heart attack, all conditions	NHS	Mortality	HHI	Increase (*mortality* ↓)

(*Continued*)

Table 9.10 (Continued)

Study	Time Period	Geographic Area	Medical Condition	Payers	Quality Measure	Competition Measure	Effect of Competition on Quality
Cooper et al. (2011)	2003/04, 2007/08	England	Heart attack	NHS	Mortality	HHI	Increase (*mortality* ↓)
Bloom et al. (2010)	2006	England	Heart attack, emergency surgery	NHS	Mortality	# of hospitals	Increase (*management* ↑ → *mortality* ↓)
Gaynor et al. 2011	2003/04, 2007/08	England	Coronary artery bypass graft	NHS	Mortality	Demand elasticity	Increase (*mortality* ↓)

related to the HHI—the HHI is lower in more competitive markets. So, the finding that competition increases quality is based on a positive empirical relationship between mortality and the HHI—mortality is higher in less competitive markets.

Kessler and McClellan (2000) is one of the first studies attempting to make inferences about a causal effect of competition on quality for hospitals. This is a study of the impact of hospital market concentration on risk-adjusted one-year mortality from acute myocardial infarction (AMI, i.e. a heart attack) for Medicare patients. Expenditures on these patients are also studied. The study included data on all non-rural Medicare beneficiaries with AMI during selected years from 1985 to 1994. Kessler and McClellan use the SCP framework discussed above, with some modifications. They instrument for the HHI with hospital market shares predicted from a model of patient choice of hospital, where patient choice is largely determined by distance from the hospital. They also employ zip code fixed effects. As a consequence, the effects of hospital market concentration are identified by changes in the predicted HHI. The specification they employ, however, omits the regulated Medicare price. A number of hospital and area characteristics are included, HMO enrollment among them. It is unclear whether they are considered demand or cost shifters.

The results from this study are striking. Kessler and McClellan find that risk-adjusted one-year mortality for Medicare AMI patients is significantly higher in more concentrated markets. In particular, patients in the most concentrated markets had mortality probabilities 1.46 points higher than those in the least concentrated markets (this constitutes a 4.4 percent difference) as of 1991. This is an extremely large difference—it amounts to over 2,000 fewer (statistical) deaths in the least concentrated vs. most concentrated markets. The results with regard to expenditures have a somewhat different pattern. Prior to 1991, expenditures were higher in less concentrated markets, while the reverse is true as of 1991.

The positive inferences from this study are clear. Mortality from heart attacks for Medicare patients is lower in less concentrated markets. The effects of concentration are stronger beginning in 1991 and are reinforced by HMO enrollment. The omission of the regulated price is unfortunate, although for this omission to lead to biased estimates the changes in the omitted price would have to be correlated with the within zip code changes in the predicted HHI. It is unclear whether the inclusion of market and hospital characteristics is intended to control for possible hospital complementarities between Medicare and private output. So long as it is unlikely there are important omitted factors there should be no problem with bias. While it is clear that concentration affects hospital quality, the mechanism by which this works is not.

It seems unlikely that hospitals deliberately choose lower quality in the form of an increased probability of death. What may be happening is that hospitals in more concentrated markets take some of their excess profits by exerting lower effort. Low effort in the hospital may have the unintended consequence of higher mortality. Another issue with regard to this application is whether hospitals compete for heart attack patients. Tay (2003) states that one-half of heart attack patients arrive at the hospital via ambulance. It seems unlikely that these patients have any choice of hospital, hence hospitals cannot compete for these patients. We think the most likely story is that heart attack patients are the "canary in the mine shaft." Hospitals in more competitive environments are pressured to be better across the board, and that manifests itself clearly in a very sensitive area—heart attack patient mortality.

While the basic positive results from this study are clear, we do not believe that there are clear normative inferences. The results show that both expenditures and mortality are lower in less concentrated markets, implying gains in benefits with a reduction in costs. Kessler and McClellan state that this implies there is a welfare gain from competition. This may be so, but the inference is not entirely clear. The measure of Medicare expenditures they use is not a measure of economic cost. Therefore, the finding that quality is higher in less concentrated markets tells us that consumers are likely better off, but does not tell us if social welfare has necessarily been improved.

Gowrisankaran and Town (2003) estimate the effects of hospital market concentration on risk-adjusted mortality rates for AMI and pneumonia, for both Medicare and HMO patients. We discuss their findings with regard to Medicare patients here, since the price is regulated for them, and discuss the findings with respect to HMO patients in the next section. Gowrisankaran and Town use data from Los Angeles county from 1991 to 1993 for AMI and 1989 to 1992 for pneumonia. Their approach is similar to that of Kessler and McClellan. They use an SCP framework, instrumenting for the HHI with hospital market shares predicted from a patient choice equation, where distance is the main determinant of hospital choice. An innovation is that they construct separate, hospital-specific, HHIs based on (predicted) hospital market shares for Medicare, HMO, Medicaid, indigent and self-pay patients, and indemnity patients.

Gowrisankaran and Town find, in contrast to Kessler and McClellan, that mortality is worse for Medicare patients treated in hospitals with lower Medicare HHIs. The implication is that competition reduces quality for Medicare patients. Gowrisankaran and Town hypothesize that Medicare margins are small or negative, or that hospitals may deviate from profit-maximizing behavior. If Medicare margins are indeed negative (i.e. $p < MC$), then the results are consistent with theory. It seems unlikely, however, that this is true for AMI. Heart treatments for Medicare patients are widely thought to be profitable. Indeed, there is substantial entry of hospitals specializing only in the treatment of heart disease. Since Medicare patients are a substantial portion of heart patients, it seems as if Medicare margins must be significant in order to generate the observed entry. Small or negative Medicare margins for pneumonia, however, do seem plausible. We do not observe the entry of hospitals specializing in pneumonia, or pulmonary disorders generally.

This study also omits Medicare price. Since Gowrisankaran and Town only examine Los Angeles county there may be little or no variation in Medicare price across hospitals for a given year. Although there should be temporal variation, they have only a short time period. As a consequence, there may not be enough variation in their sample to estimate a parameter for Medicare price. It includes some hospital characteristics, although it is unclear if these characteristics are considered demand or cost shifters.

It is hard to know why the results of this study contrast so markedly with the previous one. It may be that the Medicare price is below marginal cost (on average) for the hospitals in Gowrisankaran and Town's study, while the opposite is true for the hospitals in Kessler and McClellan's study. Since neither study included Medicare price it is impossible to evaluate this hypothesis. It is also possible that the estimated relationship between the HHI and mortality is sensitive to the choice of instruments. Gowrisankaran and Town and Kessler and McClellan use similar, but not identical, instrumenting strategies. Obviously identification is driven by the instruments, so it is possible that the differences in instruments are driving the differences between the studies. This is only speculation, however. The opposite results from the two studies suggest caution in drawing strong conclusions about the impact of market structure on hospital mortality.

Kessler and Geppert (2005) extend the framework employed by Kessler and McClellan to consider the impact of concentration on differences in quality between patients. Their work is inspired by the theoretical result that oligopolists will find it optimal to engage in product differentiation in order to relax price competition (see Tirole, 1988, section 7.5.1). These theory papers are not directly relevant for Kessler and Geppert's empirical exercise, since the theory examines quality dispersion when firms set prices. Kessler and Geppert examine Medicare patients, for whom price is set via regulation. Clearly any incentive to engage in product differentation is not related to a desire to relax price competition for Medicare patients. It is possible that hospitals may be attempting to relax price competition for private patients, and are unable to quality discriminate between Medicare and private patients, perhaps for legal or ethical reasons. It seems like it should be a straightforward result from models where firms choose both product variety and product quality that oligopolists operating in a market with a regulated price have an incentive to differentiate themselves with regard to product variety in order to avoid the kind of quality competition described previously.[83]

Kessler and Geppert examine outcomes (readmissions, mortality) and expense (expenditures, various measures of utilization) for Medicare heart attack patients, as in

[83] If one takes the kind of model used in Lyon (1999) or Kamien and Vincent (1991), where firms locate on a line, it seems evident that firms will have an incentive to locate as far apart from each other as possible (at the ends of the line), rather than nearby (in the middle). If they locate in the middle, the firms are identical, so the one that produces the highest product quality will take the entire market. Thus firms will engage in fierce product quality competition, up until the point that profits are dissipated. If firms are located at the ends of the line, then each firm will be considerably more attractive to consumers located very close to it. This will dampen quality competition.

Kessler and McClellan. They contrast outcomes and expenditures for high-risk and low-risk patients in highly concentrated vs. unconcentrated markets. High-risk patients are those who were hospitalized with a heart attack in the previous year, whereas low-risk patients had no such hospitalization. They find that low-risk patients receive more intensive treatment in highly concentrated markets, but have no statistically significant difference in outcomes. High-risk patients, on the other hand, receive less intensive treatment in highly concentrated markets, and have significantly worse outcomes. They conclude that competition leads to increased variation in patient expenditures, and that it is welfare enhancing, since [on net] outcomes are better and expenditures are lower. Medicare price is omitted, as in previous studies.

This chapter adds to the evidence that concentration is significantly correlated with readily observable measures of quality for hospitals. The statistical relationship between quality dispersion and concentration is surprising and interesting. So far as we know, this is the only paper to examine quality dispersion. What economic behavior generated these patterns in the data is an intriguing puzzle.

Mukamel et al. (2001) examine risk-adjusted hospital mortality for Medicare patients in 134 Metropolitan Statistical Areas (MSAs) in 1990. They focus on the impact of HMOs, but also examine hospital market concentration. Mukamel et al. (2001) find that HMO penetration (the percentage of the MSA population enrolled in an HMO) has a negative impact on excess hospital mortality (the difference between observed mortality and predicted risk-adjusted mortality), i.e. HMO penetration is associated with better quality. Hospital market concentration (measured by the HHI) has no statistically significant impact on mortality. HMO market concentration is also included as an explanatory variable, although it is not significant. Medicare price is omitted. It is unclear what to make of these results. First, Mukamel et al.'s specification includes inpatient expenditures, which are certainly endogenous, as well as hospital HHI, HMO HHI, and HMO penetration, which may very well be endogenous, so it is unclear that the resulting estimates are consistent. It is possible that hospital concentration does truly have an impact on mortality, but that it is not consistently estimated in this study. Second, it is not clear how enrollment in private HMO plans affects the mortality of Medicare patients. Presumably there has to be some spillover effect, but the nature of the mechanism is unclear, as Mukamel et al. acknowledge.

A study that is notable for taking account of Medicare price effects is Shen (2003). Shen examines the impact of financial pressure from reduced Medicare payments and HMO penetration on mortality from AMI, controlling for the hospital's competitive environment.[84] She examines data from 1985 to 1990 and 1990 to 1994 for most

[84] There have been a number of studies assessing the impact of the change in Medicare hospital payment from cost-plus to fixed price (the Medicare Prospective Payment system). See, for example, Kahn et al. (1990); Cutler (1995).

non-rural hospitals in the US. Shen's measure of market structure is an indicator of whether there are five or more other hospitals within a 15-mile radius of a hospital. This is interacted with a measure of the change in the Medicare price and the change in HMO penetration. There are direct effects of Medicare price and HMO penetration, but not market structure.

Shen finds a negative and significant relationship between the change in Medicare price and mortality. The interaction between the market structure and Medicare price variable is negative and significant for 1990–1994, but has no significant impact on mortality for 1985–1990. These results are consistent with standard theory. Hospitals respond to an increase in the regulated price by increasing quality. This response is amplified when hospitals face more competitors.

The effects of HMO penetration also appear to be roughly consistent with theory. Shen finds that HMO penetration leads to higher mortality, and that hospitals in markets with more competitors appeared to respond to HMO penetration with quality reductions in 1985–1990, although not thereafter. HMOs are hypothesized to increase the price elasticity of demand facing hospitals. If so, then the increased price elasticity will likely lead to a quality reduction. This should be amplified in markets with more competitors, since that should also increase the price elasticity. Shen also does a simple normative analysis of the effects of financial pressure, but not the effects of competition.

A paper by Tay (2003) takes a more structural approach. Tay specifies and estimates a structural econometric model of hospital choice by Medicare enrollees with AMI.[85] Tay uses data on urban enrollees in conventional Medicare, located in California, Oregon, and Washington in 1994. She examines the effect of a number of aspects of quality and distance on the probability a patient is admitted to a particular hospital. The quality measures include two clinical outcomes (the mortality rate and the complication rate); a measure of input intensity (nurses per bed); and whether the hospital can perform two high-tech cardiac services (catheterization or revascularization). All measures of quality are treated as exogenous.

Tay finds that hospital demand is negatively affected by patient distance and positively affected by quality. She then simulates the effects of changes in the various aspects of a hospital's quality, holding the total number of heart attack patients fixed, the locations of patients and hospitals fixed, and the qualities of all other hospitals fixed. Adopting a catheterization lab is predicted to increase demand by 65 percent, while adding revascularization in addition to catheterization increases demand by

[85] A number of papers have previously examined whether choice of hospital is affected by quality (Luft et al., 1990; Burns and Wholey, 1992; Chernew et al., 1998). These studies find that clinical quality, as measured by deviation between expected and actual mortality rates, has a significant impact on hospital choice—hospitals with lower mortality are more likely to be chosen. The responsiveness found in these studies indicates the potential for quality competition among hospitals, although how much is not clear, since the studies were not designed to assess this.

76 percent. If the number of nurses per bed is increased by 1 percent, then demand is predicted to increase by 24 percent.

Tay shows that hospital demand is significantly affected by quality and distance, thus there are potentially high payoffs to hospitals increasing quality. While this represents an advance over the previous literature by using more detailed modeling, there are nonetheless some limitations to the inferences that can be drawn from this study.

As with the previous studies, the Medicare price is omitted. It is possible that this omission is inconsequential, but we see no way to tell. Tay assumes that hospitals set the same level of quality for Medicare and non-Medicare patients. This is also an untested assumption, although it is at least explicit.

More fundamentally, the supply side of the market is not modeled. As a consequence, competition itself is not modeled and cannot be examined explicitly. There is no structure in place for dealing with the potential endogeneity of the quality variables. There is the usual reason to be concerned about endogeneity, since quality is chosen by the firm. In addition, it has been observed for a number of hospital procedures that hospital volume causes patient outcomes (see section 4.4.3 below for a review of some studies). This suggests endogeneity of the mortality and complication rates.

Further, the simulation is an out-of-equilibrium prediction. Tay's predicted effects of adding a catheterization lab or other services on demand are likely too large, since they hold rivals' responses fixed. If rivals respond by also adopting catherization labs or other services, then the equilibrium effects should be smaller, potentially even zero. It is also unclear whether firms would actually make the predicted choices. If rivals respond strongly to a firm's adoption of services, the responses may make adoption unprofitable. As a consequence it is hard to assess the magnitude of quality effects. Last, as Tay acknowledges, without a supply side no welfare analysis can be performed.

Two recent studies (Cooper et al., 2011; Gaynor et al., 2010) examine the impact of competition on hospital quality using a recent reform in the English National Health Service (NHS). The NHS introduced a reform in 2006 intended to promote competition among hospitals. Prices were administratively determined based on patient diagnoses, via a method very similar to that employed by the US Medicare system. As a consequence, hospitals were to compete solely on non-price dimensions. Although they differ in the precise methods employed, both Cooper et al. (2010) and Gaynor et al. (2010) find that, following the reform, risk-adjusted mortality from AMI fell more at hospitals in less concentrated markets than at hospitals in more concentrated markets.

Gaynor et al. (2010) also look at mortality from all causes and mortality from all causes, excluding AMI, and find the same qualitative results as for AMI, although the estimated effects are smaller in magnitude. They also examine measures of utilization and expenditure, and find that length of stay rose in less concentrated markets relative to more concentrated markets after the reform, but there were no impacts on expenditures. Quantitatively, Gaynor et al. (2010) find that the reform reduced heart attack mortality by 0.2 percent.[86] Since the reform saved lives without increasing costs, they conclude it was welfare improving. The measure of costs is hospital expenditures. As noted before, this may not accurately capture economic costs, so welfare inferences are not necessarily clear. Gaynor et al. also control for the impact of the NHS administered prices on outcomes. They estimate a positive, but statistically insignificant, effect.

Gaynor et al. (2011) estimate a structural model of demand for heart bypass surgery (CABG) in England to evaluate the effect of the reform studied by Cooper et al. and Gaynor et al. (2010). In particular, one part of the reform required referring physicians to give patients five choices of hospitals (previously they had been required to give none). Gaynor et al. (2011) use individual data on patient treatment to estimate a multinomial logit model of demand faced by individual hospitals for CABG surgery. They find that the demand elasticity with respect to a hospital's (risk-adjusted) mortality rate is greater after the reform than before. Post-reform the elasticity with respect to the adjusted mortality rate is roughly equal to 0.3. In the case of the mortality rate, an increase of one standard deviation (about a 20 percent increase) implies a drop in the choice probability of about 6 percent. This elasticity is significantly larger than the pre-reform mortality rate elasticity. They also find substantial geographic differentiation—cross-elasticities between hospitals with respect to their mortality rates fall dramatically with distance. This indicates that close-by hospitals compete with each other over quality, but not with hospitals far away. There is considerable individual heterogeneity in patient responsiveness. More seriously ill patients (as measured by a higher co-morbidity count) are more sensitive to the hospital mortality rate than the average patient. With the introduction of the reform their preference for quality, relative to the average patient, increases even more. They also find larger effects of the reform on low-income patients. This study takes a structural approach toward studying the effect of competition on quality. The English reform was intended to increase competition, and apparently did increase demand responsiveness.

Some insight into the mechanisms underlying the relationship between market structure and quality identified in Cooper et al. and Gaynor et al. (2010) is provided by Bloom et al. (2010). Bloom et al. use data for the English NHS and employ a

[86] Both the Cooper et al. (2011) and Gaynor et al. (2010) estimates of the impact of competition post-reform are quantitatively similar. Cooper et al. (2011) calculate that a one standard deviation increase of their measure of competition would lead to a reduction in the heart attack mortality rate of 0.3 percent per year. Gaynor et al. (2010)'s estimates imply that a one standard deviation decrease in concentration reduces heart attack mortality by 0.33 percent per year.

measure of management quality developed by Bloom and Van Reenen (2007) to examine the impact of market structure on management quality and, ultimately, on hospital quality (AMI mortality, emergency surgery mortality, and other measures). They find that having more close-by competitors has a strong and significant impact on management quality and hence on clinical quality of care. Their estimates imply that adding a rival hospital close by increases the measure of management quality by one-third of a standard deviation and thereby reduces heart attack mortality by 10.7 percent. This study employs only cross-sectional data (2006), so the methods differ from those in Cooper et al. and Gaynor et al. (2010). Identification of the effect of market structure is achieved by using political marginality of a hospital's geographic area. Because hospital openings, mergers, and closures are determined by a government agency (Department of Health), they are subject to political influence.

4.4.2. Studies with Market Determined Prices

We now turn to econometric studies of competition and quality where prices are determined in the market.[87] Most of these employ the SCP model, while some examine the impacts of mergers or price deregulation. A smaller number are structural (or related) and estimate entry behavior.

The results are summarized in Table 9.11. In the table the entry in the column labeled "Effect of competition on quality" indicates the direction of the relationship between the competition measure and the quality measure. The measure of quality used in the study is listed under the column heading "Quality measure," and the measure of competition is listed in the column labeled "Competition measure."

There have been a number of recent studies of competition and quality in hospital markets. These all cover time periods from the 1990s or later, when it is generally agreed that price competition had emerged in hospital markets. We first discuss SCP studies, then cover merger studies, then finally move to studies of price deregulation. In considering these studies we need to refer back to economic theory for guidance. Unlike the case of regulated prices, economic theory on competition and quality is less clear (see Gaynor, 2006b). Nonetheless, theory does provide a guide to what to look for, and what economic factors might be underlying an estimated relationship.

Some insights into the determinants of quality levels can be gained from the model of Dorfman and Steiner (1954). Their model is nominally about choice of price and advertising, but can also be interpreted as about price and quality (although in a somewhat restrictive way).[88]

[87] We omit older studies of the "Medical Arms Race." For a review that includes these studies see Gaynor (2006b).

[88] Dorfman and Steiner model a monopolist's behavior. We can consider this an approximation to the behavior of a monopolistically competitive firm if we think of the demand function as a reduced-form demand, e.g. an oligopolist's residual demand curve (see, e.g., Dranove and Satterthwaite, 2000).

Table 9.11 Health Care Quality and Competition Empirical Studies: Market Determined Prices

Study	Time Period	Geographic Area	Medical Condition	Payers	Quality Measure	Competition Measure	Effect of Competition on Quality
Gowrisankaran and Town (2003)	Heart attack, 1991–1993; pneumonia, 1989–1992	Los Angeles	Heart attack, pneumonia	HMO	Mortality	HHI	Increase (*mortality* ↓)
Sohn and Rathouz (2003)	1995	California	PTCA	All	Mortality	Competition coefficient	Increase (*mortality* ↓)
Mukamel et al. (2002)	1982, 1989	California	All, AMI, CHF, pneumonia, stroke	All	Mortality	HHI	Decrease (*mortality* ↑)
Encinosa and Bernard (2005)	1996–2000	Florida	All, nursing surgery	All	Patient safety event	Low hospital operating margin	Decrease (*patient safety events* ↑)
Propper et al. (2004)	1995–1998	UK	Heart attack	NHS	Mortality	Number of competitors	Decrease (*mortality* ↑)
Sari (2002)	1991–1997	16 states	All	All	Quality indicators	HHI	Increase (*quality indicators* ↑)
Ho and Hamilton (2000)	1992–1995	California	Heat attack, stroke	All	Mortality readmission	Merger	No effect; mortality increase: readmission (↓)
Capps (2005)	1995–2000	New York	All	All	Quality indicators	Merger	No effect: 13 inpatient and patient safety indicators Decrease: 1 year post-merger in-hospital mortality for AMI, heart failure (*mortality* ↑)

(*Continued*)

Table 9.11 (Continued)

Study	Time Period	Geographic Area	Medical Condition	Payers	Quality Measure	Competition Measure	Effect of Competition on Quality
Volpp et al. (2003)	1990–1995	New Jersey	Heart attack	All	Mortality	Price deregulation	Decrease (*mortality* ↑)
Burgess et al. (2008)	1991–1999	UK	Heart attack	NHS	Mortality	Deregulation, number of competitors	Decrease (*mortality* ↑)
Howard (2005)	2000–2002	US	Kidney transplant	All	Graft failure	Demand elasticity	Increase (small) (*elasticity* ↑)
Abraham et al. (2007)	1990	US	All	All	Quantity consumed	# of hospitals	Increase (*quantity* ↑)
Cutler et al. (2010)	1994, 1995, 2000, 2002, 2003	Pennsylvania	CABG	All	Mortality	Entrants' market share	Increase (*market share of high-quality (low mortality) physicians* ↑)
Escarce et al. (2006)	1994–1999	California, New York, Wisconsin	Heart attack, hip fracture, stroke, gastrointestinal hemorrhage, congestive heart failure, diabetes	All	Mortality	HHI	Increase—CA, NY; no effect—WI (*mortality* ↓, 0)
Rogowski et al. (2007)	1994–1999	California	Heart attack, hip fracture, stroke, gastrointestinal hemorrhage, congestive heart failure, diabetes	All	Mortality	1-HHI, 1–3 firm concentration ration, # of competitors	Increase (3–5 conditions), no effect (*mortality* ↓, 0)

Mutter et al. (2008)	1997	US	All		All	Inpatient quality indicators, patient safety indicators	Various (HHI, # of competitors, . . .)	Increase, no effect, decrease (*quality indicators* ↑, 0, ↓)
Romano and Balan (2011)	1998–99, 2001–03	Chicago PMSA	All		All	Inpatient quality indicators, patient safety indicators	Merger	No effect, increase (*quality indicators* 0, ↑)
Mutter et al. (2011)	1997–2001, 1998–2002	16 US states	All		All	25 inpatient quality indicators, patient safety indicators	42 Mergers	Increase, no effect, decrease (*quality indicators* ↑ 0, ↓)

Using this model, we can obtain the following formula, known as the Dorfman–Steiner condition (see Gaynor, 2006b, for the derivation):

$$\frac{z}{p} = \frac{1}{d} \cdot \frac{\varepsilon_z}{\varepsilon_p} \tag{9.36}$$

where d is the average cost of quality per unit of quantity, i.e. cost $= c \cdot q + d \cdot z \cdot q$ where q is quantity.

This says that the ratio of quality to price should go up if the quality elasticity of demand increases or the price elasticity of demand declines, and vice versa. An increase in the quality elasticity increases the payoff to increased quality. A decrease in the price elasticity increases the price–cost margin, which also increases the payoff.

Some other papers provide a similar intuition, although the models are quite different from Dorfman and Steiner. Dranove and Satterthwaite (1992) consider the effects of information on price and quality when consumers are imperfectly informed about both. They find that if consumers have better information about price than about quality, then this can lead to an equilibrium with suboptimal quality. Intuitively this is similar to what happens in the Dorfman–Steiner framework with an increase in the price elasticity of demand, and no increase in the quality elasticity. The price–cost margin will fall, leading to a decreased payoff to quality, and a decrease in the quality–price ratio.

Allard et al. (2009) explicitly consider competition in the physician services market. They consider a repeated game between physicians and patients. The patient's health is determined by observable medical care and physician effort. Physician effort is anything physicians do that affects patient health. It can be thought of as quality. The patient observes his health *ex post*, so physician effort is observable, but is noncontractible. In the static game physicians will supply suboptimal effort. However, in the repeated game there is an equilibrium in which physicians supply optimal effort. This equilibrium obtains under certain conditions, in particular if patient switching costs are not too high and there is an excess supply of physicians. If switching costs are high then effort will be suboptimal, but competition will result in effort levels above the minimum.[89] Again, there are parallels to the Dorfman and Steiner intuition. In the Allard et al. model optimal effort occurs when patient switching costs are not too high. This is similar to the quality elasticity of demand being sufficiently high in the Dorfman and Steiner model. Suboptimal effort occurs when switching costs are high, analogous to a low-quality elasticity of demand.

While there are no determinate conclusions from this framework, it does offer some useful guidance for thinking about issues of competition in health care markets.

[89] In addition, if there is uncertainty in the relationship between patient health and physician actions, then physicians face some risk of patients switching even if they have supplied optimal effort. In this case their physicians will supply supra-optimal effort.

For example, the advent of managed care in the 1990s is commonly thought to have increased the price elasticity of demand facing health care firms (hospitals in particular). This should have led to decreased prices, and indeed seems to have done so. If there was no sufficiently countervailing increase in the quality elasticity, then quality should have fallen.

Another change in health care markets is the recent emphasis on medical errors and quality improvement. If that leads to the quality elasticity of demand increasing, then quality will increase. If the price elasticity remains unchanged this will increase price (since increased quality raises marginal cost), but price–cost margins will remain unchanged.

A study by Gowrisankaran and Town (2003) examined the relationship between market structure and AMI and pneumonia mortality in Los Angeles county in the early 1990s for both Medicare and HMO patients. We discussed the findings for Medicare patients in the previous section. We now turn to HMO patients. Gowrisankaran and Town find that risk-adjusted mortality is significantly lower in less concentrated parts of Los Angeles county. This implies that competition in quality is increasing for HMO patients. With a standard model of price and quality competition (see Gaynor, 2006b) this could occur if the quality elasticity of demand is higher in less concentrated markets, or if the price elasticity is lower. Since we generally think that elasticities are higher with more competitors, the former seems plausible (and the latter does not).

Sohn and Rathouz (2003) study the impact of competition on risk-adjusted mortality for patients receiving percutaneous transluminal coronary angioplasty (PTCA) in 116 hospitals in California in 1995. They construct a "competition coefficient" that varies between zero and one depending on the degree of overlap in the patient pools of a pair of hospitals. Sohn and Rathouz find that mortality is lower for patients in hospitals facing more competition. This effect is stronger in lower volume hospitals. Again, this result seems to imply that the quality elasticity is higher in more competitive markets.

Mukamel et al. (2002) examine the impact of competition on risk-adjusted mortality for California patients in 1982 and 1989. The two years cover the period before and after the introduction of insurer-selective contracting in California. They hypothesize that the introduction of selective contracting increased price competition and that hospitals responded by shifting resources from clinical activities, which are hard to observe, to hotel activities, which are more easily observed. Mukamel et al. estimate the effects of the level of hospital concentration (measured as the HHI) in the base year and the change in hospital concentration on the change in inpatient clinical expenditures, and then the impact of the change in expenditures and the level of the hospital HHI in 1989 on the level of risk-adjusted mortality in 1989. They find that the change in the HHI had a negative and significant impact on both clinical and hotel expenditures for not-for-profit hospitals, but no significant impact on for-profit hospitals. The estimated relationship between clinical expenditures and mortality is negative. Mukamel et al. find that together these two results imply that increased competition from 1982 to1989 led to increased mortality, operating via competition reducing clinical expenditures on patients. The introduction of selective contracting is likely to have increased the price elasticity of demand facing hospitals, without increasing the quality elasticity by a similar proportion. In this case, the Dorfman and Steiner model predicts that quality will fall.

Encinosa and Bernard (2005) use data on all inpatient discharges from Florida hospitals from 1996 to 2000 to examine the impacts of financial pressure on patient safety. Encinosa and Bernard employ a newly available set of quality indicators developed by the Agency for Health Care Research and Quality (AHRQ). These indicators measure a variety of factors reflecting clinical quality, including mortality, obstetric complications, adverse or iatrogenic complications, wound infections, surgery complications, cesarean section, and inappropriate surgery.[90] Encinosa and Bernard estimate the impact of within-hospital changes in lagged operating profit margins[91] on the probabilities of adverse patient safety events. They find that patients at hospitals in the lowest quartile of operating profit margins have significantly higher probabilities of adverse safety events than those in any of the higher quartiles. There are no significant differences in the probability of adverse events between patients in the highest, second-highest, or third-highest quartiles.[92] Thus patients at hospitals that are doing poorly financially are at greater risk of suffering from a patient safety problem than those who are at hospitals that are doing better financially. There seems to be no impact of doing better financially above a threshold (bottom quartile of operating margin).

This finding is roughly consistent with theory. We expect that quality will be positively related to marginal profits, so the empirical finding that quality is lower at hospitals with low profits seems likely. Standard theory would predict a continuous effect of profits on quality, however, not a threshold. It is possible that this could be due to data limitations. Encinosa and Bernard have to rely on accounting data, so they are unable to measure economic profits or construct a measure of marginal profits.

There are also some issues with the econometrics. Encinosa and Bernard use hospital dummies to control for hospital-specific unobserved factors. The estimating equations are logits for the probabilities of adverse patient safety events. This is a nonlinear estimator, so unlike least squares, hospital-specific effects are not differenced away. As a consequence, it is not clear to what extent their estimates of the effects of

[90] Go to http://http://www.qualityindicators.ahrq.gov for more information.

[91] The ratio of net operating profit to net operating revenue.

[92] The first quartile covers patients at hospitals with margins below −0.5 percent. The second quartile covers margins between −0.5 percent and 4.4 percent, the third between 4.4 percent and 9.3 percent, and the fourth covers margins greater than 9.3 percent.

profits on safety are truly purged of potentially confounding hospital-specific effects. Another issue is that slope estimates from non-linear models with group fixed effects are only consistent when the number of observations per group goes to infinity. In this context, that means that the number of years each hospital is observed has to be large. Since the sample in this paper covers five years, it seems unlikely this condition is met, hence the estimates may not be consistent.

While this study does not directly examine competition, it may have implications for the impact of competition on quality. To the extent that competition reduces hospital operating margins to low levels as in Encinosa and Bernard it may put patients at higher risk of adverse safety events.

Propper et al. (2004) use an SCP approach to examine the effect of hospital competition in the United Kingdom following reforms to the National Health Service in the 1990s. These reforms encouraged payer-driven competition among hospitals. Propper et al. examine the impact of this payer-driven competition on mortality for AMI patients. They examine the impact of a measure of market structure (roughly, the number of competitors) on mortality over the period 1995–1998 and find that mortality increases with the number of competitors. This finding certainly contrasts with that of US SCP studies, but (for better or for worse) it is consistent with theory. The presence of more competitors can increase quality elasticity, price elasticity, or both. If the price elasticity increases more than the quality elasticity, then quality will fall. Whether this is the mechanism driving the result in this paper cannot be determined, although it provides some direction for future research. As previously, the welfare impacts of this finding are unclear. If increasing the number of competitors is associated with a decrease in market power, then a quality decrease may be welfare improving. Alternatively, it could be harmful.

An interesting study is by Sari (2002). Sari uses the same quality indicators as Encinosa and Bernard. Sari is one of the first studies to employ these indicators rather than following the common practice of using risk-adjusted mortality as a quality measure. He employs data on hospitals in 16 states covering the period 1992–1997 and estimates the SCP model using fixed effects, random effects, and instrumental variables with fixed effects. Sari finds that quality is significantly lower in more concentrated markets—he estimates that a 10 percent increase in hospital market share leads to a 0.18 percent decrease in quality. He also finds evidence that managed care penetration increases quality for some of the quality indicators, although there is no statistically significant relationship for others.

Ho and Hamilton (2000) and Capps (2005) are two papers that examine the impact of hospital mergers on quality of care. Ho and Hamilton (2000) study 130 hospital mergers of various types over the period 1992 to 1995. The quality measures they employ are inpatient mortality, readmission rates, and early discharge of newborns. They employ hospital-specific fixed effects to control for time invariant hospital characteristics that may be related to merger. Ho and Hamilton find no detectable impact of merger on mortality for either heart attack or stroke patients. They do find that some mergers increase readmission rates for heart attack patients and the early discharge of newborns. It is unclear whether Ho and Hamilton find no effect because there truly is no effect or because they are unable to identify the effect in the data. The effects of mergers are notoriously difficult to identify. First, there are not a large number of mergers, so there is not a lot of statistical power with which to detect an effect. Second, the identifying variation in this study comes from within-hospital variation over time. If that is not the primary source of variation in outcomes then the estimates of the parameters will be imprecise. Third, mergers are certainly endogenous. Mergers occur for reasons that are often related to the outcome variables of interest. If mergers occur for reasons related to hospitals' changing circumstances over time, then the hospital fixed effects will not control for endogeneity, so it will be difficult to obtain consistent estimates of a merger effect.

Capps (2005) uses the AHRQ quality indicators to examine the effect of hospital mergers on quality. He compares merging to non-merging hospitals in New York state during 1995–2000. There are 25 merging hospitals, and 246 total. Control groups are constructed in two ways. The first method is to select non-merging hospitals that are similar to merging hospitals in observable characteristics (e.g. teaching status, size, ownership, etc.). The second method is to use propensity scores to identify a control group. The control group for a merging hospital then consists of the ten non-merging hospitals that have predicted probabilities of merging that are closest to the predicted probability of the merging hospital.

Using the first method Capps finds no statistically significant effect of mergers on most of the quality indicators. There is no effect on four of six inpatient indicators for quality procedures, no effect for indicators for three other surgical procedures, and no effect for six patient safety indicators. Merger is found to have a negative effect on the inpatient quality indicators for two cardiac procedures: AMI and congestive heart failure (CHF). Merger is estimated to lead to an additional 12 deaths per 1,000 AMI or CHF admissions in the year following the merger, although there is no significant effect in the second year after the merger. There are no statistically significant effects of merger on any of the quality indicators when propensity scores are used to generate a control group. As with the Ho and Hamilton paper it is hard to know how to interpret the overall lack of statistical significance. Mergers may truly have had no impact on hospital quality in New York state over this period, or it may just be very difficult to precisely test the hypothesis.

Two very interesting recent papers use changes in regulation as a way to learn about the effect of hospital competition on quality. Volpp et al. (2003) study the effect of the deregulation of hospital prices in New Jersey to try to learn about the impact of the introduction of price competition on hospital quality. In 1992 New Jersey deregulated hospital prices. The neighboring state of New York had no change in its hospital regulatory regime. Volpp et al. use data on AMI hospital admissions in New Jersey and New York from 1990 to 1996 to learn about the effect of the deregulation. They look at the difference in risk-adjusted inpatient AMI mortality between New Jersey and New York before and after regulatory repeal. They find that mortality in New Jersey relative to New York increased after price deregulation. At first glance this result contrasts markedly with the SCP type studies previously discussed. However, consider the impact of price deregulation. The biggest impact should be to increase the price elasticity of demand, and decrease price.[93] The quality elasticity seems unlikely to be significantly affected. The prediction of a standard model is that quality will fall when the price elasticity of demand increases. It is impossible to say what the impact on welfare might be. If the regulated prices were set too high, then this quality decrease is welfare increasing, and vice versa.

A paper by Burgess et al. (2008) employs a similar approach to Volpp et al. In this paper Burgess et al. (2008) examine the impacts of competitive reforms in the NHS on mortality for AMI patients. Burgess et al. (2008) use a different strategy in this paper than in Propper et al. (2004). Here they use the change in regulation in the UK over the period 1991–1999, combined with geographic variation in the number of competitors.[94] Competition was introduced in 1991 and actively promoted up until 1995. It was downplayed after 1995 and actively discouraged from 1997 onwards. The impact of competition is identified by differences between hospitals facing competitors and those who are not between the time periods when competition was encouraged versus when it was discouraged.

Burgess et al. (2008) find that competition reduces quality. The differences in mortality for hospitals in areas with competitors versus those with no competitors was higher during the period when competition was promoted (1991–1995), than during the period when competition was discouraged (1996–1998). The estimated cumulative effect of competition over the entire period is to raise mortality rates by roughly the same amount as the cumulative effect of the secular downward trend in heart attack mortality (presumably due to technological change). This is a large impact. As with Volpp et al. (2003), these results can be interpreted as consistent with economic theory, although that is not testable within the framework employed in the paper. Also as before, the welfare inferences are unclear.

Howard (2005) is a paper that focuses on demand, as in the paper by Tay. Howard models the demand for kidney transplantation facilities, focusing on the effect of quality on consumer choice of facility. Howard examines the choices of all patients receiving transplants, including Medicare patients, Medicaid patients, and those with private insurance.

[93] Unfortunately Volpp et al. do not have any evidence on the effect of deregulation on prices.

[94] Only variation in the number of competitors is used in Propper et al. (2004).

Quality is measured as the difference between expected and actual one-year post-transplant graft failure rates at a center. Howard assumes that there are no price differences that affect choice between transplant centers, thus price is omitted. The explanatory variables are the quality measure, patients' distances from transplant centers, and patient characteristics. The average estimated choice elasticity with respect to quality is −0.12. The quality elasticity for privately insured patients is larger: −0.22.

These elasticity estimates are not particularly large. The low value of the average estimated quality elasticity implies that this does not give transplant centers a large incentive to compete on quality, as indicated by equation (9.23). Since Howard does not model the supply side, his model does not directly predict the impacts of competition (it is not intended to do so).

As with the Tay paper there are also some concerns about price and endogeneity. Howard assumes that price has no impact on where patients obtain their transplants. This may be true for Medicare, but it seems unlikely for patients who are privately insured. Privately insured patients face very large differences in out-of-pocket costs between providers that are in and out of their coverage networks. In addition, health insurance plans make decisions on which providers to include in their networks based on price. Thus it seems as if price should be included for those with private insurance. Further, if price is positively correlated with quality, then its omission could lead to a downward bias in the estimated effect of quality on demand. Patients may appear less responsive to quality differences than they really are if high-quality transplant centers are also high cost to them. Endogeneity of quality may also be an issue, for the same reasons as the Tay paper.

Abraham et al. (2007) has some welfare implications. Abraham et al. examine the determinants of the number of hospitals in isolated markets in the US for 1990. They do not examine price or quality explicitly. Instead, they infer whether competition is increasing by the population required to support another firm in the market. If the population required to support another firm is increasing, then average profits available post-entry must be decreasing, thus increasing the volume necessary to make entry profitable. They find that market size is the primary determinant of the number of hospitals, and that the quantity bought and sold in the market rises, and variable profits fall, as the number of hospitals in a local market increases. This implies that the market is getting more competitive as the number of hospitals increases. Further, it shows that entry is not simply demand-stealing—more hospitals increase demand. The reason is that quantity demanded can increase only if price is lower or quality is higher. Since that does happen, people are consuming more and must be better off.[95] As a

[95] As pointed out previously, increased aggregate demand is not necessary for increased quality to be welfare enhancing.

consequence, they conclude that competition increases with the number of hospitals, and that competition is welfare improving.

Cutler et al. (2010) is a recent very interesting study that, like Abraham et al., utilizes information on entry (in the coronary artery bypass graft surgery market, i.e. CABG) to make inferences about the impacts of competition. Cutler et al. use the repeal of entry restricting regulation (hospital certificate of need regulation, CON) in Pennsylvania to examine the effect of entry of hospitals into the CABG surgery market. They hypothesize that overall production is capacity constrained—cardiac surgeons are a scarce input and supply cannot be altered easily. As a consequence, entry will not lead to increased quantities of CABG surgery, but may lead to improved quality; in particular, they hypothesize that it will increase the market shares of high-quality surgeons. This hypothesis is confirmed in the empirical analysis. They find that in markets where entrants have 11–20 percent market shares of CABG surgeries, high-quality surgeons' market shares increased 2.1 percentage points more than for standard quality surgeons. Overall, they conclude that entry led to increased quality, but that there was no net effect of entry on social welfare. Their estimates of the gains from reduced mortality due to entry are approximately offset by the estimated fixed costs of entry. This is one of the few papers with welfare results.

Escarce et al. (2006) examine the relationship between hospital concentration and patient mortality for adults hospitalized for myocardial infarction, hip fracture, stroke, gastrointestinal hemorrhage, congestive heart failure, or diabetes in California, New York, and Wisconsin. They find that the probability of death is lower in less concentrated markets in California and New York, but not Wisconsin. This adds to the evidence that there can be substantial quality competition among hospitals, but also that there can be substantial heterogeneity, depending on market specifics. It is possible that in Wisconsin price competition dominates quality competition, although the study does not present evidence on that and of course there could be other reasons for the result.

A different study by Rogowski et al. (2007) examines the same six conditions in the state of California. In this study Rogowski et al. find that mortality is lower in less concentrated markets for three to five of the six conditions, depending on the measure of concentration employed. Interestingly, they find no statistically significant impact of market structure on heart attack mortality, in direct contrast to many other studies which find the opposite result.

Mutter et al. (2008) use national data on hospitals from the US Agency for Healthcare Research and Quality's Hospital Cost and Utilization Project state inpatient databases to examine the relationships between 38 different measures of inpatient quality and 12 different measures of hospital market structure. They find a variety of differing relationships: some quality measures positively related to measures of market structure, some negatively, and some not at all (insignificant). The use of national data is an improvement on prior studies which only use data from a single state. While the results seem somewhat murky, perhaps the variety of patterns they uncover in the data is not surprising. First, since there is both price and quality competition, anything can happen. Second, the use of multiple states, while laudable, does introduce additional heterogeneity, which can be hard to measure. Third, finding results in every direction is not terribly surprising with such a large number of different outcome measures.

Romano and Balan (2011) is an interesting recent study. Romano and Balan study the impact on quality of care of a consummated merger between two hospitals in the Chicago suburbs (Evanston Northwestern Hospital and Highland Park Hospital). This merger was the subject of an antitrust suit by the Federal Trade Commission, and the authors provided evidence on the case. This study uses the Inpatient Quality Indicators and Patient Safety Indicators used by Encinosa and Bernard and by Sari. The authors use a difference-in-differences methodology and compare the changes in quality measures at the two merged hospitals before and after the merger to the changes at control hospitals over the same time period. They find no significant impact of the merger on many quality measures, but there is a significant negative impact on some and a few with positive impacts. AMI, pneumonia, and stroke mortality went up at Evanston Northwestern Hospital post-merger compared to control hospitals, although there was no statistically significant impact at Highland Park. There was some improvement in quality for some nursing-sensitive quality measures: the incidence of decubitis ulcers (bedsores) fell at both merged entities, as did infections at Evanston Northwestern. Conversely, the incidence of hip fractures rose at Evanston Northwestern. Last, they found increases in some measures of obstetric outcomes (birth trauma to the newborn, obstetric trauma to the mother), and decreases in some other measures. They conclude that overall there is no reason to infer that the merger had salutary effects on quality.

Mutter et al. (2011) expand on other studies by examining the impacts of multiple mergers (42) in multiple (16) US states. The authors use difference-in-difference analysis to contrast changes in 25 different measures of quality (the AHRQ Inpatient Quality Indicators and Patient Safety Indicators) at merging hospitals against changes at control hospitals over the same time period. Mutter et al. find mixed results— mergers result in increased, decreased or no change in quality depending on the measure and the nature of the merger. For the majority of cases, mergers have no impact on quality. For a few measures there are statistically significant impacts of mergers on quality, although there are both positive and negative effects. Overall, the authors have a hard time finding statistically significant impacts of hospital mergers on quality, implying that on average there is no detectable effect. Their results do indicate, however, that mergers can have either negative or positive quality impacts, depending on the measure of quality and the specifics of the merger. The nature of these results has a lot in common with their previous study (Mutter et al., 2008), which focused on measures of market structure, rather than merger. As with that study, while the results seem somewhat murky, perhaps that is to be expected, given the large degree of heterogeneity in hospital mergers, and the large number of outcome measures employed.

4.4.3. Studies of the Volume–Outcome Relationship

There have been a very large number of studies of the "volume–outcome" relationship, the majority in the medical literature. These studies commonly find a significant correlation with the volume a hospital does of a procedure and the medical outcomes of patients receiving the procedure at that hospital. The obvious concern with studies of this kind is endogeneity. It may be that hospitals that do more of a procedure are better at it, whether from learning by doing or by making quality improving investments. It may also be true, however, that patients are attracted to hospitals with the best outcomes. The studies in the medical literature are unable to distinguish between these two alternatives.

This is important for assessing competition in the hospital sector and for antitrust enforcement. If volume causes quality, then there may be some efficiencies from improved patient outcomes in more concentrated markets. This could also affect hospital merger evaluation. We review three relatively recent studies below that present the strongest evidence to date on the volume–outcome effect: Ho (2002), Gowrisankaran et al. (2004), and Gaynor et al. (2005). The results of these studies are summarized in Table 9.12.

Ho (2002) examines the volume–outcome relationship for PTCA using data from California hospitals from 1984 to 1996. The outcomes she examines are mortality and emergency CABG. She estimates the effects of hospital cumulative and annual volume on outcomes, employing hospital and time fixed effects. Ho finds substantial improvements in outcomes over time, but a small effect of annual hospital volume on outcome. The effect of cumulative volume on outcomes is imprecisely estimated.

Gowrisankaran et al. (2004) attempt to recover the causal relationship between volume and outcome using instrumental variables. They study the volume–outcome relationship for three surgical procedures: the Whipple procedure (removing tumors from the pancreas); CABG; and repair of abdominal aortic aneurysm (this repairs weak spots in the abdominal artery). They use data on hospitals from Florida from 1988 to 1999 and California from 1993 to 1997. The instrumental variables approach is to use patient distance from the hospital to estimate patient choice of hospital and then construct predicted volume. Gowrisankaran et al. find that increasing volume causes better outcomes for all three procedures and find significant and large effects of hospital volume on patient mortality. This implies that volume–outcome effects can be important to consider when evaluating the impact of hospital competition. If competition leads to reduced volume then outcomes will decline. If competition leads to specialization then outcomes will improve.

Table 9.12 Health Care Quality and Competition Empirical Studies: Volume—Outcome

Study	Time Period	Geographic Area	Medical Condition	Payers	Quality Measure	Factor Affecting Quality	Effect on Quality
Ho (2002)	1984—1986	California	PTCA	All	Mortality, CABG	Surgical volume	Increase (small) (*volume* ↑ → *mortality* ↓)
Gowrisankaran et al. (2004)	1993—1997 (CA), 1988—1999 (FL)	California, Florida	Whipple procedure, CABG, abdominal aortic aneurysm	All	Mortality	Surgical volume	Increase (*volume* ↑ → *mortality* ↓)
Gaynor et al. (2005)	1983—1999	California	CABG	All	Mortality	Surgical volume	Increase (*volume* ↑ → *mortality* ↓)
Huckman and Pisano (2006)	1994—1995	Pennsylvania	CABG	All	Mortality	Surgical volume (physician)	Increase (*volume* ↑ → *mortality* ↓)
Ramanarayanan (2008)	1998—2006	Florida	CABG	All	Mortality	Surgical volume (physician)	Increase (*volume* ↑ → *mortality* ↓)
Huesch (2009)	1998—2006	Florida	CABG	All	Mortality	Surgical volume (new surgeons)	No effect (*volume* ↑ → *mortality*)

Gaynor et al. (2005), in a similar paper, use instrumental variables techniques to estimate the volume–outcome relationship for CABG. They use data from California for 1983–1999. Gaynor et al. find a causal, and substantial, effect of volume on outcome. For example, if CABGs could only be performed in hospitals with a volume of 200 or greater, the average mortality rate from CABG would fall from 2.5 to 2.05 percent, saving 118 (statistical) lives. In a related working paper by the same authors, Seider et al. (2000) simulate the effects of two mergers: a hypothetical "standard merger," in which two out of five firms with equal market shares merge; and the actual merger of Alta Bates Medical Center and Summit Medical Center in Oakland, California. They find that, for larger hospital mergers (hospital volumes >140), the value of saved lives from the standard merger outweighs the loss of consumer surplus from increased prices. For the Summit–Alta Bates merger, which does not, however, have a large effect on volume, the effect is a net loss of \$2.8 to \$4.4 million. The reason is that the increase in volume due to the merger is too small to have much effect on outcomes, while the price increase reduces welfare.

Huckman and Pisano (2006) examine the slightly different question of the relationship between volume and outcome for surgeons. Specifically, they ask whether it is a surgeon's volume at a particular hospital, or his/her overall volume that influences surgical outcomes. Examining cardiac bypass (CABG) cases in Pennsylvania in 1994 and 1995, they find that the mortality rate of a surgeon's patients at a specific hospital improves significantly with increases in his or her volume at that hospital but not with increases in his or her volume elsewhere. They do not specifically address the possibility of endogeneity of volume, although concerns over this may be allayed somewhat by the findings from Gowrisankaran et al. (2004) and Gaynor et al. (2005) that fail to reject exogeneity (although Ramanarayanan (2008), discussed below, rejects exogeneity in his study).

Ramanarayanan (2008) also attempts to identify physician specific volume–outcome effects for CABG surgery. Ramanarayanan's approach differs from Huckman and Pisano in that he uses an instrumental variables strategy for identification (Huckman and Pisano use lagged volume and lags of surgeon and hospital risk-adjusted mortality to try to address endogeneity concerns) and uses data from Florida for 1998–2006. The instrument is the departure of a surgeon—this departure has the impact of exogenously shifting volume to remaining physicians. Ramanarayanan finds that individual physician volume does have a significant impact on patient outcomes. Unlike Huckman and Pisano, he does find that surgeon experience is somewhat portable across hospitals. However, it is not fully portable—surgeon volume at the "home" hospital has a much bigger impact on outcomes than does volume at other hospitals. The results from these two papers (Ramanarayanan, 2008; Huckman and Pisano, 2006) provide a more nuanced view on the volume–outcome relationship. Physicians play an important role, but it is not simply the physician's volume that determines outcomes. There are hospital-specific aspects to the volume—outcome relationship, implying that concentrating procedures at a hospital can play a significant role in improved outcomes.

In a novel approach to try to identify learning effects, Huesch (2009) estimates the volume—outcome relationship for 57 "new cardiac surgeons" (physicians who had completed their residencies immediately before the beginning of the time period he examines). Huesch uses the same data covering the same time period as does Ramanarayanan. He finds no evidence of a volume—outcome relationship for these new cardiac surgeons. Indeed, allowing for forgetting, he finds that the effects of prior experience do not carry over from one quarter to the next. Huesch uses fixed effects and instrumental variables methods, although he does not reject exogeneity of volume for the new doctors he examines. This result stands in marked contrast to Huckman and Pisano and Ramanarayanan. One would expect that new physicians would be those doing the most learning. This is not supported by the results of this study. It is well known that learning by doing is difficult to identify empirically (see Thompson, 2010). Huesch and Sakakibara (2009) point out a number of possible mechanisms that could be driving observed empirical volume—outcome relationships, and suggest further thought on how to identify these specific mechanisms is in order.

4.5. Summary

The empirical literature on competition and quality in health care markets is for the most part fairly recent, and has grown very rapidly. The results from empirical research are not uniform. Most of the studies of Medicare patients show a positive impact of competition on quality. This is not surprising, since economic theory for markets with regulated prices predicts such a result. However, the results from studies of markets where prices are set by firms (e.g. privately insured patients) are much more variable. Some studies show increased competition leading to increased quality, and some show the opposite. While this may appear surprising, it is not. Economic theory predicts that quality may either increase or decrease with increased competition when firms are setting both quality and price.

This first generation of studies has provided a very valuable base of knowledge for further research. The base that has been constructed, while extremely useful, does not allow for normative analysis, for the most part. The results of these studies do not allow us to make inferences about whether their estimated results imply that competition increased or decreased social welfare.

These results also contain some useful lessons for research on competition and quality in other industries, specifically what can and cannot be learned via non-structural (SCP) econometric approaches, and what is required to obtain more refined results.

A major next step for research in this area is sorting out the factors that determine whether competition will lead to increased or decreased quality. Economic theory can be a helpful guide for these next generation studies. While theoretical models of price and quality determination are complex and usually yield indefinite predictions, there is also some simple intuition that can be gleaned from theory. Whether competition leads to increased or decreased quality will depend on its relative impacts on firms' price and quality elasticities of demand. Future research can focus on trying to recover estimates of these key elements. Additionally, studies of price regulated markets can refer back to theory to specify econometric models that include the regulated price and marginal cost (or its determinants). In general, the sorts of studies discussed above will allow for more precise positive analysis of the impact of competition on quality in health care, and provide opportunities for normative analysis as well.

We need more detailed models, however, in order to perform normative analysis. Thus, an important, although formidable, task for future work is to pursue the estimation of more complete econometric models of quality determination in health care markets. This means trying to recover preferences and costs (i.e. demand and supply). The benefit of this approach is the ability to make clearer inferences about welfare, since estimates of preference and cost parameters are in hand. The drawback is that such estimates are not easily obtained. In particular, they usually can only be obtained at the cost of making untestable assumptions. The quantity, and detail, of health care data may make some of the assumptions employed in settings with sparser data unnecessary, however. Augmenting modern bargaining models of price determination with quality choice may also be a fruitful approach to trying to identify the price and quality effects of competition where prices are market determined. In the previous section 4.3 we provided a preliminary sketch of what such a model might look like. Clearly more work remains to be done, but this may be a promising avenue for future research.

5. STUDIES OF HEALTH INSURANCE MARKETS

5.1. Introduction

While a great deal of effort in health economics has been devoted to studying health insurance, most research has been focused on consumer behavior, or on the implications of asymmetric information for selection and market outcomes (see Breyer et al., 2012, for coverage of these topics). Until recently there has been very little work on competition by health insurance firms. Part of the reason for this has been the paucity of sufficient data for given markets to construct measures of prices or market shares in the US and internationally. For the US, there are detailed household-level data (the Medical Expenditure Panel Survey, http://www.meps.ahrq.gov/mepsweb/) on health insurance decisions and prices, but these data are from surveys of approximately 4,000 households selected to be nationally representative. As a consequence, they do not fully describe the choices in a given market, or catalog the prices of alternatives, let alone the market shares of sellers. Other data (National Association of Insurance Commissioners, http://www.naic.org) do capture market shares, but at the level of a state. Since the vast majority of health insurance restricts enrollees' choices to a network of providers, most of whom are local, the geographic market for health insurance is local, and smaller than a state. In addition, there are no comprehensive data on health plans' networks of providers. The most comprehensive data on health insurance markets have been for private insurance associated with the Medicare program (Medigap coverage, Medicare + Choice/Medicare Advantage). Internationally, some countries have enacted reforms that have led to the creation or expansion of private health insurance markets (Germany, the Netherlands, Switzerland). Data from those markets have become available over the last few years.

Another reason has been the difficulty of specifying a coherent model of competition in this market due to its complexity. For the US, the majority of private health insurance is provided by employers to their workers as a (pre-tax) fringe benefit. Within this category, some employers self-insure, and contract with insurers only to administer their plans (including assembling a network of providers and negotiating terms with them). This is typical of large employers. Other employers do purchase the underwriting of risk from insurers, as well as administration. Of those that purchase actual insurance, small employers are faced with very different circumstances than large employers, mostly due to their smaller risk pool. Thinking about demand here is complicated. First, employers are faced with the task of somehow aggregating employees' preferences.[96] Employers want to retain and attract productive employees, and so have to offer competitive total compensation, including health insurance. Countries like Germany, the Netherlands, and Switzerland do not have this particular complicated institutional structure on the demand side, but have their own institutional idiosyncracies that also present a challenge to economic modeling. Second, the demand for a health insurance plan depends on its associated network of providers, as we noted previously (this tends to be true in every country). Competition among health plans is affected by their provider networks.

5.2. Empirical Studies

Empirical studies have taken a number of different forms. One group of studies have tried to study the impacts of competition on outcome variables. This includes

[96] Dafny et al. (2010) present evidence that employers' choices do not maximize employees' welfare, although they do not allow for effects of restricted choice on provider prices, and hence premiums. Also see Goldstein and Pauly (1976).

reduced-form studies, SCP studies, and studies of entry. Another set of studies have written down complete demand- and supply-side models of the health insurance market and proceeded with structural estimation. Yet another set of studies have estimated the elasticity of demand for an insurance plan (as opposed to aggregate demand for insurance). These studies are relevant to competition in insurance markets, since the elasticity faced by sellers plays a large role in competition. In what follows, we review these studies. We divide them into studies of competition and studies of demand elasticity.

5.2.1. Studies of the Impacts of Competition

Table 9.13 contains summaries of recent studies of health insurance market competition. This table is organized in a similar way to the previous tables summarizing empirical studies of hospital market competition.

Dafny (2010) is one of the first of some new studies on insurance market competition. Dafny uses data from a benefits consulting firm on the plans purchased and premiums paid by a large number (776) of large employers over the period 1998–2005. While these data are not necessarily complete by market or nationally representative, they do represent the most extensive and comprehensive data set with prices and quantities for the insurance market. Dafny's empirical approach is motivated by a bargaining model between insurers and employers.[97]

Her identification strategy is to examine the effect of shocks to employer profitability on the changes in the insurance premiums they pay. The idea is that if insurers possess no market power then the premiums they charge will not vary with employer profitability. Only if insurers have market power will they be able to price discriminate based on employer profitability.[98] Dafny finds strong evidence that premiums increase with the buyer's profitability. She also interacts profitability with the number of insurers in the market. As the number of firms increases, market power should decline. Her results are consistent with this hypothesis—the effect of employer profitability on insurance premiums falls with the number of firms in the market. This provides some evidence on competition in insurance markets where previously there was none.

Of course, like any other study, it is possible that other factors could be driving the results. In particular, premiums are not an ideal measure of the price of insurance. Premiums consist of expected medical expenses, plus the insurer's administrative costs, plus any markup due to market power. In essence, the premium is a measure of

[97] This is analogous to the bargaining model between insurers and hospitals that we presented in section 3.1. We did not specify a bargaining model between insurers and hospitals, although bargaining between these agents surely occurs. This emphasizes the complexity of the institutional structure of insurance markets and the difficult modeling choices researchers must confront.

[98] Dafny is thinking in terms of a bargaining, as opposed to posted price, model, but the basic intuition is the same.

Table 9.13 Insurance Market: Competition Empirical Studies

Study	Time Period	Geographic Area	Empirical Approach	Payers	Outcome Measure	Competition Measure	Effect of Competition
Dafny (2010)	1998–2005	US	Reduced form; insurer–employer bargaining	Private, large employers	Premiums	# of firms	Increase (↑)
Dafny et al. (2011b)	1998–2005	US	SCP	Private, large employers	Premium	HHI	Increase (↑)
Dranove et al. (2003)	1997	US	Entry model	Private HMOs	Population required to support another firm	# of HMOs	Increase (*population* ↑ ⇒ *profits* ↓)
Frank and Lamiraud (2009)	1997–2000	Switzerland	Health plan switching	Private health insurers	Effect of # of plans on probability of switching	# of plans	Decrease (*# of plans* ↑ ⇒ *switching* ↓)
Maestas et al. (2009)	2004	US	Price dispersion; consumer search	Medigap	Price dispersion; consumer search	NA	NA; ∃ price dispersion; substantial search costs
Bolhaar et al. (2010)	2005–2006	Netherlands	Price dispersion; search costs	Private health insurance	Price dispersion; search costs	NA	NA; ∃ price dispersion; education, youth, group contract (discount) → search ↑
Starc (2010)	2004–2008	US	Structural (demand, claims, costs: variable, fixed, sunk)	Medigap	Demand elasticity, welfare	Demand elasticity (−1.14), simulations	Increase welfare (*compensating variation net of profits* ↑ $230 per consumer)
Lustig (2010)	2000–2003	US	Structural (demand, costs; fixed, MC of generosity)	M + C	Demand elasticity welfare	# of firms	Increase (*# of firms* → *welfare gain from no adverse selection* ↑)
Town and Liu (2003)	1993–2000	US	Structural (demand, pricing equation-marginal costs)	M + C	Consumer surplus	# of firms	Increase (*# of firms* → *consumer surplus* ↑)

quantity of health insurance as well as the price. Expected medical expenditures are the quantity—they will vary with the generosity of the health insurance plan, the characteristics of the enrollees (sickness and preferences for medical care)—and provider prices. The part of the premium not due to medical expenses, the "load" or "load factor," is the price of insurance.

As Dafny realizes, the issue here is that if employers who experience positive profit shocks share some of the rents with employees via more generous insurance coverage then the observed relationship between employer profitability and health insurance premiums may be quantity increases as opposed to price. One of her purposes in estimating the specification with interactions between employer profitability and insurance market structure is to test for this possibility. The fact that this effect is larger in markets with fewer insurers suggests that it is not primarily due to increased plan generosity.[99] Dafny also includes a control for plan design to try to control for generosity. Including this variable does not alter the results. It is notable that there are significant effects of employer profitability in insurance premiums even for markets with 9–10 insurers (the effect is insignificant for markets with 10 or more insurers). It seems surprising that insurers would possess market power in markets with 8–9 rivals (9–10 firms total). This empirical result does raise some doubts, but research by Dranove et al. (2003) found patterns in 1997 suggesting there may be market power in HMO markets with up to six firms. In any event, Dafny is a contribution that opens a line of empirical research on competition in health insurance markets.

Dafny et al. (2011b) take a more traditional SCP approach to examining health insurance market competition. They employ the same dataset as in Dafny (2010), but examine how the growth rate of an employer's health insurance premiums is affected by health insurance market concentration (HHI). They include variables intended to control for factors that could influence medical spending or administrative costs (as opposed to markup): a demographic factor, plan design factor, and the number of enrollees in a plan. Initial OLS regressions reveal no significant effect of insurer market concentration on premium growth. Of course, the HHI may be endogenous. In order to deal with that problem Dafny et al. instrument for the observed HHI with changes in local market concentration due to a large merger in 1999 between two national health insurers: Aetna and Prudential Healthcare. Using this instrumental variables approach, they find a significant impact of the predicted change in HHI due to the merger on the change in premiums. They find that the cumulative effect of insurer market consolidation on premiums is approximately 7 percent.

Dafny et al. also recognize that insurers may have bargaining power (market power in a posted price world) with regard to providers. They therefore examine the effect

[99] More precisely, what Dafny finds is that the effect of increased profitability for an employer is to increase premiums in markets with few insurers by more than in markets with a large number of insurers, for the *same* employer.

of insurer concentration on changes in earnings and employment for physicians and for nurses as a way of testing for the presence of insurer monopsony power. They find that the merger reduced physician earnings growth on average by 3 percent, while nurses' earnings rose by approximately six-tenths of 1 percent. There is no significant effect on physician employment, while nurse employment grows as a result of the merger-induced increase in concentration. It's not clear if this is evidence of monopsony power, but it is consistent with plan concentration leading to downward pressure on physician earnings and ultimately to substitution of nurses for physicians. Overall, while the estimation results depend crucially on the use of the Aetna—Prudential merger as an instrumental variable, they show evidence of a significant relationship between changes in insurer market concentration and changes in premiums, implying a link between market structure and the exercise of market power.

Dranove et al. (2003) employ a modification of the methodologies of Brenahan and Reiss (1991) devised by Mazzeo (2002) to examine competition among HMOs. They use data from 1997 on the number of HMOs in local markets, distinguishing between HMOs that are national and those that are not. They first estimate threshold ratios (the ratio of the population necessary to support $n + 1$ firms to that necessary to support n) for all HMOs together. They find somewhat puzzling results: the threshold ratio for two firms is 0.93 and for three firms is 1.58 (it declines thereafter). A threshold ratio of 1 indicates that it takes exactly the same population (demand) to support the second firm as to support the first. In the Brenahan and Reiss framework this implies that there is no change in profitability with the entry of the second firm, i.e. there's no increase in competition in duopoly HMO markets compared to monopoly. The threshold ratio above 1 for the third firm indicates that it takes substantially more population (per firm) to support three HMOs than two, implying that profit margins must be falling with the entry of the third firm (but not the second).

Dranove et al. speculate that this seemingly strange pattern in the threshold ratios may be due to product differentiation. If local HMOs do not compete strongly with national HMOs (national employers may strongly prefer to buy from national HMOs and local employers from local HMOs), then the estimates produced by pooling them together could be misleading. Dranove et al. then employ the framework of Mazzeo (2002), allowing for the possibility of any combination of any number of firms (up to five) of each type. The parameter estimates indicate that the profits of local HMOs are virtually unaffected by the number of national HMOs, and vice versa. By contrast, the presence of a second same-type HMO reduces profits by approximately one-half. The effects of subsequent same-type competitors on profits are negative, but declining in magnitude. These results indicate that there is substantial competition in HMO markets, but also substantial product differentiation. Dranove et al.'s results indicate that there is virtually no competition at all between national and local HMOs.

The studies by Dafny (2010), Dafny et al. (2011b), and Dranove et al. (2003) find evidence that market structure affects conduct—more firms in a market are associated with tougher competition. Some other studies call that relationship into question.

Frank and Lamiraud (2009) examine the functioning of health insurance markets in Switzerland. Switzerland requires all residents to have health insurance. Health insurance is privately supplied, but the market is heavily regulated. The government defines a standardized benefit for the required coverage, mandates guaranteed issue by insurers, adjusts the payments insurers receive to compensate them for risk,[100] and provides public information on prices. Frank and Lamiraud document a high degree of price dispersion in Swiss health insurance markets, with little evidence of convergence over time. The number of health insurers has declined over time, but the mean number of health plans per canton rose from 40 in 1997 to 56 in 2004. Switching rates across plans were low: 4.8 percent in 1997, 2.1 percent in 2000, then stabilizing at around 3 percent.

Frank and Lamiraud find this puzzling, given the rather large price differences across plans with identical benefits. They speculate that the presence of a large number of choices may lead to decision overload. They make use of survey data on individuals and publicly reported information on health insurance plans to estimate a model of individual health plan switching and attempt to test these hypotheses. They find that switching is significantly larger in areas with fewer plans, and that those who switched paid significantly less than those staying with the same plan (15.9 percent less; 33.18 CHF). These results do not seem consistent with price competition getting tougher with the number of firms. Now, to be clear, the studies by Dafny, Dafny et al., and Dranove et al. are on the large employer segment of the US private health insurance market. There, purchasing decisions are made by large corporations, so one would presume that these decisions are likely to be rational. The Frank and Lamiraud study examines the decisions of individual consumers in Switzerland. The most important difference is that individuals are making decisions, not large employers. Individuals are more likely to be affected by transactions costs or irrationality than are large corporations. Of course, the institutions in the Swiss individual health insurance market and the US large employer market are also quite different, but it seems to us that the most likely reason for the different patterns observed in these studies is due to the differences between decision making for individuals vs. that for large employers.

Similar patterns with regard to price dispersion have been documented in the US market for Medigap insurance and in the Netherlands health insurance market. Medigap is private insurance purchased by Medicare beneficiaries to cover the "gaps" in the Medicare coverage provided by the government. The insurance covers coinsurance

[100] Payments are adjusted up or down based on the expected medical expenses of the insurer's enrollee pool.

payments, deductibles, and those items or services that are excluded from the publicly provided coverage (most notably prescription drugs before the introduction of Medicare Part D).

Maestas et al. (2009) document substantial price variation in Medigap insurance markets, even though plans are standardized.[101] They apply the search model of Carlson and McAfee (1983) and find that insurers have substantial differences in costs, and hence loading fees, which contribute to the observed variation in prices. This price dispersion is an equilibrium due to substantial search costs—Maestas et al. estimate an average search cost for consumers in the market of $72 and a maximum of $144.

Bolhaar et al. (2010) also find substantial price dispersion in the Netherlands market for health insurance. This market is also subject to substantial regulation, including policy standardization and the dissemination of information to consumers, so the existence of price dispersion is somewhat surprising. They employ a unique dataset, the Dutch Health Care Consumer Panel, which contains information on actual consumer search behavior. They find that more educated consumers and younger consumers are more likely to search. In the Dutch system, there are also group contracts (e.g. an employment group). These are offered at a discount. They find a very strong correlation between an offer for a group contract and the probability of search.

Starc (2010) models the Medigap market, allowing for adverse selection and market power. She documents that the market is highly concentrated—the national four-firm concentration ratio is 83 percent (compared to 44 percent for private passenger automobile insurance or 34 percent for life insurance), and two firms (United Health, 46 percent; Mutual of Omaha, 24 percent) account for almost all of that. Starc documents substantial price dispersion for Medigap policies, confirming Maestas et al., and documents a positive relationship between premiums and market concentration, the same qualitative result as in Dafny et al. (2011b), albeit for a very different market. A 1 percent increase in the two-firm concentration ratio is associated with a 0.26 percent increase in premiums.

Starc estimates a structural model of insurance demand, claims, and seller costs (variable, fixed, sunk) using data from the National Association of Insurance Commissioners (NAIC) and the Medicare Current Beneficiary Survey for 2006–2008. She estimates the average price elasticity of demand to be −1.12. This is a very low elasticity for firm demand, especially given the standardization of the products sold in this market. It is possible this is due to aggregation—the NAIC data are at the level of the state and the true geographic market is likely much smaller than that. It is also possible that the instruments are weak and that is what is driving the seemingly low estimate. The

[101] Studies of quite a few other markets have found substantial price dispersion, even in what one might think are competitive markets (e.g. Pratt et al., 1979; Dahlby and West, 1986; Gaynor and Polachek, 1994; Sorensen, 2000).

estimate of the claim function (estimated jointly with demand) reveals that insurer claims increase with premiums—a $100 increase in premiums will lead to a $15 increase in claims. This indicates the presence of adverse selection—higher risk consumers are less price sensitive. In the case of adverse selection, claims are increasing in the premium charged by the insurer. As a consequence, insurers facing adverse selection will charge lower markups of premiums over marginal costs than they otherwise would. This is a classic case of the second best—two distortions are better than one. The monopoly power of insurers is actually reduced by the "additional" distortion of adverse selection.

Starc also recovers estimates of cost parameters. For variable costs this is done in the usual manner, via a pricing equation and an assumption about conduct, but with the following wrinkle to account for an institutional feature of health insurance markets. Health insurers are subject to minimum loss ratio regulations by the federal government—65 percent of premiums collected are required to be paid out to enrollees as reimbursements for covered services. Starc incorporates this into estimation as an inequality constraint on pricing (premium setting). She estimates that United Health's variable (administrative) costs are about 6 percent of premiums, while they are estimated to be 18 percent of premiums for Mutual of Omaha.

Estimates of bounds on fixed or sunk costs can be recovered from the data. This employs the following intuition. First, assume that Mutual of Omaha faces fixed costs of entering each local market (a state). United Health, by contrast, expends resources on promotion (e.g. obtaining AARP's endorsement) entering the national market. These are sunk costs. Second, we observe, for example, one firm employing Mutual of Omaha's strategy. This implies that Mutual of Omaha is profitable, and a second firm employing that strategy would not be profitable. Therefore the lower bound for Mutual's fixed costs are the expected variable profits for a second firm employing their strategy, and the upper bound is the expectation of variable profits. The same exercise is performed to identify the bounds on the sunk costs of entering the national market. The bounds on Mutual of Omaha's fixed costs of entering a state are estimated at approximately $445,000 and $796,000, implying fixed costs of entering all of the 50 state markets between $22 and $40 million. The bounds on United Health's sunk costs of entering the national market are approximately $99 million and $488 million. The standard errors on these estimates are very large.

With these estimates in hand, Starc proceeds to welfare analysis. First, the impact of adverse selection in insurers' pricing is computed by setting the derivative of claims with respect to price to zero and then finding optimal prices.[102] This increases premiums by 9 percent and reduces the size of the market (lowers insurance coverage) by

[102] Recall that adverse selection is manifested as a positive impact of premiums on claims. This positive relationship reduces the profit-maximizing price for insurers, since setting a higher price attracts enrollees who are higher risk and more expensive.

18 percent. Welfare falls by 7 percent. This is interesting, because in this situation where there is market power, welfare is improved by the presence of adverse selection. This is entirely the opposite of the impact of adverse selection in a competitive insurance market. Starc goes on to calculate the impact of setting premiums equal to average and to marginal claims. These lead to large reductions in prices—44 and 45 percent, respectively. The median compensating variation to consumers is $644 ($670), and falls to $230 ($230) net of reduced producer profits.

These results emphasize the substantial market power exercised in this market. It points out that insurance subsidies or mandates will mostly result in increased rents to sellers, with little impact on welfare. Starc interprets the low demand elasticity and associated high degree of market power as due to strong brand loyalty. The strong brand loyalty provides sellers with a strong incentive to engage in extensive marketing and promotion activities. Policies to reduce brand effects, such as providing better consumer information, or attracting entry, can substantially enhance welfare.

Another paper that models both adverse selection and market power in insurance markets is Lustig (2010). Lustig examines the market for Medicare + Choice plans in 2000−2003. Medicare + Choice are private managed care plans that Medicare beneficiaries may choose as an alternative to traditional Medicare (the current version of this program is called Medicare Advantage). Lustig has a clever idea to identify adverse selection. Consumers' preferences for plan generosity should increase plans' costs if there's adverse selection. He recovers preferences from demand estimation, then estimates plans' cost function to test for adverse selection. He finds that generosity preferences have a significant impact on plan fixed costs, but not the marginal cost of plan generosity. Further, consumers' health risk has no significant impact on insurers' costs. This is a very clever test, and the results are interesting, but they do not seem very supportive of adverse selection. It seems like generosity preferences should affect insurers' marginal costs of generosity, as should consumers' health risks. Lustig then goes on to do welfare analysis. In particular, he uses the model estimates to simulate welfare when adverse selection is eliminated, then compares this to welfare measured at the allocation observed in the data. This gain from eliminating adverse selection is simulated for markets with increasing numbers of insurers (1,2,. . . ,6, > 6) to generate effects of competition. Lustig finds that the gains to eliminating adverse selection increase monotonically in the number of insurance firms. For example, in one of his simulations Lustig finds that removing adverse selection eliminates 17 percent of the difference in welfare between the observed and socially optimal outcomes where there's a monopoly, while it eliminates 35 percent of the difference in a duopoly, and 50 percent where there are six or more firms. This implies that when there is market power most of the welfare loss is due to the exercise of market power as opposed to adverse selection.

An earlier paper by Town and Liu (2003) focuses on estimating the welfare associated with Medicare + Choice, and conducts an analysis of the impact of competition on welfare. Their model does not allow for adverse selection. They find that the creation of the M + C program resulted in approximately $15.6 billion in consumer surplus and $52 billion in profits from 1993 to 2000 (in 2000 dollars). They find evidence of competitive effects. Consumer surplus increases in the number of plans in a county, and most of the increase in welfare is due to increased premium competition. Comparing monopoly markets versus markets with four firms, they find that 81 percent of the difference in welfare (higher in quadropoly markets) is due to increased premium competition. Of the remainder, 3 percent is from increased product variety and 8 percent from prescription drug coverage.

As stated previously, most of the literature on health insurance markets has focused on market imperfections due to asymmetric information (Breyer et al., 2012). The smaller and newer literature on market power in health insurance markets, which we have just been describing, abstracts away from issues of asymmetric information. The papers by Starc and Lustig represent significant innovations by modeling a health insurance market with adverse selection and market power. While the models differ, and are applied to different markets (Medigap, Medicare Advantage), both sets of results point to market power as the major source of welfare loss in this market, as opposed to adverse selection. We should also note that the studies by Starc (2010) and Lustig (2010) are not necessarily inconsistent with the studies by Dafny (2010), Dafny et al. (2011b), and Dranove et al. (2003). Both sets of studies point to the existence of market power in health insurance, and market power decreasing in the number of firms. It is also worth noting that these structural studies of health insurance markets find much larger estimates of demand responsiveness than have studies that estimate demand using insurance choices by employees within a single firm. Those studies find evidence of substantial switching costs (Handel, 2010) or large (and persistent) plan preference heterogeneity (Carlin and Town, 2009) that are associated with low estimates of demand elasticity.

5.2.2. Studies of the Elasticity of Demand for Health Insurance

There have been many studies of the elasticity of demand for health insurance. We do not attempt a complete review here. Our purpose is instead to report a few estimates as a means of providing insight into the potential for competition in the health insurance market. If the elasticity of demand facing a firm is low, then there is not much potential for market power.[103] Most of the US evidence comes from studies of employee choice among plans within firms. The Carlin and Town and Handel studies

[103] A traditional measure of market power, the Lerner Index, which measures the ratio of the price−marginal cost markup to price, is equal to the absolute value of the inverse of the firm's own-price elasticity of demand.

are recent examples of that. Prior work estimating demand elasticities using employee choice among plans at a single employer found substantially larger demand responsiveness than the more recent studies (e.g. Cutler and Reber (1998), −0.3 to −0.6; Royalty and Solomon (1999), −1 to −3.5; Strombom et al. (2002), −0.84 to −6.59). Unfortunately these estimates are from choices within a firm. We do not really know how much they tell us about the market. If they are informative they indicate that firms do face demand for insurance products with some elasticity, but not much. Even an elasticity of −6.59 implies that 15 percent of the price is markup (Lerner Index = 0.15), which is a substantial amount of market power.

Table 9.14 summarizes some relevant studies. There are some older studies of insurance choice in markets. Dowd and Feldman (1994) examine the health plan choices of five employers located in Minneapolis–St. Paul. They estimate a firm demand elasticity of −7.9. Atherly et al. (2004) estimate the choices of Medicare beneficiaries among Medicare + Choice plans. They estimate a firm demand elasticity of −4.57. As we noted previously, even a firm demand elasticity of (∼) −8 implies a substantial markup (12.5 percent).

A number of recent studies estimate the elasticity of demand using choice among health insurance plans in the Netherlands and in Germany. The Netherlands mandates that all individuals purchase health insurance, which is sold by private firms. As in Switzerland, benefits are standardized (although there is supplemental coverage available) and there is guaranteed issue. Insurers set their own community-rated premiums. The specifics of the German system differ from that of the Netherlands, but the key factor is that individuals have choice across insurers (referred to as sickness funds), and the amount that they pay differs. Van Dijk et al. (2008) use administrative data from

Table 9.14 Insurance Market: Firm Demand Elasticity Empirical Studies

Study	Time Period	Geographic Area	Payers	Estimates
Dowd and Feldman (1994)	1988–1993	US (Minneapolis, St. Paul)	Private insurers	−7.9
Atherly et al. (2004)	1998	US	M + C	−4.57
van Dijk et al. (2008)	1993–2002	Netherlands	Private Insurers	−0.10 to −0.38
Schut et al. (2003)	1997–2000 (Germany), 1998–2000 (Netherlands)	Germany, Netherlands	Private insurers	−3.45 (Germany), −0.41 (Netherlands)
Tamm et al. (2007)	2001–2004	Germany	Private insurers	−0.45 (short run), −12 (long run)

the Netherlands, and estimate the price elasticity of residual demand facing an insurance firm as ranging from −0.10 (for women aged 55−64) to −0.38 (for men aged 25−34). These are very low firm elasticities, which seems to imply little potential for competition in the Dutch health insurance market. Since no profit-maximizing firm should operate in the inelastic portion of their demand curve, these numbers seem too low to represent actual residual demand elasticities. Unfortunately van Dijk et al. only have one year of actual data—they construct a synthetic panel from the actual data, given institutional facts about the market. This may have something to do with the low estimates of elasticities.

Schut et al. (2003) estimate demand elasticities for the Netherlands and for Germany. They estimate the firm elasticity of demand for Germany to be −3.45 (in 1997−2000). The Dutch elasticity is estimated at most to be −0.41 (1998−2000). Again, this seems implausible as a firm elasticity of demand. Tamm et al. (2007) use panel data from Germany over the period 2001−2004 and find a short-run price elasticity of approximately −0.5. The long-run elasticity is approximately −12.

Overall, the results that find estimated firm demand elasticities below (minus) 1 are hard to understand. Those that are greater than 1 in absolute value are what one would expect. Nonetheless, those numbers, like the earlier estimates from the US, taken at face value, indicate the presence of substantial market power on the part of insurers in the German health insurance market.

5.3. Summary

There has not been much empirical research on competition in health insurance markets until very recently, as the dates of most of the studies reviewed in this section demonstrate. Most of the studies find evidence that competition leads to lower prices. In the US, the papers by Dafny and Starc present evidence that the markets for large employer insurance and for Medigap are highly concentrated, leading to higher prices. The studies by Frank and Lamiraud, Maestas et al., and Bolhaar et al. document substantial price dispersion and search costs. The Frank and Lamiraud study suggests that consumers may be subject to psychological biases that undermine the market mechanism. There are not many studies of the elasticity of demand faced by insurance firms for their products in the market. Those that exist for the US and Germany do find fairly substantial elasticities of demand, although it should be noted that even those estimates imply that insurers possess substantial market power. The demand elasticity estimates for the Netherlands are all below −1. Since firms should not be operating on the inelastic portions of their demand curves this presents a bit of a puzzle. Further work is required to understand what is driving these estimates. If it truly is consumer behavior, then more work has to be done understanding the demand side of this market.

Overall, the studies reviewed in this section represent substantial additions to knowledge. Further research is required on both the demand and supply sides of this market. The Netherlands insurance market and the market for private health insurance in the US present opportunities for employing careful economic modeling to advance our understanding of this complicated market. In addition, at present there are no studies of competition in the US (private) markets for small group or individual insurance (we presume due to data limitations). Those are the markets most frequently referred to as functioning poorly. Understanding how well these markets function, and the role played by competition, is an important task for economic research.

6. STUDIES OF PHYSICIAN SERVICES MARKETS

6.1. Introduction

Over the years a great deal of attention has been paid by health economists to issues regarding physicians. The majority of that work has focused on the role of asymmetric information. A great deal of that has been about the impact of asymmetric information on the market relationships between patients and physicians, i.e. physician-induced demand. Another component has been focused on incentives and payment mechanisms for physicians. Relatively little, however, has focused on competition *per se*. One of the reasons for that, perhaps, is the fact that the majority of physician services markets have large numbers of sellers and entry into a (local) market is relatively easy. It seems reasonable to characterize most markets for physician services as monopolistically competitive, and a relatively mild form of monopolistic competition at that.

There are some reasons, however, to think that the monopolistic competition model may be an accurate depiction of these markets no longer. Insurers no longer allow their enrollees to see any physician they like. Physicians must be members of the insurer's network. This implies that entry into a market requires entry into an insurer's provider network (at least one). This may be a more substantial cost associated with entry than existed previously. Separately, the nature of competition also depends on the product markets. Markets for more specialized services have fewer sellers. The costs of entry into a specific local market may be higher due to the need for access to specialized labor and facilities. In any event, the extent of competition in the aggregate is limited by the total stock of physicians who can supply these specialized services. Given the limited entry of new physicians into the specialties that supply these services there is only so much competition possible.

In addition, geographic markets may be fairly limited. They are almost certainly smaller than an entire metropolitan area. As a consequence, buyers who wish to have physician practices in their network in locations convenient for their enrollees may be facing fewer sellers than it might appear. An additional factor is the possibility of monopsony power in physician services markets. Insurance companies are large relative to physician practices. It may appear that insurers may be able to exercise monopsony power as buyers. The monopolistic competition model does not admit that possibility and thus is not useful for considering this issue. A posted price model of monopsony (or more accurately oligopsony) is an alternative, but does not really capture the true nature of buyer and seller interchange in this market.

There is some recent theoretical work which considers the impact of competition among physicians in an asymmetric information setting. Allard et al. (2009) examine physicians' provision of care under information asymmetry in a dynamic game. Without repetition all physicians provide minimum effort. With repetition, competition can serve to discipline physicians—it is even possible the physicians will supply optimal effort. Introducing patient switching costs reduces the effect of competition, but it still serves to set a lower bound on physician effort. Competition serves a socially useful role in disciplining shirking by physicians in the face of asymmetric information.

Dulleck and Kerschbamer (2009) analyze the case where there is a competitive market with experts and discounters supplying consumers. Experts can diagnose and treat problems, while discounters can only offer a treatment (without performing diagnosis). They show that in a competitive market experts may refrain from diagnosis to prevent consumers from obtaining a lower price for treatment from a discounter. In this setting, competition does not enhance welfare.

The bargaining model we describe in section 3.1 could also be applied to physicians, although it does not include asymmetric information. It admits market power on either side of the market through the bargaining abilities and threat points of the buyers and sellers. However, at present data limitations (at least for the US) preclude the estimation of such a model. Indeed, the empirical literature on physician competition is quite sparse. This is undoubtedly mostly due to lack of data with which to test hypotheses about competition. It may also be that health economists' attention has been drawn elsewhere. There is no doubt that there are interesting and important issues to address in this area.

6.2. Empirical Studies of Physician Services Markets

In what follows, we review the empirical literature on competition in physician services markets. We focus mostly on research that has been published (or at least written) since the previous volume of this Handbook came out. The papers are divided into two areas: entry and market structure, and studies of pricing conduct. Table 9.15 contains summary information on these studies.

Table 9.15 Physician Services Market: Competition Empirical Studies

Study	Time Period	Geographic Area	Empirical Approach	Payers	Outcome Measure	Competition Measure	Effect of Competition
Newhouse et al. (1982)	1970, 1979	US; 23 states	Reduced form	All	Physician location	Total # of physicians	Increase # MDs(↑) → *Prob. MD in small community* ↑
Rosenthal et al. (2005)	1979, 1999	US; 23 states	Reduced form	All	Physician location	Total # of physicians	Increase # *MDs*(↑) → *Prob. MD in small community* ↑
Isabel and Paula (2010)	1996, 2007	Portugal	Reduced form	All	Physician location	Total # of physicians	Increase # *MDs*(↑) → *Prob. MD in small community* ↑
Brown (1993)	1990	Alberta, Canada	Reduced form	All	Physician location	Total # of physicians	Increase # *MDs*(↑) → *Prob. MD in small community* ↑
Dionne et al. (1987)	1977	Quebec, Canada	Reduced form	All	Physician location	Total # of physicians	Increase # *MDs*(↑) → *Prob. MD in small community* ↑
Schaumans and Verboven (2008)	2001	Belgium	Entry model; simulation	All	Population required to support another firm	# of physicians, pharmacies	Increase (simulation) *Pharmacy free entry* → *welfare* ↑
Gunning and Sickles (2007)	1998	US	Structural (demand, pricing equation, marginal costs, conduct parameter)	Private insurers	Price—cost margin	Conduct parameter	Reject perfect competition; do not reject Cournot

Wong (1996)	1991	US	Reduced form	Private insurers	Price—cost margin	Panzar—Rosse test statistic	Reject monopoly, perfect competition; do not reject monopolistic competition
Bradford and Martin (2000)	1986	US	Reduced form (demand, pricing, incentives, # of partners)	Private insurers	Price, incentives, # of partners	Physican density	Increase physician density → price ↓, incentives ↑, # *of partners* ↓
Schneider et al. (2008a)	2002	California	SCP	Private insurers	Price	Physician HHI, insurance HHI	Physician HHI: increase (↑); insurer HHI: no effect
Eisenberg (2011)	1996, 1998, 2000, 2004, 2008	US	Reduced form	Medicare	Physician participation	NA	Inelastic physician supply response to Medicare price ⇒ monopsony power

6.2.1. Studies of Entry and Market Structure

Location theory implies that there will be a minimum population necessary for a given area to support a physician of a particular specialty. The smaller the total number of physicians in a given specialty, the greater the critical value of population. If the total number of physicians expands, the minimum population necessary to support a physician will fall. This was first exposited and tested by Newhouse et al. (1982), who found that the size of a town affects the probability of having a physician located there. They also make use of the fact that the number of specialists in the US increased dramatically over the decade of the 1970s. The theory predicts that towns that did not previously have a specialist would gain them at a greater rate than those that did. They find that this is so.

Rosenthal et al. (2005) revisit this hypothesis using data from the 1980s and 1990s. They examine 23 states with low physician to population ratios. The total number of physicians in these states doubles from 1970 to 1999. They find that communities of all sizes gained physicians over this period, but that the impact was larger for smaller communities, as predicted by the theory.

A recent paper by Isabel and Paula (2010) examines some of these issues using data for Portugal from 1996 and 2007. The total number of physicians in Portugal grew by approximately 30 percent over that period and the number per capita grew by approximately 22 percent. They estimate a static model using 2007 data and find that population size has a large and significant impact on the number of physicians per capita located in an area. They also test a dynamic model and find that areas that had more physicians per capita in 1996 had lower growth in the number of physicians per capita. This is consistent with the hypothesis of Newhouse et al. Brown (1993) finds confirmation of the hypothesis for the Canadian province of Alberta, although the evidence is not overwhelming. A study by Dionne et al. (1987) also found this to be true for the province of Québec, Canada.[104] The results of these studies are consistent with competitive effects from entry.

A recent paper by Schaumans and Verboven (2008) examines the determinants of entry in physician services markets in Belgium. They consider the entry decisions of pharmacies as well. Pharmacies and physician practices provide complementary services—physicians prescribe drugs and pharmacists dispense them. As a consequence, each type of firm benefits from the presence of the other. Both prescription drug prices and physician services prices are heavily regulated in Belgium. Therefore, both pharmacies and physician practices only engage in non-price competition (convenience, quality of service, quality of care, etc.). The entry of physicians into local

[104] Dionne et al. have the innovation of controlling for the number of good restaurants in a community. They find this to influence physician location. It remains an open question if Québécois physicians are uniquely responsive to restaurant quality—alas, no such data have been employed by researchers in other countries (or other parts of Canada).

markets is free, but pharmacy entry is regulated—there is a maximum number of pharmacies allowed in an area based on the local population. Schaumans and Verboven adapt the models of Brenahan and Reiss (1991) and Mazzeo (2002) to allow for entry restrictions for pharmacies and that products sold by the two types of firms (pharmacies and physicians) may be strategic complements.[105] As in the Brenahan and Reiss and Mazzeo work, this is a static game and the outcomes in terms of market structure (numbers of firms of both types), as opposed to firm identities, is what is modeled. They find that the population necessary to support a given number of firms increases approximately proportionately with the number of firms. As in Brenahan and Reiss, this implies that entry does not lead to tougher competition. As mentioned previously, price competition is not feasible for physicians' practices or pharmacies in Belgium. These results imply that they do not engage in more intense price competition as more firms of their own type enter a market. They also find that the population necessary to support another physician practice falls with the number of pharmacies, and vice versa. This supports the hypothesis of strategic complementarities.

Schaumans and Verboven then use the parameter estimates from the model to simulate the impacts of policy reform toward pharmacies. They consider easing entry restrictions by increasing the maximum number of pharmacies allowed in an area, and reducing pharmacies' regulated markups. They find that simply allowing free entry (no change in markups) would increase the number of pharmacies by 173 percent. The complementarities between pharmacies and physician practices lead to a 7 percent increase in the number of physician practices as a result of the entry liberalization for pharmacies. If pharmacy markups are reduced to 50 percent of their original levels then with free entry the number of pharmacies increases by 44 percent and the number of physician practices increases by six-tenths of 1 percent. Not surprisingly, a drop in markups decreases the magnitude of entry, but it is still extensive. The results of Schaumans and Verboven do not indicate conduct changing with the number of firms, but this is a very heavily regulated environment, so it is unlikely the results are very general except for other countries with similar regulatory environments.

6.2.2. *Studies of Pricing Conduct*

Gunning and Sickles (2007) estimate a structural model of pricing conduct by physician practices. They employ the framework described in Bresnahan (1989) to estimate the conduct parameter θ in the following pricing equation (for quantity setters):[106]

[105] Brenahan and Reiss (1991) test whether conduct changes with the number of firms in the market for doctors, dentists, plumbers, and tire dealers located in isolated markets (mostly rural) in the US. They find evidence that competition among doctors gets tougher with the number of practices in a market, up until the third. After three practices there is no further increase in the toughness of competition.

[106] Bresnahan's framework covers quantity or price setting. He refers to equation (9.37) as a "supply relation."

$$p_j = \frac{\partial c}{\partial q_j} - q_j \left[\frac{\partial q_j}{\partial p_j}\right]^{-1} \theta \tag{9.37}$$

The conduct parameter, θ, is a parameter to be estimated, along with demand and costs. The value of θ provides information about the toughness of competition. A value of θ equal to zero implies perfect competition (no markup). The farther that θ is from zero, the farther is conduct from competitive. Gunning and Sickles use data from the 1998 American Medical Association Socioeconomic Monitoring Survey (AMASMS) to estimate this model. They estimate average firm price elasticities of −1.75 to −2.35. Taken alone, these imply substantial market power and substantial markups. Their overall estimate of the conduct parameter is −1.34.

They strongly reject the null hypothesis of perfect competition, but cannot reject the hypothesis of Cournot conduct ($\theta = 1$). For generalist physicians the estimate of θ is −1.87, and the hypotheses of perfect competition and Cournot conduct are both rejected. While this is a worthy exercise, the results are surprising. An estimate of a negative value of θ implies that physician practices are pricing *below* marginal cost. This seems implausible, especially if one takes the elasticity estimates as valid. Those estimates indicate that physician practices have substantial power to mark up price over marginal cost, but the conduct parameter indicates that they do the opposite.

Identification of the conduct parameter requires a "demand rotator" (Bresnahan, 1989). Suppose an exogenous variable rotates the demand curve around the equilibrium point. If the market is perfectly competitive, there is no change in price (or quantity). If the market is imperfectly competitive there will be a change. It is not clear what sort of exogenous variation Gunning and Sickles have to rotate the demand curve. In addition, they estimate the cost function as part of the model. This is an heroic attempt. It is not clear how to measure the most important cost of a physician practice—physician opportunity cost. Since θ is estimated from the pricing equation, bias in the estimation of cost will be transmitted to the estimate of θ if cost is estimated jointly with (9.37). As a consequence, it is possible that difficulties in consistently estimating the parameters of the cost function may be a source of bias for estimating the conduct parameter.

An older paper by Wong (1996) uses a test devised by Panzar and Rosse (1987) for testing hypotheses about market structure. The Panzar–Rosse test statistic is

$$\phi^* \equiv \sum_i \frac{w_i}{R^*}\left(\frac{\partial R^*}{\partial w_i}\right) \tag{9.38}$$

where w_i represents the price of factor i and R^* is the firm's reduced form revenue function, which is a function of exogenous demand and cost shifters. The test statistic, ϕ^*, is the elasticity of equilibrium firm revenue with regard to factor prices. In the case of monopoly, the test statistic must be negative. If all factor prices increase, then marginal costs increase. The firm will then optimally choose a lower quantity and a higher price. Since a monopolist always operates on the elastic portion of their demand curve, revenues will fall. If the market is perfectly competitive, Panzar and Rosse argue that the value of the test statistic is 1. If factor prices increase, then the long-run cost curves will increase, but the quantity at which long-run average cost reaches a minimum is unchanged. As a consequence, price will increase by 1 percent, but quantity will remain unchanged, hence the value taken by ϕ^* will be 1. The derivation of the test statistic under monopolistic competition implies that ϕ^* will be less than or equal to 1 if the market is monopolistically competitive.

Wong uses data from the AMASMS in 1991 to estimate the test statistic. He estimates values of ϕ^* of 0.83 for primary care, 0.76 for general and family practice, 0.94 for internal medicine, and 0.85 for surgery. All of these estimates are significantly different from zero. The test statistics for primary care, general and family practice, and surgery are all significantly different from 1. Therefore he rejects the hypotheses of monopoly and of perfect competition (except for internal medicine). The results are consistent with monopolistic competition.

Bradford and Martin (2000) specify and model physician partnerships, then derive and estimate the reduced forms. In their model the partnership's choice of internal incentive system (profit sharing) depends on whether the firm is demand constrained. When the partnership is demand constrained, it is optimal to employ strong incentives to motivate physicians to exert more effort which will bring in business. This means unequal profit sharing, i.e. profit shares based on individuals' productivities. When the firm is not demand constrained the opposite is true. This also applies to the number of physician partners in a practice. More partners leads to weaker incentives and free riding, so their theory predicts smaller partnerships in the presence of a demand constraint. They use data from the Physician Practice Cost and Income Survey for 1986 to test their hypotheses.

They do find evidence consistent with their theory. In addition, the firm chooses the number of partners and the price they charge for their services. They find that profit sharing, partnership size, and price all respond to the number of physicians per capita in the market. Physician partnerships are significantly less likely to choose equal profit sharing the more potential competition they face in a market due to more physicians per capita being present. These firms also choose smaller size in response to more physicians per capita. Physician practices in markets where there are more rivals (physicians per capita) also set lower prices. Bradford and Martin also estimate a practice demand curve. They find that demand is responsive to the amount of physician time per visit in the practice, which they interpret as quality. The parameter estimate implies that a physician spending 3 more minutes per visit (at 10 percent increase) will lead to 9.1 more weekly visits to the practice. They also find that price decreases quantity demanded from the firm, although the implied elasticity (-0.49) is less than 1. Overall, the results of this study are consistent with physician firms' conduct becoming more competitive in response to market structure.

Schneider et al. (2008a) estimate an SCP-type model similar to what Shen et al. (2010) and Moriya et al. (2010) do for the hospital industry. They examine the impact of HHIs for physician organizations and for insurers in California on physician prices. While these models are ad hoc, one can think of them as attempting to capture the impacts of relative bargaining power on price, using buyer and seller HHIs as proxies for bargaining power. They find that physician market concentration is associated with significantly higher prices. A 1 percent increase in the physician HHI leads to 1–4 percent higher physician prices. Conversely, the health insurer HHI has no statistically significant impact on physician prices.

These results stand in sharp contrast to the findings of Shen et al. and Moriya et al., who find significant impacts of insurer concentration on price (negative). Schneider et al. stands out—there are very few studies that look at price competition in physician markets. The results have to be interpreted with some caution, however. As noted elsewhere in this chapter, SCP studies are vulnerable to problems associated with endogeneity of the HHI. The usual practice is to find some means to address this, commonly through the use of instruments of fixed effects. This issue is not addressed by Schneider et al., so some caution must be applied before making causal inference from the results of this study.

Eisenberg (2011) is a recent paper that examines monopsony power in the physician services market. Eisenberg examines whether the US Medicare program has monopsony power. He uses nationally representative data on physicians in selected markets[107] for selected years from 1996 to 2008, along with data on Medicare physician reimbursement. The idea is that Medicare physician payment rates are set administratively and should be exogenous to physician decisions.[108] Therefore variation in payment rates should trace out the physician supply curve to Medicare. One difficulty is that physicians in the US sell both to Medicare and to private insurers. If unobserved variation in the private market is correlated with Medicare payments then it will not be possible to estimate an unbiased causal effect of Medicare payment on physician supply. Unfortunately private insurance prices are not observable in the data. Eisenberg takes two approaches to deal with this problem. First, he includes a number of characteristics of local markets that likely influence the level of private insurer payments, including a measure of the insurer HHI. As a supplementary strategy, he examines only physicians in contiguous counties that had different Medicare payment rates. The idea is to reduce heterogeneity, including the private market.

[107] The Community Tracking Survey of the Center for Studying Health System Change, http://www.hschange.com/index.cgi?data = 04.

[108] Medicare payments are based to some degree on physician practice costs but it seems unlikely that the regulators are systematically capturing marginal costs in their payment rates.

Eisenberg estimates the impact of Medicare payment rates on the probabilities that physicians will accept all, some, or no new Medicare patients. He finds that a 1 percent increase in the Medicare payment rate increases the probability that a physician will accept all new Medicare patients by 0.39–0.77 percent, reduces the probability they will only see some new Medicare patients by 0.29–0.56 percent, and reduces the probability that they will see no new Medicare patients by 0.83–1.62 percent. Physicians' participation responses are inelastic, implying that Medicare possesses monopsony power with regard to physician participation in the program. This study does not answer the question of whether Medicare has monopsony power with regard to the supply of services, nor does it address whether Medicare exercises monopsony power (although this seems unlikely given political constraints and government bureaucracy).

6.3. Summary

Empirical research on competition in physician services markets is sparse. The main reason for this is lack of data. This is frustrating, since this is a very important market and evidence is limited and often dated. Researchers in industrial organization have developed sophisticated methods for the analysis of markets. Adapting these methods or inventing new ones that address the idiosyncracies of physician services markets represents an exciting opportunity. However, researchers will have to be entrepreneurial and innovative in finding or collecting data to estimate models of physician services markets.

7. VERTICAL RESTRAINTS AND MONOPSONY

The previous sections have all dealt with issues of horizontal competition and market power—hospitals competing against hospitals, insurers against insurers, physicians against physicians. In this section we take on two different issues regarding market power–vertical restraints and monopsony.

7.1. Vertical Restraints

7.1.1. Vertical Restraints—Theory

There is a small, but important, literature on vertical restraints in health care.[109] As in the general case, vertical integration can serve to achieve efficiencies. It can eliminate

[109] In health care the focus has been on vertical integration and exclusive dealing. We therefore restrict our attention to these two forms of vertical restraint. We refer to vertical integration for the most part, but make clear when exclusivity is important.

double marginalization, hold-up problems, transaction costs, and information asymmetries (improved monitoring). In the case of hospitals and insurers, there are also important spillover effects which integration can internalize. Insurers and hospitals make decisions over many matters like pricing, information systems, etc. which affect each other. Integration can allow for efficient coordination on such choices.[110]

It is also worth pointing out some other sources of potential efficiencies beyond the usual ones. Insurers may be able to obtain lower prices from hospitals, leading to improved consumer welfare. Gal-Or (1997, 1999) shows that at an exclusionary equilibrium (all insurers and hospitals are exclusive pairs), insurers obtain lower prices from hospitals in exchange for guaranteed larger volume and consumers are better off (provided that there is not too much differentiation).

Another source of possible efficiencies is the elimination of inefficient substitution. If there are multiple hospitals, say, and one hospital has greater market power than the others, and thus higher markups, an insurer will inefficiently substitute away from the hospital with market power to the other hospitals. If hospitals are not perfect substitutes to patients then this will result in a loss of utility.

It is also possible that vertical integration can lead to reduced prices. Suppose that integration eliminates double marginalization and that the integrated firm is not exclusive, i.e. it buys and sells with other market participants. Then other hospitals have to set their prices at least as low as the marginal cost of the hospital in the integrated firm in order to sell to the insurer in the integrated firm. If the hospital in the integrated firm wants to sell to outside insurers, it has to set its price as low as the outside hospitals. So, it is possible (but not necessary) that integration could lower prices via this mechanism.

The traditional concern with vertical integration, however, is that it can serve to enhance or extend market power. An integrated insurer–hospital firm may find it profitable to exclude rival insurers from access to the hospital, or charge them prices higher than the internal transfer price of the integrated firm (raising rivals' costs) (see Ma, 1997).[111] The same could be true for excluding rival hospitals from access to the insurer in the integrated firm. There may also be a horizontal aspect to the vertical integration, if, say, there are multiple hospitals that join the integrated firm. This may

[110] Eggleston et al. (2004) study a model of vertical integration between hospitals and physicians and hospitals and insurers. They find that vertical integration does not necessarily increase net revenues.

[111] There have been some recent theoretical advances in this literature, using more general frameworks than in previous work. These newer papers tend to find anticompetitive effects of integration or exclusivity. Bijlsma et al. (2009) show that there can be foreclosure and anticompetitive effects if there are uninsured consumers. Douven et al. (2011) demonstrate foreclosure and anticompetitive effects using a more general bargaining framework due to de Fontenay and Gans (2007). They show that any exclusionary equilibrium is likely to be anticompetitive—a much stronger result than previous work. Halbersma and Katona (2011) find that vertical integration always harms consumers. The elimination of double marginalization results in a softening of price competition between the insurers.

have the standard anticompetitive effect of horizontal merger increasing market power. Another horizontal effect is that integration may facilitate collusion. If the insurer in the integrated firm buys from outside hospitals, it can communicate pricing information between the hospital in the integrated firm and its rivals, thereby facilitating collusion.

In an industry with uncertainty and with differentiated products, like health care, integration can be inefficient without being anticompetitive, simply by reducing choice. The key here is exclusivity, not integration *per se*. If a hospital–insurer pair are exclusive, then consumers' choices are restricted. When consumers choose an insurer they do not know what kind of illness they will have should they fall ill, and therefore they have an option demand for hospitals that can best treat any illness they might contract. Exclusivity restricts choice and therefore results in a loss of utility, even if there is no anticompetitive effect. Gaynor and Ma (1996) show a loss of consumer welfare from exclusive dealing in the absence of foreclosure in such a situation.

In health care there is also the possibility of another effect on consumers—risk segmentation. Consider the following situation. Let there be two differentiated upstream hospitals: H1 and H2. Let H1 offer specialized care for very ill patients, e.g. H1 is a tertiary care facility. Let H2 offer ordinary care, but nothing specialized, e.g. H2 is a primary care facility. H1 has higher costs than H2. Let there be two downstream homogeneous insurers: I1 and I2. There are two types of consumers: high risk and low risk. The high-risk consumers have a high probability of contracting a serious illness that will require treatment at a tertiary care facility. The low-risk consumers have a low probability of this happening. Suppose that I1 and H1 are integrated and exclusive (by implication I2 and H2 also are exclusive).[112]

We conjecture that there is an equilibrium with risk segmentation.[113] I2 will offer insurance at a lower premium, since H2 has lower costs. High-risk consumers will want insurance from I1 and low-risk consumers from I2. Since there is risk segmentation, there is an efficiency loss (in addition to any welfare effects due to pricing and restriction on choice, as discussed previously). This is a very informal argument—it may not be correct. But it points to a factor to examine in health care markets.

7.1.2. A Model of Vertical Integration and Hospital Prices

The framework we laid out in section 3.1 can be used to examine the impact of hospital–insurer integration on hospital prices paid by independent insurers.[114] In

[112] Enhancement of market power is not the effect of interest here.

[113] Baranes and Bardey (2004) have a formal model where exclusivity leads to risk segmentation. The setup of their model is quite different from what we have proposed here. They find that exclusivity reduces hospital differentiation and intensifies price competition. They conclude that exclusivity is welfare improving.

[114] Halbersma and Katona (2011) lay out a sketch of a potential empirical framework based on their model in Appendix B of their paper.

other industries, vertical integration has been linked to an increase in rivals costs, and that is the phenomenon we focus on here.[115] More concretely, assume that hospital j is now owned by insurer m and, for now, that the insurer does not contract with any other hospitals. The insurer's ownership of the hospital changes the bargaining game by changing the agreement and disagreement payoffs for the hospital.[116] As previously in section 3.1, the negotiations between the insurer and hospital j take the other prices as given. Let $\pi_m(p_j^h)$ be the profit the insurer m earns as a function of the price hospital j negotiates with insurer h holding all other prices constant.[117] Assume that if there is an agreement $\frac{\partial \pi_m}{\partial p_j^h} > 0$ for all l—increasing the price hospital h negotiates with other insurers raises their costs and therefore raises the profits of insurer m. Disagreement profits for the vertically integrated hospital are denoted $\pi_m(D)$. We assume that the insurer profits under a disagreement between hospital j and any other insurer are greater than the insurer's profits under agreement. That is, $\pi_m(D) \geq \pi_m(p_j^h)$, $\forall p_j^h < \infty$.

The hospital's agreement and disagreement outcomes are now:

$$H_{\text{agree}} = (p_{jh} - c_j)q_{jh}(J_h) + \pi_m(p_j^h)$$

$$H_{\text{disagree}} = r_j + \pi_m(D)$$

Because π_m is a function of p_h there is no simple closed-form relationship between hospital price and the other parameters of the model. However, it is straightforward to assess the impact of integration on prices. As long as $\beta > 0$, hospital prices are decreasing in the difference between the hospital's agreement and disagreement outcomes. The more important the agreement is to the hospital, the lower are prices. Here the difference is $(p_{jh} - c_j)q_{jh}(J_h) - r_j + (\pi_m(p_j^l) - \pi_m(D))$, which is smaller than in the non-integrated case. In addition, the marginal return from increasing prices is now $q_{jh}(J_h) + \frac{\partial \pi_m}{\partial p_j^l}$, which is greater than without integration. These two effects work to force prices higher.

Similar logic shows that insurer m it will be able to negotiate lower rates with the other hospitals in the market. If the insurer pays hospital j its marginal cost for providing care, then the difference in the agreement and disagreement values for insurer h when it is negotiating with hospital k is: $c_j d_{kh} + (F_h(J_h) - F_h(J_{h-k}) - cm_{kh}) + \beta \sum_{l \neq j,k} p_{lh} d_{jlh}$. The difference between the agreement and disagreement values if the insurer owns hospital j is $(p_{jh} - c_j)d_{kh} > 0$, where p_{jh} is the price the insurer and hospital j would have negotiated if they were not jointly owned.

The intuition is straightforward. A vertically integrated insurer pays its hospital marginal cost, which implies that under a disagreement with another hospital it will

[115] Hastings and Gilbert (2005) study the impact of vertical integration in the gasoline industry on rivals' prices.

[116] The structure of the payoffs for the insurer is unaffected by the integration; however, the functional relationships (e.g. $F_h(J_h)$ and $F_h(J_h - j - k)$) will almost surely change.

[117] We assume that the insurer pays the hospital a transfer price equal to the marginal cost of care.

have lower disagreement expenditures. To summarize, in this framework, vertical integration leads the vertically integrated hospital to negotiate higher prices with other payers and the vertically integrated insurer to negotiate lower prices with the other hospitals in the market.

7.1.3. Empirical Evidence on Vertical Restraints

There is very little evidence at present on the impact of vertical restraints on market power. In part, that is because vertical integration has not been that common in health care. It was quite rare until the mid-1990s, and then declined rapidly thereafter. Integration between hospitals and physician practices peaked in 1996 at approximately 40 percent of all hospitals, and declined thereafter (Burns and Pauly, 2002; Ciliberto, 2005). This pattern was repeated with vertical integration of hospitals into the insurance market, although the extent of vertical integration was never as great as between hospitals and physicians (Burns and Pauly, 2002). This growth coincided with the growth of managed care, and in particular with the perceived growth in managed care organizations' negotiating power with hospitals. Nonetheless, there are reports that vertical integration and exclusive deals are on the increase in health care, in part because of elements of the health reform law in the US. Burns et al. (2000) find that hospital–physician alliances increase with the number of HMOs in the market. They infer that providers may be integrating in order to achieve or enhance market power. More recently, Berenson et al. (2010) conducted 300 interviews with health care market participants, and report that increased bargaining power through joint negotiations listed as one of several reasons for hospital–physician alliances.

Certain types of vertical relations in health care have been the subject of significant antitrust scrutiny—exclusive dealing between physician practices and hospitals (usually for a specialized service, e.g. radiology, anesthesiology, or pathology), and most-favored-nations clauses between insurers and providers, which require the provider to give the insurer a rate as low as it gives to any buyer (see Gaynor and Haas-Wilson, 1998; Haas-Wilson, 2003, for reviews of vertical issues in health care).[118]

In spite of the interest in this topic, there is relatively little evidence on the effects of vertical restraints in health care. The evidence comes from reduced-form studies.

[118] Complaints about exclusive contracts between hospitals and physician practices are the most numerous type of antitrust case brought in health care. One of these cases was decided by the Supreme Court (*Jefferson Parish Hosp. Dist. No. 2 v. Hyde*, 466 US 2(1984)), and represents an important legal precedent on exclusive dealing and tying. There have also been a number of cases on most-favored-nations clauses, e.g. *Ocean State Physicians Health Plan v. Blue Cross & Blue Shield*, 883 F.2d 1101 (1st Cir. 1989), *cert. denied*, 494 US 1027 (1990) and *Blue Cross & Blue Shield v. Marshfield Clinic*, 65 F.3d 1406 (7th Cir. 1995), *cert. denied*, 116 S. Ct. 1288 (1996).

Ciliberto and Dranove (2005) and Cuellar and Gertler (2005) are the only two papers of which we are aware that examine the competitive impacts of vertical integration in health care. Both papers look at the effects of hospital–physician practice integration on hospital prices. The two studies find opposite results—Cuellar and Gertler find evidence consistent with anticompetitive effects of physician–hospital integration, while Ciliberto and Dranove find no such evidence. As Gaynor (2006a) points out, these seemingly contradictory results are fully consistent with economic theory—vertical integration can be anticompetitive and lead to higher prices or be efficiency enhancing and have the opposite result.

Research on efficiencies from integration is not very encouraging. Burns and Muller (2008) review the empirical evidence on hospital–physician relationships. They find little evidence of an impact of integration on costs, quality, access or clinical integration. Madison (2004) investigates the relationship between hospital–physician affiliations and patient treatments, expenditures, and outcomes using data on Medicare heart attack patients. She finds little evidence of any impacts of hospital–physician relationships.

If integration between various types of providers or providers and insurers grows, there may be continued interest (and more data) in these relationships. The model we sketched out above in section 7.1.2, or one like it, may provide a useful framework for future empirical investigation.

7.2. Health Care Providers and Monopsony Power

It is well known that market power in the purchase of health care inputs can (but does not necessarily) lead to welfare loss.[119] While the textbook depiction of monopsony results in a reduction in output below the competitive equilibrium, other models of monopsony can yield more ambiguous welfare results. Herndon (2002) shows that if sellers are forced into all-or-nothing decisions by a buyer with monopsony power that there is no reduction in output and no welfare loss. Consumers are better off, because the sellers' prices have been reduced with no decrease in output. She argues that this model applies to health care, where insurers are able to force such decisions on providers.

There is also a literature that examines why large purchasers (e.g. Walmart) are able to negotiate more favorable terms with their suppliers (e.g. Snyder, 1996). Insurer economies of scale may ultimately be based on their ability to exercise some monopsony power and negotiate lower provider payment rates. The issue of the role of monopsony extends beyond any individual antitrust case or the understanding of the provider price-setting mechanism, but is relevant for considering health system design. Health policy commenters have argued that the relative cost advantage of

[119] The analysis of monopsony power dates to Robinson (1933). Gaynor and Vogt (2000) provide a nice review of the theory of monopsony and vertical foreclosure.

single payer systems principally rests in their ability to exercise monopsony power over providers.[120]

Health care providers sell their services to insurers and purchase labor and other inputs in order to produce their services. Because of the role in the supply chain, health care providers can both exercise monopsony power in the purchase of inputs (namely labor) or can be subject to monopsony power by insurers. The framework outlined above in section 3.1 provides a lens through which one can examine the role of insurer bargaining power in affecting provider prices. A hospital negotiating with a monopsonist insurer will face a large discrepancy between its agreement and disagreement outcomes, which, in turn, implies that the negotiated price will be lower than if there were other insurers in the market. In this model, the mechanism through which this occurs is the increased volume of patients that a monopsonist insurer brings to the hospital under an agreement. Higher volumes imply a lower price.

The empirical literature examining monopsony generally examines the role of insurance market concentration on provider prices. Much of this literature naturally overlaps with the analysis of provider market concentration and provider prices. The typical analysis will include measures of both insurer and provider market concentration as right-hand-side variables. Shen et al. (2010) find that hospital revenue was significantly lower in markets with high levels of HMO penetration and low hospital concentration. Moriya et al. (2010) find that increases in insurance market concentration are significantly associated with decreases in hospital prices, whereas increases in hospital concentration are non-significantly associated with increases in prices, although the results are very sensitive to the inclusion of one or two states. A hypothetical merger between two of five equally sized insurers is estimated to decrease hospital prices by 6.7 percent. However, given the fragility of the results, this effect should be interpreted with caution. As mentioned previously, Schneider et al. (2008a) apply a model similar to Shen et al. and Moriya et al. to the physician services market. In contrast to the preceding papers, they find no significant impact of insurance market concentration on physician prices. However, they find that physician market concentration raises physician prices significantly.

A longstanding concern with hospital market power is that not only can they leverage it into higher prices from insurers but they may be able to reduce nurses' wages below competitive levels. Yett (1975) argued that the chronic shortage of nurses may result from monopsony equilibrium. However, the importance of monopsony in the nursing market is inversely related to the elasticity of labor supply. For a number of reasons, including the large number of non-hospital nursing jobs and the large numbers of nurses that move into and out of the labor force, that elasticity is likely to be high. Sullivan (1989) is one of the early papers that uses the methods of the new

[120] For example, see Reinhardt et al. (2004) and Anderson et al. (2003).

empirical industrial organization (Bresnahan, 1989). He estimates the inverse elasticity of nurse labor supply to hospitals as 0.79 over a one-year period and 0.26 over a three-year period. He interprets these estimates as evidence of substantial monopsony power on the part of hospitals.

More recently, the role of monopsony in the purchase of health care labor inputs has received significantly less attention. Staiger et al. (2010) rely on exogenous changes in Veterans Affairs hospitals to identify the extent of hospital monopsony power. They find very inelastic labor supply curves and conclude that their results are consistent with the presence of monopsony power. Hirsch and Schumacher (2005) critique the Staiger et al. (2010) approach and use variation in hospital market structure over time to estimate a reduced-form wage regression. They find no link between hospital market concentration and nurses' wages suggesting that hospitals do not exercise monopsony power.

Matsudaira (2010) uses the effects of a minimum staffing law in California to estimate the elasticity of labor supply in long-term care facilities. Only those facilities whose staffing was below the required level had to hire additional staff. Matsudaira finds that these facilities added staff with no corresponding increase in wages, implying a perfectly elastic labor supply curve, and no monopsony power.

As mentioned previously, the recent study by Eisenberg (2011) examines whether Medicare has monopsony power as a purchaser of physician services by estimating the impact of Medicare physician payment rates on physician willingness to participate in the program by taking on new Medicare patients. He finds that physician participation with regard to Medicare payment is positive, but inelastic, implying that Medicare has monopsony power (whether they exercise it is another question).

To summarize, it is clear that the bargaining leverage of insurers, which is determined by their size and the presence of alternative insurers, lowers provider prices. It is in that sense that monopsony clearly affects the costs of health care provision. However, evidence of monopsony in health care markets is quite limited.

8. SUMMARY AND CONCLUSIONS

In this chapter we have attempted to lay out a framework for thinking about competition in health care markets. In particular, we sketched out what a relatively simple model of bargaining between insurers and providers might look like. Many of the market relationships in health care can be captured with such a model. It provides an intuitive framework for thinking about the economics of these markets as well as a springboard for developing econometric models for estimation.

We also reviewed the recent literature on competition in health care markets. There has been an explosion of work in this area since the publication of the first volume of the *Handbook of Health Economics*. Four developments in particular are worth noting.

One is the increasing use of modern structural models of industrial organization, adapted to the specifics of health care markets. The chapters by Dranove and Satterthwaite (2000) and Gaynor and Vogt (2000) described structural models that might be estimated, but that had not yet been executed at the time of the Handbook's publication. The models described in those chapters, and more sophisticated models, were estimated only a few short years ago. In addition, there has been increasing (and productive) interchange between health economics and industrial organization scholars, leading to more sophisticated and informative modeling of health care markets.

Second is the volume of empirical work on hospital markets, particularly work on quality competition. At the time of the writing of the first volume of the Handbook there was a fair amount of non-structural work on hospital price competition, but virtually none on hospital quality competition. This has changed dramatically.

Third is the entry of work on competition in health care markets in countries other than the US, and by non-US scholars working in this area. This is largely due to health system reforms in countries like England, the Netherlands, and Switzerland designed to increase the use of markets. This has become an important area of work internationally and is no longer US-centric.

Fourth is the very recent work on health insurance markets. This development is so recent that most of the papers we cite in this chapter are yet to be published. This expansion of interest in this area is something that hopefully will continue.

It is disappointing that there is so little empirical research on competition in physician services markets. In the US this is largely due to data limitations. Hopefully scholars will find ways to surmount this problem and we will see the kinds of advances in knowledge about this market that we have seen for hospital markets.

There are tremendous research opportunities for ambitious scholars interested in the economics of health care markets. We expect to see further developments in thinking about the economics of these markets and in devising estimable models for analysis.

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