Rev Ind Organ (2015) 47:167–193
DOI 10.1007/s11151-015-9467-y

Market Power, Transactions Costs, and the Entry of Accountable Care Organizations in Health Care

H. E. Frech III.[1] · Christopher Whaley[2] · Benjamin R. Handel[3] · Liora Bowers[4] · Carol J. Simon[5] · Richard M. Scheffler[6]

Published online: 15 July 2015

Abstract ACOs were promoted in the 2010 Patient Protection and Affordable Care Act (ACA) to incentivize integrated care and cost control. Because they involve vertical and horizontal collaboration, ACOs also have the potential to harm competition. In this paper, we analyze ACO entry and formation patterns with the use of a unique, proprietary database that includes public (Medicare) and private ACOs. We estimate an empirical model that explains county-level ACO entry as a function of: physician, hospital, and insurance market structure; demographics; and other economic and regulatory factors. We find that physician concentration by organization has little effect. In contrast, physician concentration *by geographic*

Earlier versions of this paper were presented at the International Industrial Organization Conference in Boston, the International Health Economics Association meeting in Sydney, the Allied Social Science meetings in Philadelphia, the ACO Workshop in Berkeley, and the Bates White Health Care and Life Science Seminar in Washington, D.C. Thanks are due to the participants of those meetings, especially Martha Starr, Dean Rice, and Martin Gaynor for helpful comments. Thanks are also due to Sandra Decker, Abe Dunn, Robert Obstfeldt, Jim Rebitzer, Michael Morrisey, Jessica Foster, and Lee Mobley for helpful comments on earlier versions and to the referees and editor of this journal for more recent useful comments.

✉ H. E. Frech III.
frech@econ.ucsb.edu

Christopher Whaley
cwhaley@berkeley.edu

Benjamin R. Handel
handel@berkeley.edu

Liora Bowers
liora.bowers@gmail.com

Carol J. Simon
carol.j.simon@uhg.com

[1] Department of Economics, University of California, Santa Barbara, Santa Barbara, CA 93106, USA

site—which is a new measure of locational concentration of physicians—discourages ACO entry. Hospital concentration generally has a negative effect. HMO penetration is a strong predictor of ACO entry, while physician-hospital organizations have little effect. Small markets discourage entry, which suggests economies of scale for ACOs. Predictors of public and private ACO entry are different. State regulations of nursing and the corporate practice of medicine have little effect.

Keywords Health care competition · Antitrust · Entry · Integration · Accountable care organizations · Transactions costs · Obama plan

JEL Classification L 14 · I11 · L44 · I18 · L41

1 Introduction and Overview

The US health care sector has been an area of continuing public policy concern for many years, with increased emphasis on cost control, in particular, that stretches back at least to the 1960s. The most recent major federal legislation to address the sector is the Patient Protection and Affordable Care Act of 2010 (the ACA).

Included in the ACA was a major provision to encourage the formation of accountable care organizations (ACOs). ACOs are a type of joint venture that typically includes both physicians and hospitals, and often health plans. ACOs partially integrate to coordinate care and share the risks and rewards of cost reduction to specific consumers in a specific geographic area. They provide an overlay of managed-care-type incentives and organization. Managed care organizations (MCOs), which are especially tightly integrated health maintenance organizations (HMOs), have arisen in the market over time. ACOs extend many of the operational structures of MCOs and HMOs (see the glossary of US health care terms in Table 1). The current ACO movement is designed to spread the

[2] School of Public Health, University of California Berkeley, Berkeley Center for Health Technology, 1950 Addison Street, Suite 202, Berkeley, CA 94704-7360, USA

[3] Department of Economics, University of California Berkeley, 521 Evans Hall, Berkeley, CA 94720, USA

[4] Health Policy and Practice—California Delivery System, Nicholas C. Petris Center on Health Care Markets and Consumer Welfare, University of California, Berkeley, School of Public Health, 2150 Shattuck, Suite 525, Berkeley, CA 94720, USA

[5] United Health Group Center for Health Reform and Modernization, Optum Institute for Sustainable Health, 13625 Technology Drive, Eden Prairie, MN 55344, USA

[6] Health Economics and Public Policy, School of Public Health and Goldman School of Public Policy, Nicholas C. Petris Center on Health Care Markets and Consumer Welfare, University of California, Berkeley, School of Public Health, 2150 Shattuck, Suite 525, Berkeley, CA 94720, USA

Table 1 Glossary of US health care terms

Accountable Care Organizations (ACO) An organization of health care providers that is rewarded for meeting quality standards and for saving costs of a group of enrollees or beneficiaries. They are often joint ventures of physicians, hospitals, and other health care providers. Medicare ACOs are formally approved by the Centers for Medicare and Medicaid, following the framework of the Affordable Care Act (ACA). They provide services to Medicare fee-for-service beneficiaries
Centers for Medicare and Medicaid (CMS) Federal governmental agency that manages the Medicare and Medicaid programs. CMS is delegated the authority to create rules for the Medicare ACO programs
Corporate Practice of Medicine Restrictions State statutes that prohibit physician practices from being controlled by a corporation or anyone other than a physician
Health Maintenance Organization (HMO) A type of managed care organization (MCO) that integrates the financing and provision of health care services, by ownership or, more often, by contracts with providers. HMOs are distinctive in providing no benefits for care that is provided by out-of-plan providers
Managed Care Organization (MCO) A type of health plans that uses managerial controls to limit utilization, contract for low prices, or improve quality. Examples include health maintenance organizations (HMOs) and preferred provider organizations (PPOs)
Medicare US national health insurance plan mostly for the elderly (age 65 and over), administered by the federal government. Most beneficiaries are in traditional unmanaged fee-for-service Medicare
Medicare Shared Savings Program (MSSP) One of the ACO programs for Medicare beneficiaries, administered by the CMS. The MSSP limits the possible losses and gains of ACOs
Medicaid US health insurance program for low-income consumers. It is administered by the states, with partial federal government subsidy and some federal standards
Patient Protection and Affordable Care Act of 2010 **T**he US national health insurance and health care reform. It is often referred to as the Affordable Care Act (ACA) or Obamacare
Physician Hospital Organization (PHO) An organization that combines physicians and hospitals, by contract or by hospital ownership of physician practices
Pioneer Program One of the ACO programs for Medicare beneficiaries, administered by the CMS. The Pioneer Program allows for higher-powered incentives (more possible losses and gains) than the Medicare Shared Savings Program (MSSP)
Preferred Provider Organization (PPO) A type of managed care organization (MCO) that integrates the financing and provision of health care services, by ownership or, more often, by contracts with providers. PPOs are distinctive in providing more benefits for seeking care within the plan, but still providing some benefits for care that is provided outside of the plan. PPOs are typically managed more loosely than are HMOs

general type of organization and incentives more broadly. ACOs are hybrid organizations, formed by contract.[1]

As a means to promote care coordination, which proponents argue will reduce unnecessary and duplicative care, the ACA promotes ACOs. Medicare-sponsored (hereafter "public") ACOs meet the regulatory requirements of the federal Medicare program for consumers who are 65 or over. Public ACOs can also serve privately-insured consumers. In contrast, other ACOs are designed only for privately-insured consumers (private ACOs) and cannot participate in the Medicare ACO program. Several prototypical ACOs took part in an earlier demonstration project, with mixed results (Wilensky 2011).

[1] See Williamson (1991) for a description of hybrid organizations.

ACOs involve both vertical and horizontal cooperation, which could increase market power and raise antitrust concerns.[2] Higher prices or lower quality for private health plans is a possible outcome (Scheffler et al. 2012; Federal Trade Commission/Department of Justice 2011; Berenson et al. 2010; Greaney 2011; Cuellar and Gertler 2006). Medicare sets prices, so the use of market power against Medicare primarily affects non-price dimensions such as amenity, quality, and access (Kessler and McClellan 2000; Gaynor et al. 2013).

In this paper, we analyze ACO patterns of entry (or formation) with the use of a unique, proprietary database of ACOs that has been created by the Optum Institute. The database includes public and private ACOs that were in full operation or in development. The proprietary data were created by searches in May 2011, October 2011, and May 2012 (ACO Market Activity 2012).[3] The data on the private ACOs are especially interesting, since there is no formal registry for them. We find that market structure, demographics, and other economic variables affect local market entry.[4]

2 ACOs Explained

ACOs are a type of joint venture that encompasses existing health care providers. There is a vertical element: the combination of complementary providers, such as hospitals and physicians of various specialties. There is also a horizontal aspect, since they combine otherwise competing providers, such as physicians. They are expected to incentivize coordination of health care, improve quality, and lower costs. For example, a policy hope is that ACOs will reduce duplicative medical tests by encouraging physicians to share the results of the tests with others. ACOs typically reward participating providers by providing a financial incentive—which is referred to as a "shared savings" payment—for reducing participant costs relative to benchmark costs. Note that the entry of an ACO corresponds to a new level of coordination and communication among existing providers. Entry or formation of an ACO does not create a new provider itself but instead allows the coordination of care across separate, and possibly otherwise competing provider organizations. The ACO movement arises from a view that the existing health care system is excessively fragmented.

3 Why Integration Has Evolved Slowly in the Existing Healthcare System

Integration in the health care system has evolved slowly due to tax incentives and legal, regulatory, and cultural constraints. The moral hazard caused by the third-party subsidy of health insurance in concert with fee-for-service (FFS) payments

[2] For discussions of vertical integration in health care, see Berenson et al. (2010) and Haas-Wilson (2003, pp. 169–173) and Nevo (2014).

[3] This paper includes data that were gathered through May 31, 2012.

[4] Generally similar results are found in two related papers in the health services literature: Auerbach et al. (2013) and Lewis et al. (2013). Those papers focus less on local market structure and competition than we do. Further, they use fewer control variables.

leads to overutilization of services (Pauly 1986; Feldman and Dowd 1991). Moral hazard is further encouraged by the tax exclusion of employer-provided health insurance, which leads to overly complete health insurance (Pauly 1986; Thomasson 2003). The FFS payment system frequently leads to fragmented care.

Coordination and continuity of care often depend on individual physicians communicating with patients and other providers. This work is typically poorly compensated by insurers because it is difficult to observe. At the same time, physicians have some market power, so prices for easily observable procedures often exceed marginal costs (Frech 1996, pp. 51–101; McGuire 2000, pp. 475–481; Dunn and Shapiro 2014). Further, there is little incentive for efficient non-price rationing to mitigate moral hazard.

Evolving in response, MCOs combine provider networks with utilization controls (non-price rationing) and often include performance-based bonuses. MCOs integrate the insurer with the providers to varying degrees. During the 1990s, MCOs, especially health maintenance organizations (HMOs), reduced utilization and cost growth. Some form of managed care has become the norm in the private sector (Mobley and Frech 2007, p. 159).[5] In contrast, traditional Medicare (which covers most beneficiaries) does not use provider networks or utilization controls, and private supplemental insurance has largely negated Medicare cost-sharing policies that were originally designed to control costs and reduce moral hazard (Atherly 2002).

Further, consumers value the freedom to choose physicians and facilities. On the supply side, physician groups and hospitals value independence from payers. MCOs, and especially HMOs conflict with both of these sets of values, which led to a consumer and provider backlash in the late 1990s. This caused political problems and led to both federal and state statutes that hindered HMOs (Hall 2005; Rich and Erb 2005; Sloan and Hall 2002).

US physicians have traditionally practiced independently of hospitals. Counter to this tradition, hospitals are attempting to form physician-hospital organizations (PHOs) of various forms. An earlier wave of PHO formation was generally reversed (Burns and Pauly 2002, 2012; Gaynor 2011, p. 14).

In addition, statutes and regulations further increase transactions costs and hinder integration. For example, "corporate practice of medicine" regulation prevents hospital ownership of physician groups. Perhaps more importantly, federal and state anti-kickback laws, most notably the Stark Law, prevent payment for inducing referrals. These laws, such as the Civil Monetary Penalty and the Anti-Kickback statutes prohibit hospitals from rewarding physicians for reducing services, even inappropriate services. These laws cause contracts to be incomplete (Cuellar and Gertler 2006; Leibenluft 2011). The legal and regulatory structure practically requires that providers be economically fragmented.

On the positive side, electronic health records (EHRs) can assist in sharing information, which facilitates integration by contract. The federal government is subsidizing EHR use via the Health Information Technology for Economic and Clinical Health (HITECH) Act. Unfortunately, many different EHR systems are

[5] HMOs are the most tightly-integrated form of managed care. Only 21 % of coverage is the more tightly integrated HMO form (Mobley and Frech 2007, p. 167).

incompatible. Research by Sidorov (2006), McCormick et al. (2012), and Kellermann and Jones (2013) indicates that the actual savings have been small at best.

4 Transaction Cost Economics and Health Care

Health care contracts are necessarily incomplete, which opens the door to *ex post* opportunism (Williamson 1985; Klein et al. 1978). Under insurance and FFS medicine, physicians have high-powered incentives to supply more services than is optimal for the consumer from an *ex ante* point of view, for the ACO, or for the economy as a whole. Another issue is the referral and handoff of patients across different providers, which is a classic coordination problem.[6] Another type of transaction cost involves measurement, such as individual contribution to team production (Alchian and Demsetz 1972; Grosse et al. 2011). Measuring the contribution of physicians, hospitals, or nursing homes is imperfect and costly.

Transaction cost economics (TCE) has been applied to health care. Cuellar and Gertler (2006) test the implications of TCE and market power for integration. They find no efficiency improvement, but substantially higher prices for most forms of integration, which supports a market power explanation for PHOs. On the other hand, Ciliberto and Dranove (2006) perform a similar exercise with hospital-level data from California. They find a small and generally statistically insignificant reduction in prices for integrated organizations.

David et al. (2011) analyze integration between hospitals and nursing homes and home health care agencies. They note that statutes and regulations against side payments lead to contractual incompleteness (David et al. 2011; Leibenluft 2011; Cuellar and Gertler 2006).[7] Nursing homes have an incentive to delay taking a patient. Integrated hospitals were found to have shorter stays and the same or better health outcomes (David et al. 2011, p. 30).

Using national hospital-level data from 1994 to 1999, Ciliberto (2006) finds that overall investment is higher in hospitals that are integrated with physicians. He interprets the higher investment as efficiency-enhancing. The ACA's promotion of ACOs is designed both to incentivize integration similar to that observed in these studies and to reduce the statutory and regulatory barriers to integration.

5 Background on Medicare and Accountable Care Organizations

The ACA created the Medicare Shared Savings Program (MSSP), which incentivizes an ACO to reduce costs for FFS Medicare beneficiaries who are attributed to it. ACOs receive additional payments based on reducing costs if they meet governance and quality standards for 33 different quality metrics.

[6] This handoff problem with hospitalization has been exacerbated by the rise of the new specialty of "hospitalists" who manage the care of inpatients in place of primary care physicians (Rebitzer and Votruba 2011, pp. 22–23).

[7] The statues and regulations against side payments create an extra incentive for integration through common ownership to allow payments within a firm. For an application of this idea to the hospital/nursing home integration issue, see Afendulis and Kessler (2011).

In addition to the MSSP, the ACA created the Pioneer ACO program, which allows experienced organizations to share even more risk.[8] First-year results were mixed, with 13 of the 32 Pioneer ACOs achieving savings. Nine have left the Pioneer program; seven became regular Medicare ACOs and two left the Medicare ACO program altogether (Goldsmith 2013). More recent research is somewhat more promising, indicating some savings to the Medicare program, mostly through reduced utilization (Nyweide et al. 2015).

Private ACOs predate the Medicare MSSP program. Also, several states—including Colorado, New Jersey, and Oregon—have started ACO initiatives that are focused on low-income consumers in Medicare and Medicaid (a federal/state program for the poor) programs. The Optum Institute database, which is described in the "Appendix", identified 230 ACOs in existence on either May 2011 or May 2012.

The period between 2011 and 2012 was characterized by substantial entry and some exit. Over the dates of the scans (May 2011, October 2011 and May 2012), the number of private ACOs was 106, 130, and 135, respectively. For public ACOs, the number was 19, 21, and 86. Most public ACOs were established following the approval of applicant organizations by the Centers for Medicare and Medicaid (CMS) in April 2012. The Optum Institute data excludes existing "preferred provider organizations" (PPOs) or HMOs that do not meet risk-sharing and quality and governance accountability criteria that are similar to public ACOs, as well as older organizations that were formed prior to 2005.

Of the 161 ACOs that provided detailed partner information, the most common participants were hospital groups (73.9 %), physician groups (60.2 %), and commercial (insurance) payers (50.3 %). Collaborations are common: 44.7 % of ACOs have both hospital and physician groups. Hospital/payer (33.5 %) and physician/payer (27.3 %) pairings were also common.

6 Explaining ACO Entry: Expectations and Interpretations

We develop an empirical model to explain ACO entry at the county level. We are most interested in variables that relate to policy, especially those that promise some ability to distinguish entry for two purposes: (1) to enhance market power by vertical and horizontal joint ventures or mergers; and (2) entry to improve efficiency, primarily through reducing transactions costs.

To estimate the coefficients of economic and policy interests accurately and avoid omitted variable bias, we control for other important determinants of entry. This approach leads to the use of 25 independent variables in the full model. We focus on three specifications. The first includes five market structure variables only. The second adds a block of six demographic variables. The third adds the full set of 14 other economic variables. For more information on data sources, see the "Appendix" and Table 2.

[8] Retrieved May 22, 2012 from http://innovations.cms.gov/initiatives/aco/pioneer/.

Table 2 Variables and sources

Variable	Definition	Year	Source
Public ACO entry	Any public ACO in the county	May 2011 May 2012	Optum Institute Survey
private aco entry	Any private ACO in the county	May 2011 May 2012	Optum Institute Survey
Hospital system HHI	Hospital system HHI (measured using beds)	2010	American Hospital Association Annual Survey of Hospitals
Insurance HHI	Insurance HHI	2009	Health-Leaders-InterStudy Survey
Physician group HHI	Physician group HHI	2010	SK&A
Physician site HHI	Physician HHI	2010	SK&A
HMO penetration	Share of HMO enrollees	2009	Health-Leaders-InterStudy Survey
Population (100k)	County population	2009	Area Resources File
Income ($1000)	Median county household income	2009	Area Resources File
Metropolitan	Rural–urban continuum classification (rural–urban continuum 1–3 = metropolitan, 4–9 = rural)	2013	USDA: http://www.ers.usda.gov/data-products/rural–urban-continuum-codes.aspx
Midwest	Census region		Census
South	Census region		Census
West	Census region		Census
PHOS: grp. prac. w/o walls	Percentage of hospitals that operate as a "medical group without walls"	2010	American Hospital Association Annual Survey of Hospitals
PHOS: closed	Percentage of hospitals that operate as closed hospital-physician organizations	2010	American Hospital Association Annual Survey of Hospitals
PHOS: IPA	Percentage of hospitals that operate as open hospital-physician organizations	2010	American Hospital Association Annual Survey of Hospitals
PHOS: open	Percentage of fully integrated hospitals	2010	American Hospital Association Annual Survey of Hospitals
PHOS: fully integrated	Percentage of independent practice association (IPA) hospitals	2010	American Hospital Association Annual Survey of Hospitals

Table 2 continued

Variable	Definition	Year	Source
Medicare EHR subsidy	Proportion of eligible providers that have received payments from the Medicare and Medicaid Electronic Health Records Incentive Program	2012	CMS: http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/DataAndReports.html
percent EHR use	Percentage of physicians actively using an electronic health record to e-prescribe via the Surescripts Network	2011	Surescripts Network
Corporate practice prohibition	State has corporate practice of medicine law	2006	Michal (2006)
Nurse: no MD involvement	State law allows nurses to operate without physician oversight	2007	Catherine Dower et al. (2007)
Nurses authorize tests	State law allows nurse practitioners to authorize tests	2007	Catherine Dower et al. (2007)
Medicare spending ($1000)	Age, sex, and price-adjusted total Medicare Parts A and B per enrollee spending	2009	Dartmouth Atlas of Care
Amb. sensitive admits (100)	number of Medicare discharges for ambulatory care sensitive conditions per 1000 Medicare enrollees	2009	Dartmouth Atlas of Care
Eligible for Medicare	Share of population eligible for Medicare	2009	Area Resources File
Eligible for Medicaid	Share of population eligible for Medicaid	2009	Area Resources File

6.1 Market Structure and Market Definition

We measure market structure in the physician, hospital and insurance markets by the Herfindahl–Hirschman Index (HHI) for each county market.[9] The rationale for using counties as geographic markets is spelled out below. Creating an ACO to enhance market power is more attractive in a more concentrated market because the ACO can collectively organize a smaller number of independent competitors.[10] On the other hand, creating an ACO for efficiency motives is less likely in a more concentrated market. The estimates include entry for either motive or for mixed motives. The two effects could cancel, leading to no observed net effect.

Following the common approach of antitrust cases, we define the hospital product market as a cluster of all inpatient care. HHIs are based on the number of beds. We define the physician product market as a cluster of all specialties. Physician HHIs are based on the number of physicians. For some purposes, these definitions are probably broader than ideal (Kleiner et al. 2012; Dunn and Shapiro 2014). Note that different physician and hospital services are complements from the viewpoint of a health plan or an ACO. In the health plan market, we include all types of health insurance. Insurer HHIs are based on the number of enrollees. Again, for some purposes, this is probably broader than ideal.

For physician markets, there are two very different concentration measures: The first is HHI measured at the physician group level. Physicians at several locations who are members of the same group count as a single firm.

The second physician HHI measure is defined by physical sites. Physicians at one location count as one "seller," regardless of ownership.[11] It provides a measure of the physical or locational concentration of physicians.

To illustrate how the site-based HHI variable differs from the group-based HHI, consider a county with physicians in two groups, located at three sites. Suppose that each group has 10 physicians at each site. The traditional group-based HHI is $(30/60)^2 + (30/60)^2 = 0.50$. The site-based HHI differs. It is $(20/60)^2 + (20/60)^2 + (20/60)^2 = 0.33$. In this example, the group-based HHI is greater than the site-based HHI, which is the usual relationship in the data. Now, consider another county with the same group organization, but with much more geographic concentration, where all the physicians are located at a single site. In this situation, the group-based HHI is unchanged at 0.50, but the site-based HHI is now 1.0, reflecting the higher geographic concentration of the physicians.

Higher site-based HHI is a proxy for lower transaction costs of informal clinical coordination, and thus less incentive to form an ACO. It is also a proxy for lower costs of forming an ACO, with opposite implications for the estimated effect.

[9] The HHI is the sum of squared market shares in proportion, scale from 0.0 to 1.0. Physician HHI is based on counts of physicians. Hospital HHI is based on bed counts. Insurer HHI is based on number of enrollees.

[10] In highly concentrated markets, ACO formation may not increase market power. Thus, the relationship between entry for market power and concentration could be an inverted U-shape. To test for this possibility, we (separately) entered two other variables: a dummy variable for counties with an HHI of 1.0; and a quadratic term (HHI^2). Neither was close to statistical significance, not even at the 10 % level.

[11] This measure has been independently developed by Hausman and Lavetti (2015).

We also include the HHI for health insurers. A negative coefficient on insurer HHI would likely have a pro-efficiency interpretation.

Several papers have focused on defining geographic markets for health care services. Markets for hospital and physician care are local (Frech 1996, pp. 30–31). The market for health insurance is similar; perhaps it is somewhat larger. The necessity to form local networks has made markets for MCOs more local than the market for indemnity insurance (Haas-Wilson 2009, p. 124; Capps 2009).

Some definitions of geographic markets have been based on patient flows, in the spirit of the Elzinga and Hogarty approach (1978). While intuitive, the Elzinga–Hogarty approach does not have a strong theoretical basis and is fragile in implementation (Werden 1981; Frech et al. 2004; Elzinga and Swisher 2011). Other methods have used provider-specific distance (Dafny 2009) or travel time (Dunn and Shapiro 2014) or fixed areas: metropolitan areas (Town et al. 2011); counties (Schneider et al. 2008); or fixed areas that are smaller than counties (Mobley et al. 2009).

We use the same geographic definition for local markets in all three of our industries: counties.[12] We believe that this is a reasonable method for defining thousands of local markets for research purposes and thus use counties as our unit of observation.[13] In our most parsimonious model, we include HMO penetration. While this can also be considered an ACO precursor, HMO penetration is also a fundamental feature of market structure and competition in local markets.

6.2 Demographics and Geography

As in other industries, market size (population) likely affects ACO entry (Bresnahan and Reiss 1991). Also potentially important are income, region (partly reflecting medical culture), and urban/rural balance. These variables are correlated with variables of economic and policy interest, so including them makes the results for the market structure variables more credible. Two of our specifications add these demographic variables to the local market competition variables.[14]

6.3 Precursors of ACOs: HMOs and Physician-Hospital Organizations (PHOs)

Due to management and incentive systems, culture and experience, forming an ACO is less costly in locations with ACO precursors. At least in some markets, there is also the possibility that providers who are not in an HMO may form ACOs

[12] Auerbach et al. (2013) use the Hospital Referral Regions (HRRs) from the Dartmouth Atlas of Health Care (2013). HHRs are larger than counties. There are 306 HHRs in the U.S., compared to 3141 counties. Lewis et al. (2013) use Hospital Service Areas (HSAs) also from the *Dartmouth Atlas*. HSAs are roughly comparable to counties. There are 3436 HSAs.

[13] The FTC and the DOJ use a screening test for ACOs, based on a simplified approach to market definition. It uses finer product definitions than we do. For geographic markets, it uses the "Primary Service Area" that accounts for 75 % of the consumers using the provider.

[14] As an alternative to the demographic variables, we also ran a version with state-level fixed effects. The results were generally similar.

to compete better with existing HMOs. For both of these reasons, we expect more ACO entry where there are more precursors: HMOs and physician/hospital organizations (PHOs).

6.4 Electronic Health Records

Where electronic health records are more widely used, coordination by ACOs should be more effective and less costly. We generally expect EHR use positively to predict ACO entry. While we think it is less likely, there is also the possibility that higher EHR use is related to higher informal coordination, so that there is less to gain by forming an ACO.

6.5 Regulation: Corporate Practice of Medicine Prohibitions

State "corporate practice of medicine" statutes prohibit non-physician organizations from owning physician practices. Although anachronistic, these laws still exist in several states that contain 20 % of US counties. The laws can be circumvented by forming hospital "foundations", but this raises transactions costs. We expect these statutes to raise the barriers to coordination and thus hinder the entry of ACOs.

6.6 Regulation: Nursing Scope of Practice Laws

Non-physician workers, especially nurse practitioners, are expected to play a large role in ACOs. Recent research suggests that restrictive laws reduce the efficiency and use of nurse practitioners (Yee et al. 2013; Kuo, Loresto, Rounds, and Goodwin 2013). Legislative activity on these laws at the state level is common (FTC 2014). We expect that these restrictive laws will discourage ACO entry.

6.7 Poor Baseline Integration

ACO formation has more potential to improve care in poorly integrated markets. We proxy for poor baseline integration with the use of two measures: (1) the hospital admission rate for diagnoses where appropriate outpatient care could have prevented hospitalization; and (2) Medicare spending per enrollee, adjusted for price differences. Medicaid spending might also be a proxy for poor baseline integration, but Medicaid plans are so heterogeneous that comparable cross-sectional data are not available.[15] We expect these variables to be positively related to ACO entry.

[15] There are three major difficulties in comparing Medicaid spending across areas. First, in some areas, Medicaid uses private HMOs and in some it is FFS. Second, in many states, Medicaid pays providers, especially physicians very poorly, leading to access and quality problems and nonprice rationing by waiting. Third, eligibility rules vary across states, leading to very different populations being covered by Medicare. Recently, some states followed the lead of the ACA and greatly expanded Medicaid eligibility and some have not. This has exacerbated the heterogeneity of the Medicaid populations across states.

6.8 Public Program Eligibility

We expect that a larger Medicare-eligible population would attract public ACO entry. A larger Medicare population strengthens incentives and eases monitoring because a larger proportion of the ACO providers' business is covered by the Medicare ACO (Frandsen and Rebitzer 2013). However, we do not have priors for the proportion of the population that is Medicaid-eligible.

7 Cross Tabulations

Counties with ACOs are larger, more urban, and somewhat higher in income, have lower provider HHIs, have higher HMO penetration rates, and tend to be in the West. See Table 3. Differences in insurer HHI and PHOs are small. Many of these differences appear to be artifacts of the tendency of HMOs to enter in larger markets. See also Table 4 for minimum and maximum values for all continuous variables.

There are 615 counties (3141 minus 2526) with no hospitals. We exclude these observations from estimation because hospital market concentration is undefined. Further, these exclusions make statistical sense. The counties with no hospitals are generally very small in population, and thus are likely to be different in unmeasured ways and to have large errors, and thus contribute to systematic errors and to heteroskedasticity. We also excluded a small number of counties because of missing data.

8 Econometric Models, Approaches and Identification

We model ACO entry at the county level and estimate the probability of ACO entry as a function of the variables that were discussed above. We define ACO_j as a dichotomous variable that equals one if an ACO is present in county j and zero otherwise.[16] We estimate ACO entry as

$$ACO_j = \alpha + \beta_1\, conc_j + \beta_2\, demo_j + \beta_3\, othercon_j + \varepsilon_j \qquad (1)$$

We define $conc_j$ as the hospital, physician, and health insurance concentration of county j; $demo_j$ as the set of demographic variables; and $otherecon_j$ as the other variables of economic interest, including some regulation variables that are measured at the state level.

We estimated Eq. (1) using a probit model. Robustness checks with logit yielded almost identical results, and checks with the linear probability model were roughly consistent. As a further robustness check, we also estimated ordered probit and

[16] Auerbach et al. (2013) use the proportion of Medicare beneficiaries who can be attributed to an ACO. They develop a clever algorithm to attribute Medicare beneficiaries to ACOs. Lewis et al. (2013) use a binary variable for whether an ACO has a physical facility in the area. This is narrower definition of entry than we use.

Table 3 Descriptive statistics

ACOs—all	1028
ACOs—public	434
ACOs—private	594
Counties	3141
Counties w/hospital	2526
Counties with ACO	667
Counties with public ACO	356
Counties with private ACO	433
ACOs/county with an ACO	1.54

	All counties	Counties w/ACO	Counties w/public ACO	Counties w/private ACO	Counties w/o ACO	*P* value dif in means (with ACO vs. w/o ACO)
Hospital system HHI	0.80	0.65	0.63	0.61	0.84	$p < 0.01$
Insurance HHI	0.30	0.25	0.25	0.26	0.31	$p < 0.01$
Physician group HHI	0.20	0.13	0.14	0.11	0.23	$p < 0.01$
Physician site HHI	0.17	0.09	0.10	0.07	0.20	$p < 0.01$
HMO Penetration	0.22	0.30	0.30	0.32	0.20	$p < 0.01$
Population (100k)	1.22	3.12	3.58	3.49	0.62	$p < 0.01$
Income ($1000)	44.88	51.72	52.44	53.64	42.73	$p < 0.01$
Metropolitan	0.39	0.63	0.59	0.71	0.32	$p < 0.01$
Midwest	0.33	0.29	0.22	0.35	0.35	$p < 0.01$
South	0.44	0.28	0.16	0.32	0.49	$p < 0.01$
West	0.14	0.24	0.34	0.15	0.11	$p < 0.01$
PHOS: grp. prac. w/o walls	0.02	0.02	0.02	0.02	0.02	0.61
PHOS: closed	0.06	0.08	0.09	0.08	0.05	$p < 0.01$
PHOS: IPA	0.06	0.07	0.06	0.08	0.06	0.97
PHOS: open	0.08	0.10	0.11	0.09	0.07	$p < 0.01$
PHOS: fully integrated	0.32	0.33	0.36	0.31	0.32	0.50
Medicare EHR subsidy	0.04	0.05	0.05	0.05	0.03	$p < 0.01$
Percent EHR use	0.43	0.48	0.49	0.47	0.41	$p < 0.01$
Corporate practice prohibition	0.21	0.31	0.41	0.26	0.18	$p < 0.01$
Nurse: no MD involvement	0.12	0.13	0.20	0.10	0.12	0.41
Nurses authorize tests	0.34	0.33	0.39	0.32	0.35	0.08
Medicare spending ($1000)	9.23	9.00	8.94	9.14	9.31	$p < 0.01$
Amb. sensitive admits (100)	0.87	0.73	0.69	0.74	0.92	$p < 0.01$
Eligible for Medicare	0.18	0.17	0.17	0.16	0.19	$p < 0.01$
Eligible for Medicaid	0.21	0.18	0.18	0.18	0.22	$p < 0.01$

Table 4 Continuous variable maximums and minimums

Variable	Minimum	Maximum
Physician site HHI	0.00	1.00
Physician group HHI	0.00	1.00
Insurance HHI	0.10	0.87
Hospital system HHI	0.03	1.00
HMO penetration	0.00	0.77
Population (100k)	0.01	98.48
Income ($1000)	$20.49	$111.58
PHOS: grp. prac. w/o walls	0.00	1.00
PHOS: closed	0.00	1.00
PHOS: IPA	0.00	1.00
PHOS: open	0.00	1.00
PHOS: fully integrated	0.00	1.00
Medicare EHR subsidy	0.00	0.75
EHR use	0.00	1.00
Medicare spending (in $1000s)	$4.54	$21.25
Amb. sensitive admits (in 100s)	0.25	3.14
Eligible for Medicare	0.05	0.49
Eligible for Medicaid	0.01	0.59

count regressions on the number of ACOs in a county, with similar results. We report robust standard errors. Clustering at the state level led to almost identical results. We separately estimated Eq. (1) for public ACO and private ACO entry.[17,18]

Independent variables are treated as exogenous with respect to ACO entry or formation. The assumption is reasonable due to timing. Most of the variables are lagged some time before actual entry: generally between 2 and 5 years.[19] In addition, many of our county-level variables are fixed in the short-run.

ACO entry, of course, is very recent. Virtually all entered in the last three years, and the first Medicare ACOs entered in 2011. Thus the concept of "presence" and "entry" of an ACO are operationally identical in these data. Since we do not use the exact date of entry, our data technically refers to presence of ACOs. We follow what we believe is common usage and ordinarily use the term entry.[20]

[17] Auerbach et al.'s (2013) main variable is penetration by public ACOs They also do some robustness checks with ACO penetration that they attribute to private ACOs, but only for Medicare beneficiaries (Auerbach et al. 2013, "Appendix").

[18] Pooling the public and private ACO entry was strongly rejected by the data, with a Wald test p value < 0.001. This is reflected in the quite different estimated equations for pubic versus private ACO entry.

[19] The variables on electronic medical records are nearly contemporaneous with ACO entry, due to data limitations.

[20] See, e.g., Bresnahan and Reiss (1991), Sein (2006) and Campbell and Hopenhayn (2005).

9 Probit Regression Results

The marginal probabilities from the probit regressions are presented in Table 5. Our full specification is inclusive in order to avoid the risk of omitted variable bias. The results of testing blocks of variables are presented in Table 6. The models perform well from an overall statistical viewpoint. The Wald Chi-square statistics are 67, 162, and 253 for public ACO entry and 149, 254, and 533 for private ACO entry. All are statistically significant at better than the $p < 0.001$ level. The pseudo R^2 values are 0.09, 0.23, and 0.28 for public ACOs and 0.16, 0.21, and 0.21 for private ACOs.[21] In what follows, we focus primarily on the full model.

9.1 Market Structure

If we first look at the market concentration variables, we see that in the models with full controls, hospital concentration has a small negative and generally statistically significant effect on ACO entry.[22] This suggests that hospital concentration promotes informal coordination, so that there is a reduced efficiency motive to form ACOs in more concentrated markets.

Insurer concentration has a strong negative effect on the entry of public ACOs, but only a small and statistically insignificant effect on the entry of private ACOs. Insurer HHI is probably measured with some error, leading to attenuation bias (Dafny et al. 2011). Our interpretation of the negative effect in public markets is that where insurers are highly concentrated, they are already performing a substantial amount of coordination, and thus there is less to be gained by forming ACOs.

For physician concentration by organization, the results are weaker statistically. The effects are all positive, but they are statistically significant only for one specification for public ACOs (at the 10 % level) and generally economically insignificant.[23]

Most interestingly, physician HHI measured *by site* is strongly and statistically significantly negatively related to private ACO entry. For public ACO entry, the effect is smaller but still statistically significant. The effect is economically important. For private ACO entry, doubling site-based physician concentration from its mean level of 0.17 leads to a decrease in the probability of any ACO entry of 4.7 % points: a 28 % decrease.[24] Doing the same exercise for the smaller estimate for public ACO entry, nets a decrease of the probability of entry of 1.7 % point: a 10 % decrease. We infer that informal baseline coordination is better when the

[21] Of the several possible pseudo R^2 measures, we report the McFadden (1974) version, which is the STATA default.

[22] Auerbach et al. (2013) find small and insignificant effects of hospital concentration. Lewis et al. (2013) do not analyze hospital concentration.

[23] Lewis et al. (2013) find statistically significant negative effects of physician concentration, differing from us. Different definitions and specifications complicate comparison. Auerbach et al. (2013) use a related measure: the proportion of primary care physicians in large groups. They find a small, but generally positive effect, which is consistent with our results.

[24] For counties with at least one hospital (our probit dataset), the unconditional probability of ACO entry is 582/2441 = 0.2384. For all counties, it is slightly smaller at 667/3141 = 0.2124.

Table 5 Marginal effect on probability of ACO entry

Variables mean of dep. Var.	(1) Public ACO entry 0.125	(2) Public ACO entry 0.125	(3) Public ACO entry 0.125	(4) Private ACO entry 0.163	(5) Private ACO entry 0.163	(6) Private ACO entry 0.162
Hospital system HHI	−0.164***	−0.0349	−0.0287	−0.176***	−0.0850**	−0.0876**
	(0.0393)	(0.0273)	(0.0236)	(0.0336)	(0.0337)	(0.0359)
Insurance HHI	−0.242	−0.264*	−0.241*	−0.0539	−0.0619	−0.0468
	(0.180)	(0.155)	(0.136)	(0.166)	(0.148)	(0.140)
Physician group HHI	0.0554	0.0613*	0.0512	0.0407	0.0184	0.0179
	(0.0385)	(0.0328)	(0.0325)	(0.0809)	(0.0757)	(0.0722)
Physician site HHI	−0.121*	−0.121**	−0.0978*	−0.381***	−0.265**	−0.275***
	(0.0723)	(0.0518)	(0.0554)	(0.138)	(0.108)	(0.105)
HMO penetration	0.169	−0.0220	0.0316	0.404***	0.255**	0.236**
	(0.107)	(0.0945)	(0.0944)	(0.0863)	(0.108)	(0.101)
Population (100k)		0.00745***	0.00571**		0.00444	0.00455
		(0.00267)	(0.00248)		(0.00414)	(0.00442)
Income ($1000)		0.00198**	−0.000067		0.00410***	0.00535***
		(0.000892)	(0.00130)		(0.00125)	(0.00183)
Metropolitan		0.00466	−0.00730		0.0309	0.0411**
		(0.0181)	(0.0168)		(0.0217)	(0.0202)
Midwest		−0.154***	−0.173***		−0.00977	0.0150
		(0.0512)	(0.0506)		(0.0628)	(0.0636)
South		−0.208***	−0.202***		−0.0593	−0.0425
		(0.0526)	(0.0479)		(0.0660)	(0.0637)
West		−0.0312	−0.0106		−0.0600	−0.0509
		(0.0647)	(0.0690)		(0.0664)	(0.0802)
PHOS: group prac. w/o Walls			−0.0121			0.0587*
			(0.0394)			(0.0330)
PHOS: closed			0.0316			0.0361
			(0.0285)			(0.0309)
PHOS: IPA			−0.0436			0.0397
			(0.0388)			(0.0368)
PHOS: open			0.0594***			0.00952
			(0.0211)			(0.0329)
PHOS: fully integrated			0.0334**			−0.0238
			(0.0154)			(0.0190)
Medicare EHR subsidy			−0.0982			0.0944
			(0.145)			(0.117)
Percent HER use			0.0864***			0.0159
			(0.0266)			(0.0359)
Corporate practice prohibition			0.0616*			−0.00428
			(0.0368)			(0.0448)

Table 5 continued

Variables mean of dep. Var.	(1) Public ACO entry 0.125	(2) Public ACO entry 0.125	(3) Public ACO entry 0.125	(4) Private ACO entry 0.163	(5) Private ACO entry 0.163	(6) Private ACO entry 0.162
Nurses no MD involved			−0.0395			0.0261
			(0.0583)			(0.0787)
Nurses authorize tests			0.0521*			−0.0282
			(0.0313)			(0.0359)
Medicare spending ($1000)			0.0188***			−0.00251
			(0.00696)			(0.00965)
Amb. sensitive admits (100)			−0.0947**			0.0128
			(0.0456)			(0.0372)
Eligible for medicare			−0.0695			0.376
			(0.232)			(0.287)
Eligible for medicaid			−0.292			0.165
			(0.216)			(0.271)
Observations	2448	2448	2439	2448	2448	2439
Pseudo R^2	0.09	0.23	0.28	0.16	0.21	0.21
Wald-χ^2	66.53	161.86	252.85	148.87	254.46	533.43

Standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 6 Likelihood ratio tests for blocks of variables

	Public ACO entry	Private ACO entry
Market structure	0.01	<0.01
Demographics	<0.01	<0.01
Physician-hospital organizations	0.01	0.16
Electronic health records	<0.01	0.70
Corporate practice prohibition	0.09	0.92
Nursing restrictions	0.25	0.72
Poor baseline coordination	0.02	0.94
Program eligibility	0.38	0.39

physicians are practicing at the same location. Therefore, there is less gain from creating an ACO to improve coordination. In the data, this informal coordination effect dominates the ease-of-formation effect of locational concentration. Therefore, there is less gain from creating an ACO to improve coordination.

HMO penetration can be interpreted both as an aspect of local market structure and competitive environment and as a precursor to ACOs. HMO penetration is strongly, positively and statistically significantly related to private ACO entry. But, its effect on public ACO entry is mixed and small for public ACO entry in the fuller models. For private ACOs, the effect is economically important. Doubling HMO

penetration from its mean level of 0.22 leads to an increase in the probability of ACO entry of 5.2 % points: a 22 % increase.[25] We interpret this as reflecting experience with coordinated care in HMOs and, at least in some markets, attempts by non-HMO providers to form an ACO to compete more directly with existing successful HMOs.

The market structure variables alone explain a reasonable amount of the variation in entry, with a pseudo R^2 of 0.10 for public ACO entry and 0.16 for private ACO entry. As a block, the market structure variables, including HMO penetration, are highly statistically significant, at better than the 1.0 % level.

9.2 Demographics and Geography

Demographic and geographic controls are important as a block, though distinguishing the effects of individual variables is not always possible. A large population is generally favorable. The individual effect is statistically significant for public ACO entry, but not for private ACOs.[26] Higher median household income is statistically insignificant in the full model of public ACO entry, but significant and positive for entry of private ACOs. Adding the demographic variables to the market structure variables adds greatly to the explanatory power of the model, raising the pseudo R^2 from 0.09 to 0.28 for public ACO entry and from 0.16 to 0.21 for public ACOs. As a block, the demographic variables are significant at better than the 1.0 % level for both public and private ACO entry.

Controlling for the demographic variables is important to clarify the interpretation of the competition variables. In the basic model, demographic and local market competition variables are confounded. In particular, the effects of the local HHI for both insurers and hospitals generally decline when the demographic controls are added. The same is true for both insurer HHI and HMO penetration.

9.3 Precursors of ACOs: HMOs and Physician-Hospital Organizations

HMO penetration can be viewed as an aspect of market structure or as a precursor to ACOs. As is shown above, HMO penetration is generally positively related to ACO entry.

The other precursors are all aspects of hospital/physician integration, in five different forms, that are defined similarly to Ciliberto and Dranove (2006) and Cuellar and Gertler (2006). We expected these variables to be major predictors of ACO entry, but this was not the case. The coefficients are all small and mostly insignificant. They are slightly more important in predicting public ACO entry, but the individual coefficients are small and only statistically significant at the 0.05 level for two out of a possible five variables, and two out of five signs are negative.

[25] Auerbach et al. (2013) and Lewis et al. (2013) similarly find a positive impact of variables that are related to HMO penetration, for public ACO penetration and entry.

[26] Auerbach et al. (2013) find a large positive effect of population density on ACO penetration, which they interpret in a similar way to our finding on population. Also related, Lewis et al. (2013) find a positive effect of urbanization.

Even as a block, the PHOs variables are only statistically significant for public ACO entry. The block is not close to statistically significant for private ACO entry. We find the minimal effect of PHOs surprising, but the last wave of hospital/physician integration is widely considered to have been a failure (Burns and Pauly 2002, 2012).[27]

9.4 Electronic Health Records

We employ two measures of the use of electronic health records (EHRs), which is expected to reduce the transactions costs of coordination across ACO providers, and encourage entry by ACOs. We find little evidence to support this hypothesis. The (small) proportion of physicians that receive a Medicare subsidy for electronic health records has a small and statistically insignificant effect. The proportion of physicians that use electronic drug prescribing has a small, but statistically significant (at the 0.01 level) effect for public ACOs. The effect on private ACOs is very small and statistically insignificant. Thus, the use of EHRs does not appear to facilitate the entry of private ACOs.

EHR use is a requirement to qualify for the public (Medicare) ACOs. Thus, the relationship between EHR use and ACO entry for public ACOs could be reverse causation: providers must have EHR systems to be allowed to form a public ACO.[28] The lack of effect for private ACOs may suggest that the private providers and payers do not regard EHR systems as helpful. This is consistent with the disappointing findings that EHR, so far, has had little or no effect on health care cost or utilization (Sidorov 2006; McCormick et al. 2012; Kellermann and Jones 2013). As a block, the EHR variables are statistically significant only for public ACO entry.

9.5 Regulation: Corporate Practice of Medicine Prohibitions

State corporate practice of medicine restrictions have a small statistically significant (at the 10 % level) positive effect on public ACO entry. They have a very small, statistically insignificant effect on private ACO entry. We expected negative effects, since these prohibitions raise the cost of integration. While reforming these restrictive laws maybe good policy in general, we would not expect the reforms to encourage ACO entry.

9.6 Regulation: Nursing Scope of Practice Laws

We expected more liberal regulation of nurse practitioners to encourage ACOs, since ACOs are expected to make more use of nurses. Surprisingly, the results are mixed in sign, mostly statistically insignificant, and always small. As a block, nursing restrictions are statistically insignificant. One interpretation is that restrictive nursing regulation does not greatly increase costs, so liberalizing it is not important for ACO entry. Reforming these protectionist laws may be good

[27] Auerbach et al. (2013) similarly find no effect of PHOs on ACO penetration. Lewis et al. (2013) do not examine PHOs.

[28] Reverse causation is more likely with EHR than the other economically-interesting variables, because EHR use is not lagged. We ran a version of the full regression that exclude EHR variables as a robustness check, but found little difference in other coefficients.

policy on many levels. But, like reforming the corporate practice of medicine restrictions, we would not expect these reforms to boost ACO entry.

9.7 Poor Baseline Integration

The coefficients on the variables for poor baseline integration have mixed signs. Medicare spending is statistically significantly related to public ACO entry. The effect is fairly large. It is far smaller and insignificantly related to private ACO entry.[29] This result makes sense because public ACOs are designed for Medicare enrollees.

On the other hand, hospital admissions for ambulatory sensitive conditions, which is a classic measure of poor outpatient care, is negatively and statistically significantly related to public ACO entry. As a block, the poor baseline integration variables are statistically significant (at the 5 % level) only for public ACOs. The overall picture is not perfectly clear, but it does seem that opportunities for improvement in care are not highly predictive of ACO entry.

9.8 Public Program Eligibility

For public ACOs, the effect of Medicare (for the elderly) eligibility on public ACOs is very small and insignificant. The point estimate of the effect of Medicaid (for the poor) eligibility is large and negative, but imprecisely estimated. For private ACO entry, the point estimate of the effect Medicare eligibility is large and positive, but also imprecisely estimated. The program eligibility variables are statistically insignificant as a block.

10 Robustness

Our robustness tests involve conservative data editing and more parsimonious specifications. Goodness of fit and coefficients are generally similar to the main specifications.

The first test drops the smallest (population <5000) and the largest (population >1,000,000) counties. Very small counties likely have large measurement errors because of very small cells for some variables: e.g., they may have very few Medicare ambulatory-sensitive admissions. Very large counties likely include more than one market. As is discussed above, medical care markets appear to be quite local. This data editing drops the sample from 2441 to 2292 (615 counties without hospitals, generally very small, have already been dropped).

The second test drops the novel physician site-based HHI, primarily to see if the estimates on group-base physician HHI are affected. The third test drops the

[29] Auerbach et al. (2013, "Appendix") find no effect of unadjusted Medicare spending on ACO penetration. In contrast, Lewis et al. (2013) find a positive effect of unadjusted Medicare expenditures on entry.

electronic health records variables to see if possible endogeneity due to Medicare rules affects the other estimates.

For both public and private entry, dropping the large and small counties makes very little difference, except for increasing the coefficients on population. Dropping the physician site HHI has little effect on the results for public ACO entry; but for private ACO entry, it causes the coefficient on physician group HHI to become statistically significantly negative. This makes sense because the effect of physician site HHI on ACO entry is negative. Dropping the EHR variables makes little difference.

11 Summary and Conclusions

By reducing the transaction costs of coordinating health care, ACOs have the potential to reduce spending and improve efficiency. However, they also raise anti-competitiveness concerns.

This paper uses the TCE framework to explain the motivation for ACOs and to examine empirically the determinants of ACO entry into local markets, using a unique proprietary dataset. Our probit model performs well statistically, showing that many economically relevant variables are important in explaining entry.

High physician concentration by *geographic site*—a measure of locational concentration of physicians—is a strong negative predictor of ACO entry. This finding suggests that geographic concentration reduces the transaction costs of informal coordination, and thereby reduces the advantage of ACO entry. High hospital concentration is also generally negatively related to entry. This effect could be interpreted in a similar fashion if market power for hospitals reduces the incentives for ACO formation. Furthermore, reducing hospitalizations is a primary component of spending reductions that lead an ACO to capture incentive payments. Hospitals with market power may resist such efforts if the magnitude of the shared savings payments does not offset the revenue reductions due to decreased hospitalizations.

HMO penetration is a strong determinant of private ACO entry, while physician-hospital organization penetration is not a determinant of either public or private ACO entry, despite the attention that these organizations have received. Demographic controls are important. Public (Medicare) and private ACO entry differ in reasonable ways. For example, Medicare spending is significant only for public ACO entry. State regulations of nursing and corporate practice of medicine have little effect.

In the future, we plan to extend this work by measuring the effect of ACO formation on utilization, health outcomes, costs, prices, and market concentration. Such an analysis would be useful to understanding fully both ACOs and the competitive effects of vertical integration more generally. As these markets evolve in the future, more data will make these studies of outcomes possible.

Appendix: Data Sources

Proprietary ACO Data

The Optum Institute proprietary data on ACOs was generated by its global searches of published peer reviewed, grey literature (such as working papers); government publications; news media and systematic Internet-web searches. Searches were conducted in May 2011, October 2011, and May 2012 to identify and document all ACOs that were operating or were in development across the US.[30] We found 230 entities that met inclusion criteria and are represented in our May 2012 database as having been in existence in either May 2011 or May 2012.

We included public and private ACOs, ACOs at all stages of development, and participants in an ACO implementation collaborative.[31] All organizations that clearly used population health management and accountability for population quality measures and that imposed financial risk on providers were included.

We excluded potential ACOs where we found no evidence of investments or documented steps towards ACO formation. Approximately 12 % of entities that were identified as "ACOs" in the general press were excluded from the data due to conflicting information or the absence of this evidence. We excluded older organizations that were formed before 2005. Geographically specific searches were conducted for each of the 50 states and the District of Columbia. We believe that our criteria have resulted in conservative estimates of the number of ACOs. We compared our California data to data that were collected for the same time period by Cattano & Stroud (CS). Nearly all counties with an ACO in our scan data also have one in the CS data. There are 12 counties where our scan data indicate an ACO but the CS data do not. This makes sense because our data use much broader sources. Our scan data are likely to pick up small-scale ACO entry that is not captured in the CS data. Further, our data include ACO in-development and in-pilot entry while the CS data do not.

Independent Variables

We include many county-level control variables that account for variation in healthcare market structure, health care practice, and regulatory and demographic environments. Median household income and Medicare spending are both normalized for county-level differences in price level, using Medicare's Geographic Adjustment Factor (Edmunds et al. 2012).

We include hospital, insurer, and physician concentration, as measured by the Herfindahl–Hirschman Index (HHI). The hospital data are from 2010 AHA Annual Survey of Hospitals, and the insurer HHI and HMO penetration are from the 2009

[30] This paper includes data that were gathered through May 31, 2012.

[31] Implementation collaborative include the American Medical Group Association (AMGA) Implementation Collaborative and the Premier Implementation Collaborative, and the Brookings-Dartmouth ACO Learning Network.

Health-Leaders-InterStudy. The physician site and group HHIs are calculated using 2010 physician census data from SK&A.[32]

From the AHA Survey, we obtain several measures of physician-hospital organization structure. Following Cuellar and Gertler (2006), we include the percentage of hospitals that operate as a "medical group without walls"; hospitals that operate as closed hospital-physician organizations; hospitals that operate as open hospital-physician organizations; fully integrated hospitals; and independent practice association (IPA) hospitals. We employ two measures of technology use: the proportion of eligible providers that have received payments from the Medicare and Medicaid Electronic Health Records Incentive Program, as of March 2012[33]; and the percentage of physicians who actively used an electronic health record to e-prescribe via the Surescripts Network, as of December 2011.[34] These are the only two independent variables that we could not lag, due to data limitations.

Using 2009 data from the Dartmouth Atlas, we include the number of Medicare discharges for ambulatory care sensitive conditions per 1000 Medicare enrollees (rescaled for convenience)[35] and also age, sex, and price-adjusted total Medicare Parts A and B per enrollee spending.[36]

We include corporate practice of medicine laws using 2006 data from Michal (2006), and we use 2007 data on the ability of nurse practitioners to authorize tests and operate without physician oversight from Catherine Dower et al. (2007).

From the 2009 to 2010 Area Resources file, we obtained each county's 2009 population. Finally, the Area Resources file provided the share of the population eligible for Medicare and Medicaid). See Table 2 for a list of variables, sources, and dates and Table 3 for maximums and minimums of the continuous variables.

References

ACO Market Activity. (2012). Optum Institute White Paper.

Afendulis, C., & Kessler, D. (2011). *Vertical integration and optimal reimbursement policy*. NBER working paper 17316, August 2011.

Alchian, A. A., & Demsetz, H. (1972). Production, information costs, and economic organization. *The American Economic Review, 62*(5), 777–795.

Atherly, A. (2002). The effect of medicare supplemental insurance on medicare expenditures. *International Journal of Health Care Finance and Economics, 2*(2), 137–162.

Auerbach, D. I., et al. (2013). Accountable care organization formation is associated with integrated systems but not high medical spending. *Health Affairs, 32*(10), 1781–1788. **(plus Appendix)**.

Berenson, R. A., Ginsburg, P. B., & Kemper, N. (2010). Unchecked provider clout in California foreshadows challenges to health reform. *Health Affairs, 29*(4), 699–705.

[32] Data from http://www.skainfo.com/physician-mailing-lists.php. HHI calculations by authors. We use data on physician group membership and physical location. For more detail on SK&A data, see Dunn and Shapiro (2014).

[33] Downloaded from http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/DataAndReports.html.

[34] Office of the National Coordinator for Health IT; Health IT datasets, downloaded from http://dashboard.healthit.gov/data/. Accessed May 2012.

[35] Downloaded from http://www.dartmouthatlas.org/tools/downloads.aspx#primary.

[36] Downloaded from http://www.dartmouthatlas.org/tools/downloads.aspx#reimbursements.

Bresnahan, T. F., & Reiss, P. C. (1991). Entry and competition in concentrated markets. *Journal of Political Economy, 99*(5), 977–1009.
Burns, L. B., & Pauly, M. V. (2002). Integrated delivery networks: A detour on the road to integrated health care? *Health Affairs, 21*(4), 128–143.
Burns, L. B., & Pauly, M. V. (2012). Accountable care organizations may have difficulty avoiding the failures of integrated delivery networks of the 1990s. *Health Affairs, 31*(11), 2407–2416.
Catherine Dower, J. D., Sharon Christian, J. D., & Edward, O. N. (2007). *Promising scope of practice models for the health professions*. Center for the Health Professions University of California, San Francisco.
Campbell, J. R., & Hopenhayn, H. A. (2005). Market size matters. *The Journal of Industrial Economics, 53*(1), 1–25.
Capps, C. S. (2009). Buyer power in health plan mergers. *Journal of Competition Law and Economics, 6*(2), 375–391.
Ciliberto, F. (2006). Does organizational form affect investment decisions? *Journal of Industrial Economics, 54*(1), 63–93.
Ciliberto, F., & Dranove, D. (2006). The effect of physician–hospital affiliations on hospital prices in California. *Journal of Health Economics, 25*, 29–38.
Cuellar, A. E., & Gertler, P. J. (2006). Strategic integration of hospitals and physicians. *Journal of Health Economics, 25*, 1–28.
Dafny, L. S. (2009). Estimation and identification of merger effects: An application to hospital mergers. *Journal of Law and Economics, 52*(3), 523–550.
Dafny, L. S., Dranove, D., Limbrock, F., & Scott Morton, F. (2011). Data impediments to empirical work on health insurance markets. *B.E. Journal of Economic Analysis & Policy*, *11*(2): Article 8.
Dartmouth Atlas of Health Care. (2013). Accessed March 2013. http://www.dartmouthatlas.org/data/region/
David, G., Rawley, E., & Polsky, D. (2011). *Integration and task allocation: Evidence from patient care*. NBER working paper 17419, September, 2011.
Dunn, A., & Shapiro, A. H. (2014). Do physicians possess market power? *Journal of Law and Economics, 57*(1), 159–193.
Edmunds, M., Sloan, F. A., & Steinwald, A. B. (Eds.). (2012). *Geographic adjustment in medicare payments: Phase II: Implications for access, quality and efficiency*. Washington, DC: The National Academies Press.
Elzinga, K. G., & Hogarty, T. F. (1978). The problem of geographical market delineation revisited: The case of coal. *Antitrust Bulletin, 23*(1), 1–18.
Elzinga, K. G., & Swisher, A. W. (2011). Limits of the Elzinga–Hogarty test in hospital mergers: The evanston case. *International Journal of the Economics of Business, 18*(1), 133–146.
Federal Trade Commission/Department of Justice, Antitrust Division. (2011). Statement of antitrust enforcement policy regarding accountable care organizations participating in the medicare shared savings program: Final statement. *Federal Register, 76*(209), 67026–67032.
Federal Trade Commission. (2014). *Policy perspectives: Competition and the regulation of advanced practice nurses*. Washington, DC.
Feldman, R., & Dowd, B. (1991). A new estimate of the welfare loss of excess health insurance. *American Economic Review, 81*(1), 297–301.
Frandsen, B., & Rebitzer, J. B. (2013). *Structuring incentives within organizations: The case of accountable care organizations*. Working paper, Boston University.
Frech, H. E, I. I. I. (1996). *Competition and monopoly in medical care*. Washington, DC: AEI Press.
Frech, H. E, I. I. I., Langenfeld, J., & McCluer, R. F. (2004). Elzinga–Hogarty tests and alternative approaches for market share calculations in hospital markets. *Antitrust Law Journal, 71*(3), 921–948.
Gaynor, M. (2011). *Health care industry consolidation, statement before the committee on ways and means health subcommittee*. Washington, DC: US House of Representatives.
Gaynor, M., Moreno-Serra, R., & Propper, C. (2013). Death by market power: Reform, competition and patient outcomes in the National Health Service. *American Economic Journal: Economic Policy, 5*(4), 134–166.
Goldsmith, J. (2013). Pioneer ACOs disappointing first year. *Health Affairs Blog*. http://healthaffairs.org/blog/2013/08/15/pioneer-acosdisappointing-first-year/.
Greaney, T. L. (2011). Accountable care organizations—the fork in the road. *New England Journal of Medicine, 364*(e1), e1(1)–e1(2).

Grosse, S., Putterman, L., & Rockenbach, B. (2011). Monitoring in teams: Using laboratory experiments to study a theory of the firm. *Journal of the European Economic Association, 9*(4), 785–816.
Haas-Wilson, D. (2003). *Managed care and monopoly power: The antitrust challenge*. Cambridge: Harvard University Press.
Haas-Wilson, D. (2009). *Managed care and monopoly power: The antitrustchallenge*. Harvard University Press.
Hall, M. A. (2005). The death of managed care: A regulatory autopsy. *Journal of Health Politics, Policy and Law, 30*(3), 427–452.
Hausman, N., & Lavetti, K. (2015). Physician concentration and negotiated prices: Evidence from state law changes. Unpublished paper, Department of Economics, Ohio State University.
Kellermann, A. L., & Jones, S. S. (2013). What it will take to achieve the as-yet-unfulfilled promises of health information technology? *Health Affairs, 32*(1), 63–68.
Kessler, D. P., & McClellan, M. B. (2000). Is hospital competition socially wasteful? *Quarterly Journal of Economics, 115*(2), 577–615.
Klein, B., Crawford, R. G., & Alchian, A. A. (1978). Vertical integration, appropriable rents, and the competitive contracting process. *Journal of Law and Economics, 21*(2), 297–326.
Kleiner, S., Lyons, S., & White, W. D. (2012). Provider concentration in markets for physician services for patients with traditional medicare. *Health Management, Policy and Innovation, 1*(1), 3–18.
Kuo, Y.-F., Loresto, F. L, Jr, Rounds, L. R., & Goodwin, J. S. (2013). States with the least restrictive regulations experienced the largest increase in patients seen by nurse practitioners. *Health Affairs, 32*(7), 1236–1243.
Leibenluft, R. F. (2011). ACOs and the enforcement of fraud, abuse, and antitrust laws. *New England Journal of Medicine, 364*(2), 99–101.
Lewis, V. A., et al. (2013). Accountable care organizations in the united states: Market and demographic factors associated with formation. *Health Services Research, 48*(6 part 1), 1840–1858.
McCormick, D., Bor, D. H., Woolhandler, S., & Himmelstein, D. U. (2012). Giving office-based physicians electronic access to patients' prior imaging and lab results did not deter ordering of tests. *Health Affairs, 31*(3), 488–496.
McFadden, D. F. (1974). Conditional logit analysis of qualitative choice analysis. In P. Zarembka (Ed.), *Frontiers in econometrics* (pp. 102–145). New York: Academic Press.
McGuire, T. G. (2000). Physician agency. In A. J. Culyer & J. P. Newhouse (Eds.), *Handbook of health economics* (Vol. 1a, pp. 461–536). Amsterdam: Elsevier.
Michal, M. H., et al. (2006). Ctr. to advance palliative care, corporate practice of medicine doctrine: 50 state survey summary (2006). Retrieved December 15, 2013 from http://www.nhpco.org/files/public/palliativecare/corporate-practice-of-medicine-50-state-summary.pdf
Mobley, L. R., & Frech, H. E, I. I. I. (2007). Health insurance: Designing products to reduce costs. In V. J. Tremblay & C. H. Tremblay (Eds.), *Industry and firm studies* (4th ed., pp. 158–180). Armonk, NY: M.E. Sharpe.
Mobley, L. R., Frech, H. E, I. I. I., & Anselin, L. (2009). Spatial interaction, spatial multipliers and hospital competition. *International Journal of the Economics of Business, 16*(1), 1–17.
Nevo, A. (2014). Mergers that increase bargaining leverage. U.S. Department of Justice, Antitrust Division.
Nyweide, D. J., et al. (2015). Association of pioneer accountable care organizations vs. traditional medicare fee for service with spending, utilization, and patient experience. *JAMA, 313*(21), 2152–2161.
Pauly, M. V. (1986). Taxation, health insurance, and market failure in the medical economy. *Journal of Economic Literature, 24*(2), 629–675.
Rebitzer, J. B., & Votruba, M. E. (2011). *Organizational economics and physician practices*. NBER working paper no. 17535, October, 2011.
Rich, R. F., & Erb, C. T. (2005). The two faces of managed care regulation & policymaking. *Stanford Law & Policy Review, 16*(1), 233–276.
Scheffler, R. M., Shortell, S. M., & Wilensky, G. R. (2012). Accountable care organizations and antitrust. *JAMA, 307*(14), 1493–1494.
Schneider, J. E., et al. (2008). The effect of physician and health plan market concentration on prices in commercial health insurance markets. *International Journal of Health Care Finance and Economics, 8*(1), 13–26.
Sein, K. (2006). An empirical model of firm entry with endogenous product-type choices. *The Rand Journal of Economics, 37*(3), 619–640.

Sidorov, J. (2006). It ain't necessarily so: The electronic health record and the unlikely prospect of reducing health care costs. *Health Affairs, 25*(4), 1079–1085.

Sloan, F. A., & Hall, M. A. (2002). Market failures and the evolution of state regulation of managed care. *Law and Contemporary Problems, 65*(4), 169–206.

Thomasson, M. (2003). The importance of group coverage: How tax policy shaped U.S. health insurance. *American Economic Review, 93*(4), 1373–1384.

Town, R., Feldman, R., & Kralewski, J. (2011). Market power and contract form: Evidence from physician group practices. *International Journal of Health Care Finance and Economics, 11*(2), 115–132.

Werden, G. J. (1981). Use and misuse of shipments data in defining geographic markets, the. *Antitrust Bulletin*, *26*, 719.

Wilensky, G. R. (2011). Lessons from the physician group practice demonstration—A sobering reflection. *The New England Journal of Medicine, 365*(18), 1659–1661.

Williamson, O. E. (1985). *The economic institutions of capitalism*. New York: Free Press.

Williamson, O. E. (1991). Comparative economic organization: The analysis of discrete structural alternatives. *Administrative Science Quarterly, 36*(2), 269–296.

Yee, T. E., Boukus, D. C., & Samuel, D. (2013). *Primary care workforce shortages: Nurse practitioner scope-of-practices laws and payment policies*. National Institute for Health Care Reform. Research brief no. 13, February, 2013.