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How Vertical Integration Affects Health Outcomes and Total Costs for Medicare Recipients *

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Abstract

Recent years have seen a sharp increase in the number of healthcare providers employed by health systems. The implications of this trend are poorly understood and controversial. To shed light on the phenomenon, we exploit rich data from the Centers for Medicare and Medicaid Services in conjunction with a set of mergers that financially integrated one or more hospitals with formerly independent physician practices. We specifically examine whether these transactions are associated with changes in the location of service provision, overall costs, and health outcomes. Our results suggest that these mergers have had heterogeneous effects. Some mergers led to statistically significant reductions in hospital utilization and costs, while others produced the opposite. An analysis of the determinants of mergers' effects suggests that transaction-level details matter a great deal.

JEL Codes: Keywords: Vertical integration, mergers, healthcare

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I Introduction

Historically, the U.S. healthcare system has been characterized by physician groups, hospitals, and other providers all operating relatively independently. However, for at least the last 10 years, providers have increasingly become parts of larger, financially integrated systems. For example, survey evidence from the American Medical Association indicates that between 2007-2008 and 2012-2013, the proportion of physicians partly or fully employed by hospitals almost doubled from 16 percent to 29 percent (Kane and Emmons, 2013).[1] The increase has been accomplished by both mergers and new physicians' growing preference for employment rather than solo practice.[2] Regardless of how it was accomplished, economic theory does not provide unambiguous predictions about the effects of this type of consolidation, which has given rise to considerable debate about whether or not the changes are concerning (Gottlieb, 2013) or a sign of improvement (Blankenthorn, 2009). Moreover, to date, the empirical implications of this major structural change remain poorly understood.

To shed light on the issue, we assess the consequences of 45 different mergers between hospitals and physicians' groups that operated in close geographic proximity to each other.[3] We exploit highly-detailed claims-level data from the Centers for Medicare and Medicaid Services (CMS), which offer several important advantages. First, they provide access to the medical claims of a representative sample of Americans sixty-five and older, a population that

[1]The rise cannot be attributed soley to the passage of the Affordable Care Act (ACA), which encouraged different types of healthcare providers to at least partially integrate as "affordable care organizations."

[2]See, e.g., the Advisory Board Company's discussion of recent evidence at `http://www.advisory.com/Daily-Briefing/2012/07/10/More-than-75-percent-of-newly-hired-physicians-will-work-for-hospitals`. See also Dafny (2013) for a discussion of the implications of hospital market consolidation.

[3]These acquisitions represent both the acquisition of physician groups by hospitals, and hospitals by physician groups.

accounts for a large and growing share of overall healthcare episodes.[4] Second, the granularity of the data allow us to observe the nature of care as well as the overall distribution of hospital claims. This richness permits us to determine whether mergers are causally associated with changes in how care is provided, differences in the overall cost to CMS, and variation in simple measures of clinical care quality. Finally, since CMS administratively determines provider reimbursement, we can assess whether governmental reimbursement policies, such as location-based billing, affect the costs and method of treating patients.

Following the bulk of the prior literature (Ashenfelter and Hosken, 2010), we use standard panel data program evaluation methods to identify the mergers' effects. We contrast the results from specifications that assume a common effect across mergers to the results found by estimating each merger's effect, separately. This permits us to rigorously assess the importance of unobserved differences across the country as well as directly test whether vertical mergers have heterogeneous effects.

In specifications that pool mergers and estimate an average effect, we find that vertical integration is associated with moderately increased expenditures by CMS in the hospital-based outpatient setting.[5] Moreover, we find evidence suggesting that some of this increase occurs as a result of shifting treatment episodes from physicians' offices to the outpatient departments of hospitals. Such shifting is consistent with the hypothesis that vertical integration is a response to the incentives created by Medicare's location-based billing policies,

[4]This ignores the selection associated with Medicare Advantage plans, which compete with traditional Medicare. Unfortunately, claims for Medicare Advantage plans, and privately-insured plans more generally, are not widely available.

[5]To be clear, in these models, we focus on the average effect of a vertical merger and not the effect of the average merger. As discussed in recent work by Gibbons et al. (2014), these are not necessarily the same.

which provide higher compensation for treatments provided in a hospital relative to otherwise otherwise identical treatments provided in physician offices. However, all of these pooled estimates are imprecisely estimated, and not statistically significant at conventional levels.

When we estimate the impact of each merger separately, we find quite a different set of stylized facts. While the average estimated effect is similar in sign to that from our pooled results for most outcome variables, the average magnitude is smaller. This suggests that even non-merging hospitals located in areas experiencing mergers behave differently than those in other parts of the country. Moreover, the estimated effects were highly heterogeneous, with non-trivial numbers of mergers associated with results that are quite different from the average. For example, we observe 12 transactions associated with statistically significant reductions in the utilization of hospital outpatient departments for office care.

Though characterized by substantial variation, certain broad generalities nevertheless appear in our individual merger effects. In particular, it does appear that most mergers increased CMS' overall expenditures relative to other local hospitals, which is consistent with the findings of the most similar previous study of vertical integration's impact on Medicare patients (Afendulis and Kessler, 2007) as well as recent analyses of the impact of vertical integration on the commercially insured (Baker et al., 2014). Interestingly, the increase in costs appears to reflect relatively higher average expenditures per visit rather than dramatic increases in the number of visits, which runs contrary to the inference one would take from our pooled models. This difference again suggests that local markets where mergers are taking place are unobservably different, and that all hospitals in these areas are utilizing

their outpatient departments relatively more intensively – as opposed to more extensively – for reasons other than the merger. Moreover, these findings are at odds with the concern that vertical integration is simply a means of taking advantage of CMS' location-based billing policies.[6] Similarly, they are inconsistent with the claims of non-merging hospitals that such transactions are done to foreclose hospital markets (Lowes, 2014).

Finally, although an imperfect measure of overall clinical quality, our results are notable for *not* suggesting consistent improvements in mortality rates among patients. If anything, our results suggest that the average merger leads to a modest increase in the likelihood that patients die within a quarter of their outpatient treatment episode following a merger. However, these results are highly preliminary and await further study.

To further explore the variability of our merger-by-merger estimates, and their plausibility, we examined a series of different factors. First, we checked how the different estimated effects were correlated, finding broadly intuitive results. Higher overall CMS expenditures are positively associated with higher total claims as well as increased office visits and higher average expenditures per claim. On the other hand, spending per claim was negatively associated with more office visits, which makes sense given the low acuity of these encounters. Interestingly, we observe nothing being especially strongly correlated with mortality, which is weak evidence that any change in that outcome is not driven by a change in the characteristics of the underlying patient population.

Second, we decompose the estimated effects on simple explanatory variables related to the parties involved in the transaction. Our results suggest that acquisitions involving car-

[6]See, e.g., Medpac's March 2012 Report to the Congress.

diologists are likely to lead to increased emergency department visits and lower spending per claim. Although we cannot directly identify the mechanism for why cardiologists should differ from other types of physicians, we hypothesize that cardiologists may have greater influence over patient behavior than other types of physicians. This would be consistent with anecdotal reports about cardiologists following up with patients and inducing them to seek immediate emergency care (Jenkins, 2014). In contrast, involvement by a multi-hospital system is associated with reduced emergency department visits and a slight (but statistically insignificant at conventional levels) increase in mortality.

Finally, we examine the specific circumstances of a handful of mergers to see if a finer set of observables might help to explain their outcomes. In this small sub-sample, we observe that large structural events, such as the opening of a new hospital or the settlement of a legal dispute with the Department of Justice, are often associated with the mergers and are intuitively correlated with the effects. This suggests that idiosyncratic factors may be highly influential in determining merger outcomes, which is consistent with the heterogeneous effects that we find. However, it implies that stakeholders should be hesitant to apply any particular rule of thumb to a proposed merger as opposed to thoroughly investigating it.

The paper is organized as follows: Section II quickly reviews the existing literature on vertical mergers in health services markets, and describes the Medicare billing framework that might incentivize location-shifting by vertically integrated care providers. Section III describes our data. Section IV presents our empirical strategy, while Section V discusses our findings. In Section VI, we conclude.

II Background and Literature Review

II.1 Literature Review

The theoretical literature on vertical integration is rich, but frequently provides ambiguous predictions about the relationship between the boundaries of the firm and economic behavior or outcomes. The comparative statics are highly dependent on the underlying modeling assumptions. For example, research on agency issues has shown that the integration of complementary services may better align all parties' incentives, facilitating the provision of higher service quality and reducing prices (Spengler, 1950, Brickley and Dark, 1987, Cooper et al., 2005). Similarly, transactions cost models ten to predict that vertical integration reduces contracting frictions and encourages investment in efficiency-enhancing technologies since the residual claimant and party responsible is unambiguous (Bresnahan and Levin, 2012).

On the other hand, theoretical models focusing on information asymmetries tend to show that integrating the provision of a service with the decision over how much is needed can lead to over-production in the presence of asymmetric information (Wolinsky, 1993). Moreover, vertical integration may also lead to a reduction in competition if it facilitates the foreclosure of a previously unconcentrated market (Whinston, 2006). This possibility has been a key concern of market participants in several recent cases (see, e.g., Lowes (2014)).

The welfare ambiguity in the theoretical literature leads to an obvious need for empirical assessment. Regrettably, the existing evidence on the implications of vertical integration in healthcare markets does little to settle the debate about whether the integration of complementary provider services increases or decreases total welfare. The papers examining the

issue are small in number and mixed in their findings.[7] Most have focused on the implications of vertical integration on commerically insured patients. For example, both Cuellar and Gertler (2006) and Ciliberto and Dranove (2006) exploit state discharge data in conjunction with American Hospital Association survey data on hospital characteristics, and control for the endogeneity of outcomes and forms using fixed effects. Despite similar data and methods, they reach largely opposite conclusions. Cuellar and Gertler (2006) find that integration leads to higher discounted charges, while Ciliberto and Dranove (2006) do not.[8]

In recent work, Baker et al. (2014) extend the literature by using data from Truven MarketScan, which contain actual price information.[9] They examine a variety of outcomes as a function of the share of hospitals within a county that are vertically integrated, finding evidence of higher prices and spending in counties with more vertical integration. In addition, the data suggest that integration reduces readmissions. Thus, Baker et al. (2014) implies that the overall welfare effects of vertical mergers are mixed. While an improvement on the previous findings, the paper is nevertheless vulnerable to concerns about the endogeneity of prices and market structure insofar as they are unable to rule out the possibility that higher unobservables simultaneously influence the extent of vertical integration and pricing.

Afendulis and Kessler (2007) circumvent the endogeneity of prices and market structure by comparing spending and health outcomes for Medicare patients seen by "integrated" cardiologists relative to those seen by non-integrated ones. The focus on publicly insured

[7] See also the recent survey by Burns et al. (2013), which includes coverage of some of the health literature.

[8] Cuellar and Gertler (2006) also find that integration does not impact overall utilization or quality. Ciliberto and Dranove (2006) do not report on this issue.

[9] Both Cuellar and Gertler (2006) and Ciliberto and Dranove (2006) only had access to hospitals' charge-master rates, not the prices they actually receive for services provided. As discussed in Herman and Ulrick (2012), these may be very different.

patients removes the need to worry about the cross-sectional endogeneity of prices, since CMS administratively determines them based on average costs across the entire nation. Further, difference-in-difference comparisons control for geographically-determined cross-sectional confounders. The paper finds that vertical integration statistically significantly increases spending, but does not similarly alter outcomes for all patients. Focusing on the subset of patients requiring surgery, however, they find the opposite: lower spending and superior outcomes. While highly useful, the paper does not clarify what underlies any of the changes in spending patterns. In particular, it does not indicate whether the higher spending simply reflects the higher compensation paid for treatment in out-patient centers, an increase in utilization on the extensive margin, or delivery of more sophisticated procedures (i.e., a change on the intensive margin) whose health impact may not be detectable in their sample period.

In this paper, we follow Afendulis and Kessler (2007) in focusing on Medicare patients, but build on their approach by exploiting quasi-natural experiments that shock the existing market structure. In addition, by assembling a set of dozens of mergers, we are able to explore whether observables may explain any variation in their causal impacts. Finally, by focusing on a set of complementary outcome metrics, we can more precisely gauge the mechanisms through which vertical integration acts.

II.2 Medicare Reimbursement

In many respects, the combination of physicians and hospitals are similar to other types of acquisitions that combine complementary or vertically related services. However, these types of acquisitions also have attracted critical attention because of a unique regulatory benefit associated with only these types of combinations. The benefit, which accrues to the integrated system, is related to the interaction of various state laws and the nature of CMS' reimbursement policies.

CMS currently reimburses outpatient Medicare claims as a function of the (estimated) *total* cost of treatment. In other words, the policy takes account of both both fixed and variable cost components.[10] This policy is known as "provider-based billing" (PBB), for it factors in the variation in total cost due to the location of care provision. Thus, under PBB, outpatient services provided to Medicare patients seen in physician offices are reimbursed at one rate, while the same service performed in a hospital outpatient department (OPD) receives another (higher) rate. Medicare reimbursement for services provided at hospitals are often higher than those of a physician office because the fixed costs of running an OPD exceed that of a physician office. The differences in overall reimbursement may be substantial. For example, a doctor would receive $68.97 for a 15-minute visit for an established patient (CPT code 99213) when done in their office, but the same visit in an OPD could be as much as $124.40, of which $75.13 goes to the hospital.[11]

[10]CMS currently reimburses most inpatient admissions using fixed payments for treatment-oriented diagnosis-related groups (DRGs). Medicare's inpatient billing strategies does not impact the incentives to vertically merge as inpatient services can only be provided in hospitals.

[11]See Medpac's March 2012 Report to the Congress.

One might expect that physicians would respond to the incentives created by PBB by referring patients to hospitals (or performing services at the hospital) under some arrangement that allows them to share in the differential payment rents. However, anti-kickback Stark laws restrict the ability of hospitals to pay providers for referrals. These laws imply that physicians and hospitals can only share in the rents if the same entity employs the physician and owns the hospital. In such circumstances, a profit-maximizing decision-maker would shift patients to OPD's in order to capture the mechanically higher payments.

Thus, CMS' rationale for offering differential payment crucially depends on the independence of the physician's decision to refer to a hospital. Independent doctors' self-interest would cause them to prefer to provide care in their office, where they are the full residual claimant, even though the total compensation would be higher if the service were performed in a hospital setting. Thus, only if there are patient characteristics suggesting better outcomes if treated in a hospital will CMS end up paying the higher rate. However, CMS' policy may provide incentives for hospitals to acquire physicians in order to avoid the Stark laws and share in the reimbursement rent differentials.

Correlating the rising trend of vertically integrated physicians and an increase in the number of procedures performed in outpatient departments (e.g., a 6.7 percent increase between 2009 and 2010 for the basic office visit discussed above), both CMS and other commentators have become increasingly concerned that such profit-maximizing patient-shifting is occurring and having economically significant effects on spending. For example, the 2012 Medpac Report to Congress hypothesizes that the integration of physicians and hospitals could lead

annual expenditures to increase by $2.5 billion if current trends persisted for another 10 years.

However, an ability to capture the mechanical increase in reimbursement is but one effect of a merger. As noted above, the combination of complements may have any number of effects that, depending on circumstances, may mitigate or exacerbate these types of effects. Neither the Medpac report, nor other analyses, have been able to dispositively link vertical integration to alterations in the location of provided services much less variation in other outcomes.

III Data

III.1 Five Percent Sample of Medicare

The hospital claims from a 5% Medicare sample comprise our principal dataset.[12] Patients are tracked over time with a unique identifier that allows us to associate all services and events to an individual patient. Once a patient enters the sample, all of their subsequent hospital-based interactions are recorded for the period between 2005 and 2010. The 5% sample of Medicare beneficiaries leads to a sample size of approximately 2.5 million persons per year. While the claims are inclusive of both inpatient admissions and hospital outpatient visits, we focus exclusively on outpatient interactions as this is the area most likely to be directly affected by vertical integration.

Each record provides details about the patient, the claim (i.e., services performed), and

[12]The sample represents 5% of Medicare recipients.

the provider. The patient information includes age, sex, and residential zip code of the individual. However, in the current analyses, we largely abstract from patient level characteristics to focus on aggregate behavior at hospitals. In terms of the nature of the visit, our data provide detailed information about the diagnosis of the patient (i.e., up to 25 5-digit ICD-9 codes), as well as details about the types of services performed (e.g., DRG codes for inpatient admissions, and CPT codes for outpatient visits) and the specific dates on which each "event" and service occurred. Provider information includes the name, address, and tax id of the hospital. In particular, the data are able to separately identify claims to each hospital in every system. We relate the facility information to the system owner of all the facilities in our data at any point in time using data from the American Hospital Association.

To assess the impact of mergers, we focus on six outcome measures, each of which is measured at the hospital-quarter level, that might be affected by vertical integration. These six variables can be divided into three categories. The first relates to the volume of services of provided, which we consider in three different ways. First, we focus on the number of claims that contain a CPT associated with a "basic office" visit. We choose to look at "basic office" visits because they are the focus of Medpac's 2012 discussion of location-shifting. The second is the number of visits to the emergency department at the hospital, which is a service that the previous academic literature has not associated with being affected by vertical integration. Third, we consider the total number of hospital-based outpatient claims, which might provide some insight into claims that from competitors that vertical mergers are a tool used to foreclose hospital markets.

Our second group of variables are for financial outcomes. First, we focus on total CMS expenditures for outpatient procedures. As a means of further testing what might underlie such a change, we examine the average expenditures associated with each claim. If we observe an overall increase in expenditures, but a decline in the average expenditure per claim, this would buttress the argument that the mergers are a mechanism through which providers can take advantage of the current billing system. This would particularly be the case if we observe an increase in all claims and/or "basic office" ones.

Finally, we focus on the most common metric for evaluating clinical quality: mortality. In particular, we focus on the likelihood that a patient seen during an outpatient visit dies within three months of that visit. To be sure, this is a flawed metric for evaluating quality. One might imagine that if the merger leads to a dramatic increase in low acuity claims, then the relative probability of death at the hospital-quarter level might decline even if there were some associated deterioration in quality. Nevertheless, we include this variable as some of our other results should allow us to assess whether this confounding mechanism appears likely, and we simply find the net effect of increased integration on mortality to be an interesting question. In future work, we plan to explore whether focusing on events at a more granular level alters the results.

III.2 Levin and Lexis-Nexis Merger Databases

We merge the Medicare data with a list of healthcare provider mergers that occurred between the third quarter of 2005 and the second quarter of 2010. We identified these mergers using

the Levin Health Care Acquisition Reports, which we then supplemented with the Lexis-Nexis database of mergers. On only two occasions did a merger that appeared in one dataset also appear in the other.[13]

Once we identified our candidate mergers, the associated geographic markets and provider numbers of the involved hospitals were identified by hand.[14] Both databases report the date that the deal was announced as well as the date that the deal was closed. Our baseline approach is to assume the structural break in incentives occurred on the date of close. However, as this variable was not identifiable for all transactions, we used the announcement date when necessary. If substantially incorrect about when the merger actually begins to affect physicians' referral behavior, this approach will lead to attenuated estimates of the true merger effect, and hence is a conservative approach.[15]

III.3 Descriptive Statistics

Table 1 shows descriptive statistics for all of our outcome variables distinguishing between merging and non-merging hospitals. The Table shows that merging hospitals tend to see more CMS patients in all settings than non-merging ones. They also receive both higher total and per-visit compensation on average. Their comparative mortality rates are lower.

[13]This may reflect the separate underpinnings of the two data sources. The Levin Reports are annual lists of mergers and acquisition activity in the healthcare sector compiled by the Irving Levin Associates, a private company. The reports indicate that their lists are generated from public announcements, SEC filings, and interviews with industry management. The Lexis-Nexis database culls public announcements of mergers, identifying the merging parties, their industries, which party was the target, and the values associated with the deal. We hope to explore alternative approaches to dating mergers in future work.

[14]Table A-1 in the Appendix details the names of the target and acquiring firm, the data source, number of hospitals involved, and transaction date.

[15]Two buyers in our list of mergers engaged in multiple acquisitions. We have excluded these mergers from the pooled regression, since it muddles the pre/post-comparison we are estimating. However, these acquisitions are considered when we look at each merger separately.

This strongly suggests that the hospitals being "assigned" to treatment are non-randomly selected.

Table 2 shows summary statistics for just the merging hospitals distinguishing between the pre- and post-periods. It indicates that on average vertical mergers are associated with substantial increases in the number of office visits and smaller, though still economically significant, increases in the number of overall claims. Interestingly, both financial metrics on average grow by around one quarter.

The combination of the two tables suggests that vertical mergers are associated with behavioral changes; however, they also strongly indicate that such mergers do not occur in a vacuum. Therefore, we now turn to methods that more rigorously allow us to control for potential confounding factors.

IV Econometric Approach

The standard concern when trying to identify the impact of an event (or events) using non-experimental data is that there may be confounding factors associated both with the incident and the outcomes of interest. We address this concern using standard approaches from the literature on difference-in-differences estimation, exploiting variation in the control group and included geographic/intertemporal controls.

IV.1 Pooled Models

We begin with the least restrictive sample available to us. We use our entire sample window, and simply require that there be at least two quarters of data prior to the merger and two quarters after it in order to identify any change from the financial integration of the different provider types. We do drop the quarter in which we believe our merger took place to account for the possibility that the change in control takes some time to be realized.

Our estimating equation takes the following form:

$$y_{hmt} = \alpha_h + \beta AFTER_{ht} + \Gamma_{mt} + \epsilon_{hmt}, \tag{1}$$

where y is the outcome of interest for hospital h in market m at time (i.e., quarter-year) t, α is a hospital-specific fixed effect, $AFTER$ is an indicator variable that takes the value of 1 if the hospital has merged by t, Γ is a function that addresses intertemporal (as well as perhaps inter-regional) variation, and ϵ is the unobserved information.

In our first specification, Γ is simply a set of quarter-year dummies. Thus, the vertical merger effect β is identified off of variation between the control and merged sample controlling for time invariant hospital unobservables and intertemporal variation affecting all hospitals. We supplement this model with one that also includes CBSA-state specific quadratic time trends. In this model, effects are identified off of differences between the control and treated samples with geographic trends having been netted out.[16]

[16]Two systems in our sample purchased multiple physicians groups. In these instances, the pre-period for one acquisition is also the post-period for another acquisition in the same system. To avoid the potentially confounding effects of this, we have excluded from our pooled analysis the hospitals and systems that appear multiple times.

Specification (1) assumes that all vertical mergers have the same proportional effect on affected hospitals, and that the effects do not vary over time. These choices differ from those made in many recent merger retrospectives, where the control group is often also selected to be geographically distinct, albeit similar to, the treatment group. These standard approaches have the advantage of reducing the possibility that the treatment and control groups are subject to different trends. However, given our use of Medicare data, such peer effects are less likely than if we used the outcomes for payers that are bilaterally negotiated.[17] Moreover, by varying the extent to which we refine the control group using additional measures to account for heterogeneity, we can gain insight into the type and magnitude of unobservable confounding factors.

For all of the outcomes except the likelihood of mortality, we use the log of the variable (plus one) described above. The estimated coefficient on $AFTER$ can thus be interpreted as the percent change in the outcome due to the merger relative to the control group. We cluster the standard errors at the hospital level.

IV.2 Merger-by-Merger

The assumptions underpinning our pooled approach may be strong. It is possible that the impact of mergers differ as as result of differences in the parties involved. For example, one would not necessarily anticipate the same proportional effect at a small hospital as a large one from the acquisition of a given physician practice. Furthermore, there may be

[17] E.g., consider the consequences of the same-market comparisons if the experimental group negotiated with the same payers for the same patients as the control groups.

systematic variation in the ease which which different acquirors integrate their purchased assets or behavioral variation across the country not captured by Γ.

For this reason, we relax the assumption that every merger has the same effect by estimating the impact of each merger, separately. In these specifications, we also refine our approach by limiting the control group to be other hospitals in the same CBSA as hospitals impacted by the merger. While these choices more broadly fit with those in the merger retrospective literature (Ashenfelter and Hosken, 2010, Garmon, 2014), it should be noted that they nevertheless make strong assumptions. In particular, the validity of the control group requires that the other hospitals in the local area are not impacted by the merger. If in fact this assumption does not hold, and some element of the change at the treated hospitals comes at the expense of the merged hospitals, then we will be upwardly biasing our estimated treatment effects. Thus, finding a lack of any significant effect from a merger is particularly strong evidence that the transaction does not causally alter behavior.[18]

The particulars of our estimating approach for the merger-by-merger models closely tracks that for our pooled specification. The chief difference is that for mergers in very small areas where there may only be one or two hospitals, we simply estimate a model with the $AFTER$ variable and year fixed effects. In addition, in these small markets, we no longer cluster at the hospital level but instead simply account for the possibility of heteroskedasticity.

[18]In future work, we plan to explore whether implementing a bounds estimator as in Huse and Koptyug (2013) leads to substantial qualititative changes in the estimates.

V Empirical Findings

V.1 Pooled Models

Table 3 contains the results of our pooled analyses. For each of our six different outcome variables, the estimated merger effects are reported for the two different methods of addressing regional variation in trends.

Evaluating the results shown in Table 3, we find – consistent with expectations – that any change in emergency visits after a merger are very small in magnitude and not statistically significant. In contrast, the point estimates on the number of office claims are quite large in economic magnitude, suggesting that mergers trigger an increase of 10-16% in such visits. These sizable changes would appear to buttress the allegations made by MedPac (2012) that rising vertical integration is associated with changes in the location of treatment that are made to take account of mechanical differences in compensation for the equivalent service. Despite the large magnitude, however, these effects are imprecisely estimated and not statistically different from zero at conventional levels. Moreover, it is worth pointing out that the estimated changes for office and total claims are substantially smaller than implied by the pre/post differences shown in Table 2. This indicates that there has been a general increase in the utilization of out-patient departments over time.

Focusing on the average financial implications of vertical mergers, our results indicate that CMS's reimbursements for outpatient care increase by 2-3 percent after a vertical merger. In contrast, we find that spending per patient visit decreases with the merger, but also not statistically significant.

These different results suggest that mergers are having effects on both the intensive and extensive margin. On the extensive margin, merged hospitals are seeing more patients (or patients more often). However, the average effect of a vertical merger in our data seems to be a reduction in the intensity of care provided per encounter insofar as CMS' average cost per encounter declines. These changes are consistent with the direction of the results for office visits. If the mergers trigger a shift toward providing more treatments in hospitals, which had previously been performed in doctors' offices, this should both lead to greater overall spending, and lower average costs since these services are likely to be lower acuity than those services which can only be performed in a hospital. However, given the imprecision of the effects, these conclusions should be considered with substantial caution.

Finally, we find that any changes in treatment patterns caused by the mergers are largely uncorrelated with major changes in patients' health. Our estimates suggest that the average vertical merger is associated with a statistically insignificant change in mortality rate. Although hardly an indication that vertical integration has large adverse consequences for patients, these estimates are highly inconsistent with the statements of some stakeholders that such integration is a critical step in improving patient health through better coordination of care.

Overall, the pooled estimates calculate the average change following a physicians' group-hospital merger. The fact that we find a positive correlation with overall spending is directionally consistent with other recent work assessing the implications of vertical integrations such as Baker et al. (2014), who report that a one standard deviation in the share of hospitals

that operate as fully integrated organizations would lead to commercial insurers' spending almost 2.5 percent more on average. Across the different outcome variables, we observe comparatively little action on the difference in specifications. This might suggests broadly similar trends nationwide. However, given the very sizable standard errors for our estimates, we believe this conclusion should be approached with significant caution. We now turn to analytical approaches that allow us to assess whether the imprecision of our pooled estimates stems from variation in the underlying effects of vertical mergers.

V.2 Individual Merger Effects

Table 4 shows the means and standard deviations for the different estimates. Overall, the Table shows that the average individual merger's effects tend to be directionally similar to those found in our pooled models. However, they are of substantially smaller economic magnitude. For example, our average effect on the number of office visits is only around a fifth of what we found before. This would be consistent with there being substantial differences in trends at the local market level, which our national control group fails to account for.

The table also highlights the extremely high degree of variation of our estimates. For example, the coefficient of variation (i.e., the ratio of the standard deviation to the mean) for the estimated effects on the number of office visits is over 10, which is very high. This suggests that a prominent reason for the imprecision of our national estimates is that there are highly heterogeneous treatment effects.

The extent of the variation in estimates for our different mergers and outcome models can

be seen in detail in Figures 1 - 6. In each figure, the point effects are represented by the blue bars, and the 95% confidence intervals by the red whisker plots. The mergers are sorted based on announcement date of the transfer of control rights. Thus, any trend in the magnitude or precision of the estimated effects will be evident. One obvious concern would be that our lower bound of a two quarter pre or post period was insufficient. If that were the case, we would expect to see especially noisy or attenuated estimates at the beginning and/or end of the figure. Looking across the different figures, these patterns are not obviously evident in the data, suggesting that out effects window is not obviously affecting our estimates.

Focusing on whether or not mergers are associated with changes in the utilization of out-patient departments, i.e., Figures 1 - 3, we find that merging with a physician practice has a statistically positive significant impact on office visits in only 8 of the 45 mergers. In contrast, we find that such mergers were associated with statistically significant declines in 12 separate occasions. Such heterogeneous estimates at least facially suggest that whether or not vertical integration leads to the type of location shifting feared by MedPac may well be merger-specific. Focusing on the change in emergency department visits, we observe that although most effects were of small magnitude and no statistical significance, as in the pooled results, there were nonetheless 9 mergers associated with statistically signficant increases (and three with statistically significant declines). This may indicate that physicians' ability to alter patients' choices is more profound than than has generally been hypothesized.

Finally, we observe that there is very little impact in most cases on the total number of claims performed. This result appears to significantly rebut the claims of market participants

that vertical integration is a means to foreclose on competitors and monopolize the hospital care market. Although there are a couple of instances when a merger can be said to have increased the volume of treatment, they certainly do not constitute the bulk of transactions.

Shifting gears to consider the financial variables, we see continued evidence of considerable heterogeneity. That said, certain stylized facts appear to hold more broadly than for utilization. First, Figure 4 shows that in the majority of instances, vertical mergers are associated with increased total compensation from Medicare (31 of 45). Moreover, not only are there more positive estimated effects, more of them are statistically significant. Insofar as the total number of claims seems to have remained broadly unchanged, this would seem to suggest an increase in the average compensation per claim. Figure 5 shows that this is indeed the case. In most instances, the per visit compensation received by a merging hospital appears higher than that recieved by neighboring hospitals. This may reflect an increase in the level of acuity of patient visits as the doctors centralize more of their high cost procedures in a single hospital. We hope to explore this question in a more granular fashion in future work.

Finally, Figure 6 shows the results for mortality. It indicates that most mergers were not associated with statistically significant changes in the incidence of mortality following treatment. However, of those comparatively rare number of mergers associated with precisely estimated results, we find more quality-reducing mergers. While we cannot rule out the possibility that some of this increase may reflect an increase in the acuity of patient conditions, which would be consistent with greater spending per claim, the raw estimates

appear inconsistent with the claims that vertical mergers are a necessary tool to increase care coordination and improve patients' outcomes. We plan to explore these issues further in future work.

Overall, our individual merger results clearly indicate that vertical healthcare providers mergers have different implications depending on context. However, the results themselves do not provide any insight into whether the variation is coherent or predictable.

VI Determinants of Variation

VI.1 Examining Correlation between Estimates

As a first step in evaluating the differences across the vertical mergers in our sample, we assess the correlation between the various merger effects across the mergers we have considered. These correlations are presented in Table 5.

The merger effects for ER and office visits are positively correlated with the merger effects for the number of claims, total outpatient spending, and mortality, but negatively correlated with average spending. When the acquisition increases the number of patient visits to a hospital, they increase the hospital's outpatient revenue. However, these new visits are reimbursed at a lower level than the procedures and visits already being performed in the hospital's outpatient setting, since they use fewer resources (clinical visits, for example). For those mergers that involve inflows of new patient visits, there is a very weak relationship to mortality. This raises the question of whether or not the underlying health of patients may

be the principal determinant of any estimated change in mortality. In the future, with access to patients' physician claims, we hope to more clearly distinguish what may be going on.

Overall, these simple correlation results suggest intuitive relationships between the different elements involved in vertical mergers. However, they do not offer any insight into how one might anticipate the outcome of a particular merger. In the next section, we examine how a number of straightforward variables correlate with our different estimates.

VI.2 Decomposition Results

We have demonstrated the presence of hetergeneous effects of hospital-physicians' group mergers. To understand how they vary by the characteristics of the merger, we regress the estimated effects for the six outcomes under study here on the following characteristics: whether the physicians' group was a cardiology group; whether the hospital was part of a system, and if so, the number of hospitals in the system (locally); and whether the hospital was part of multiple acquisitions of physicians' groups. The results of our analyses can be seen in Table 6.

We have 45 observations, which limits the statistical power of our tests. Thus, it is not surprising that few significant results in the table. However, a few strong relationships stand out. First, for ER visits, a hospital acquiring a cardiology group increases the ER visits to that hospital, relative to non-cardiology acquisitions. Alternatively, the effect on ER visits is diminished if the hospital is part of a system, though this effect does not change with the number of hospitals in the system. All three indicators (system, cardiology, and

repeat acquirer) have point estimates of similar magnitudes, though only the first two are statistically significant.

A merger's mortality effects are larger when the hospital is part of a system, but the effect is diminished if the system has more hospitals. That is, those systems with more than eight hospitals that acquired a physicians' group had more negative changes in mortality rates compared to an acquisition by a singleton hospital. Smaller systems had the opposite, when compared to singleton hospitals. The coefficients behind this pattern were statistically significant.

VI.3 Case Studies

To drill deeper into what may be driving the heterogeneity in our merger estimates, we turn to examining the changes in encounter patterns at the various hospitals involved in several of the more striking mergers.[19]

When thinking about the impact of a merger, it is important to be wary of other changes to the affected parties. The Henry Ford system merger is a case in point. This transaction is associated with negligible merger impacts except for a substantial increase in emergency room visits. Upon investigation, we observe that the system opened a fourth hospital about a year after the merger.[20] This new facility appears to have attracted away office visits that had been seen at the flagship hospital, and by virtue of receiving some new increment of emergency

[19]Due to cell-size issues and privacy concerns, we are not able to include figures illustrating the results described here at this time.

[20]Our process of compiling our merger sample indicated that this hospital's ID was active at the time of the merger even if it was not yet seeing out-patient visits. The noise in and intertemporal lumpiness of our data keep us from being to dispositively say that it was not licensed to operate at the time of the merger.

visits can explain why our merger-by-merger estimates suggest that the transaction caused the former to decline and the latter to increase. The idea that the estimated effect on ER visitation actually reflects a consequence of the merger relies on the proposition that, in the but-for world, Henry Ford would not have opened the hospital absent their purchase of CuraNet. That claim seems tenuous.

One of the more curious acquisitions in our sample is the purchase of Alvarado Hospital in 2006 by Plymouth Health, a firm owned and operated by physicians. Examination of news reports revealed that Plymouth's purchase of Alvarado occurred as part of an agreement with the Department of Justice, which had pursued them for violations of the Stark Act.[21] It was alleged that the former administrators of Alvarado paid doctors to refer patients to their facilities. As part of the settlement of these charges, the hospital had to be sold, and it was purchased by practicing physicians. As a result, it is not surprising that we observe no consequence of the merger, which effectively formalized the relationship that was already in place during the pre-period. Thus, the fact that we observe no consequences from the transaction can actually be seen as an indication of the reasonableness of our identification approach overall. However, it does raise questions about just what problem the settlement was supposed to solve.

Overall, these case studies present suggestive evidence that transaction-specific details may often dramatically outweigh any possible systematic implication of vertical integration amongst healthcare providers. In the future, we hope to more rigorously assess this possibility

[21] For details, see press coverage such as `http://www.bizjournals.com/memphis/stories/2007/04/16/daily28.html`.

by diving deeper into our sample of mergers.

VII Conclusion

Recent economic and policy interest has focused on physician group-hospital integration, asking whether vertically integrated systems have adverse or beneficial consequences for physicians, patients, and payers. Using a database of Medicare hospital claims and a sample of mergers, we find that in some instances vertical integration does change the billing and care practices at those hospitals. However, the effects appear to be highly idiosyncratic. Nevertheless, we believe it seems clear from the evidence that these mergers are not systematically having the enormous consequences that either their bitterest foes or most ardent advocates have anticipated.

In the future, we hope to more deeply test these conclusions by simultaneously addressing how these vertical mergers are changing physicians' behavior, both in terms of treatments provided in office/clinic settings and their referrals.

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Tables and Figures

Table 1: Summary Statistics for Merging and Non-Merging Hospitals

		Office	ED	Claims	Spending	Avg Spending	ProbDeath
	N	103072	103072	103072	103072	103072	103072
Non-Merging	mean	29	38	360	85262	273	0.029
	sd	59	31	469	112598	259	0.033
	N	3599	3599	3599	3599	3599	3599
Merging	mean	41	46	446	122824	346	0.026
	sd	84	37	655	144380	227	0.024

Table 2: Summary Statistics for Merging Hospitals Before and After Mergers

		Office	ED	Claims	Spending	Avg Spending	ProbDeath
	N	2157	2157	2157	2157	2157	2157
Pre	mean	36	46	425	111689	313	0.027
	sd	75	37	591	125105	187	0.023
	N	1442	1442	1442	1442	1442	1442
Post	mean	49	45	477	139479	396	0.025
	sd	95	38	739	167835	268	0.025

Table 3: Pooled Merger Effects for the Outcomes of Interest. Estimates for linear probability models in logs, with robust standard errors in parentheses. The control group in all cases is all unmerged hospitals in the U.S. * significant at 10%; ** significant at 5%; *** significant at 1%

	Base	Time Trends
	b/se	b/se
Office	0.133	0.162
	0.12	0.11
ED Visits	-0.017	-0.033
	0.03	0.03
Claims	0.052	0.049
	0.05	0.05
Spending	0.02	0.03
	0.04	0.04
Avg Spending	-0.03	-0.017
	0.03	0.03
Prob. Of Death	0	0.001
	0	0

Table 4: Summary Statistics for the Estimated Merger Specific Estimates

	b	b_se
Log(Avg Spend + 1)	0.042	0.190
Log(Claims + 1)	0.007	0.306
Log(ED + 1)	0.017	0.242
Log(Office + 1)	0.025	0.741
Log(Spending + 1)	0.047	0.245
Prob of Death	0.001	0.014

Table 5: Pearson Correlation Coefficients Among the Estimated Merger Specific Estimates

	Avg Spending	Claims	ED Visits	Office	Tot Spending	Death
Log(Avg Spend + 1)	1.00					
Log(Claims + 1)	-0.62	1.00				
Log(ED + 1)	-0.26	0.52	1.00			
Log(Office + 1)	-0.48	0.70	0.17	1.00		
Log(Spending + 1)	-0.02	0.79	0.46	0.53	1.00	
Prob of Death	0.15	-0.01	0.15	-0.20	0.10	1.00

Table 6: Decomposition of Merger Specific Effects. * significant at 10%; ** significant at 5%; *** significant at 1%

	Avg Spending b/se	Claims b/se	ED Visits b/se	Office b/se	Tot Spending b/se	Death b/se
System	0.126*	-0.032	-0.056	0.144	0.094	0.007
	0.072	0.122	0.092	0.296	0.098	0.005
Cardiology	-0.092+	0.131	0.159*	0.209	0.045	0.001
	0.066	0.112	0.084	0.27	0.09	0.005
Multiple Merger	0.097	-0.01	0.176+	-0.188	0.086	0.009
	0.101	0.171	0.128	0.413	0.137	0.008
Num of Hospitals	-0.013	0.004	-0.009	-0.026	-0.009	-0.001+
	0.011	0.018	0.014	0.044	0.014	0.001
_cons	0.022	-0.019	0.025	0	0.001	-0.001
	0.048	0.081	0.061	0.196	0.065	0.004
N	45	45	45	45	45	45
r2	0.119	0.038	0.134	0.04	0.031	0.058

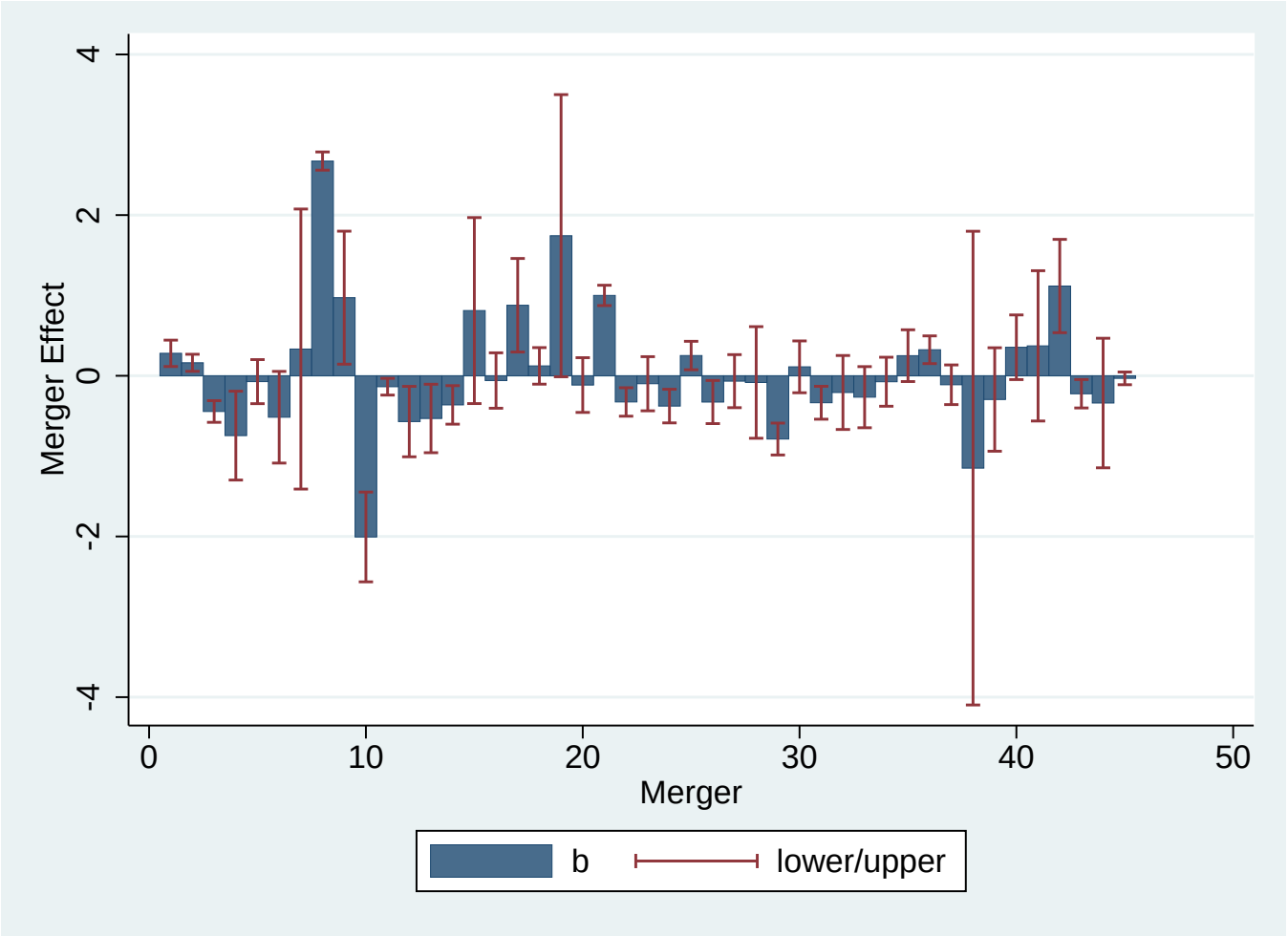

Figure 1: Percentage Change in Office Visits Due to Individual Mergers

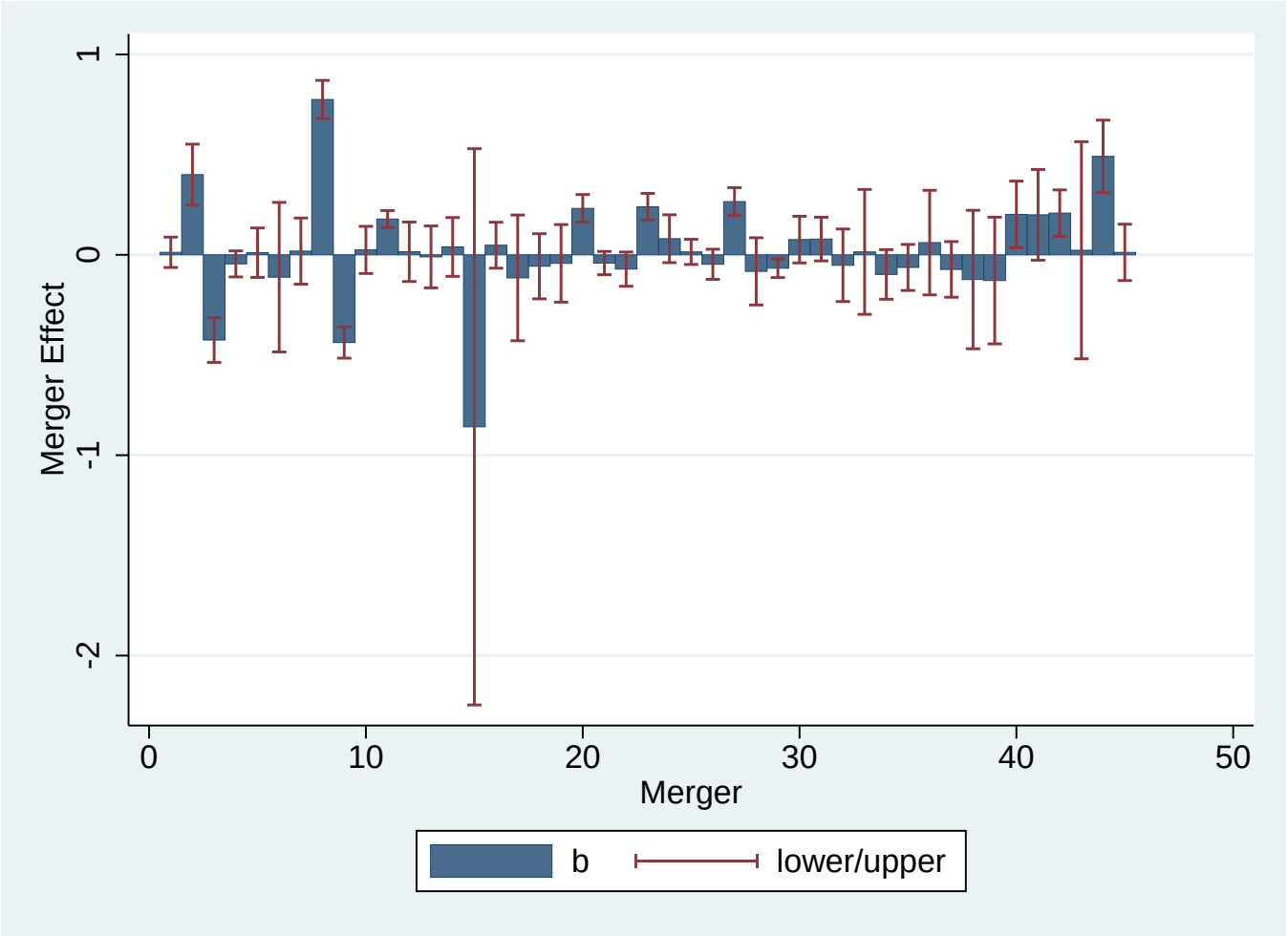

Figure 2: Percentage Change in ED Visits Due to Individual Mergers

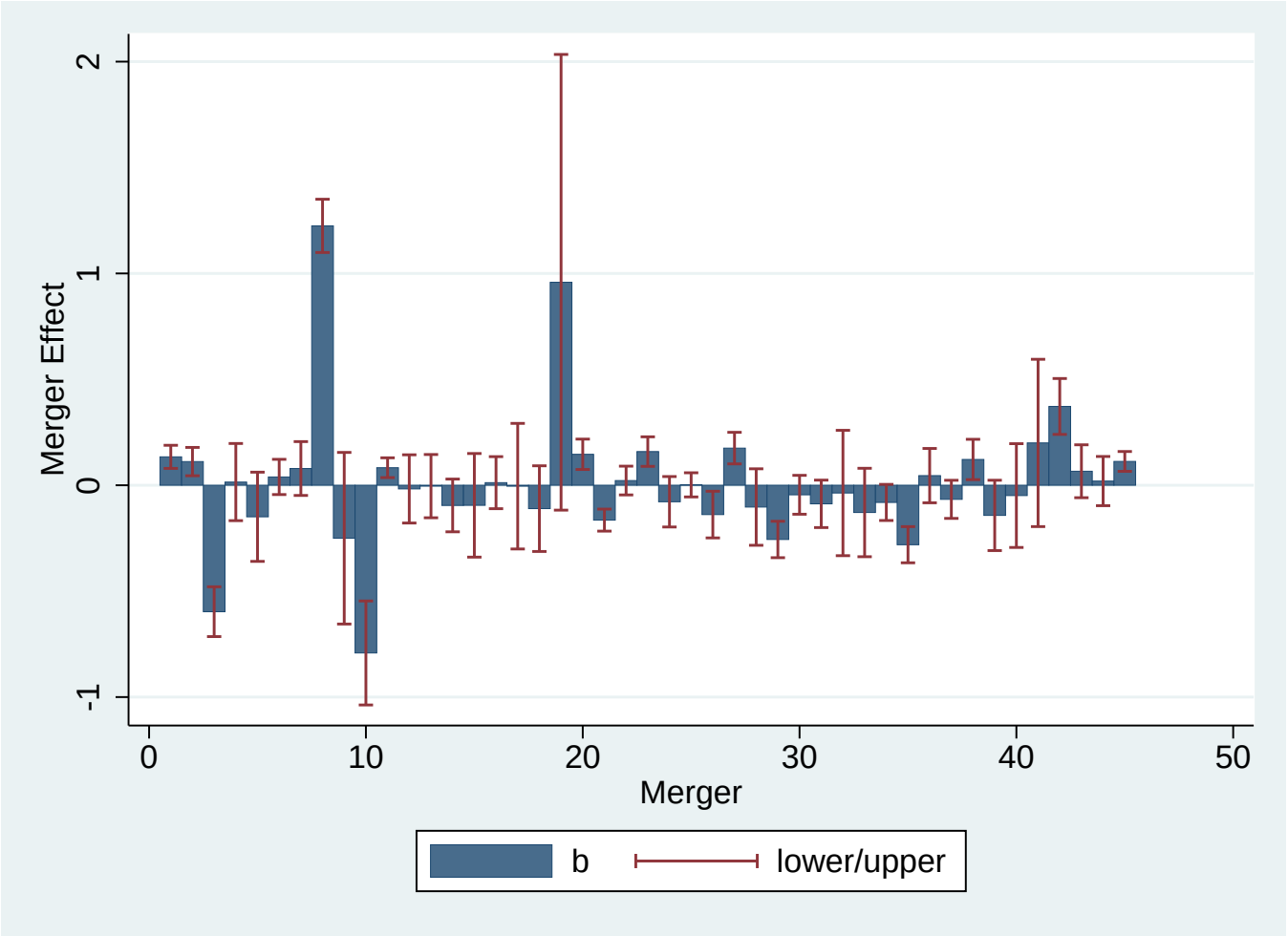

Figure 3: Percentage Change in Total Claims Due to Individual Mergers

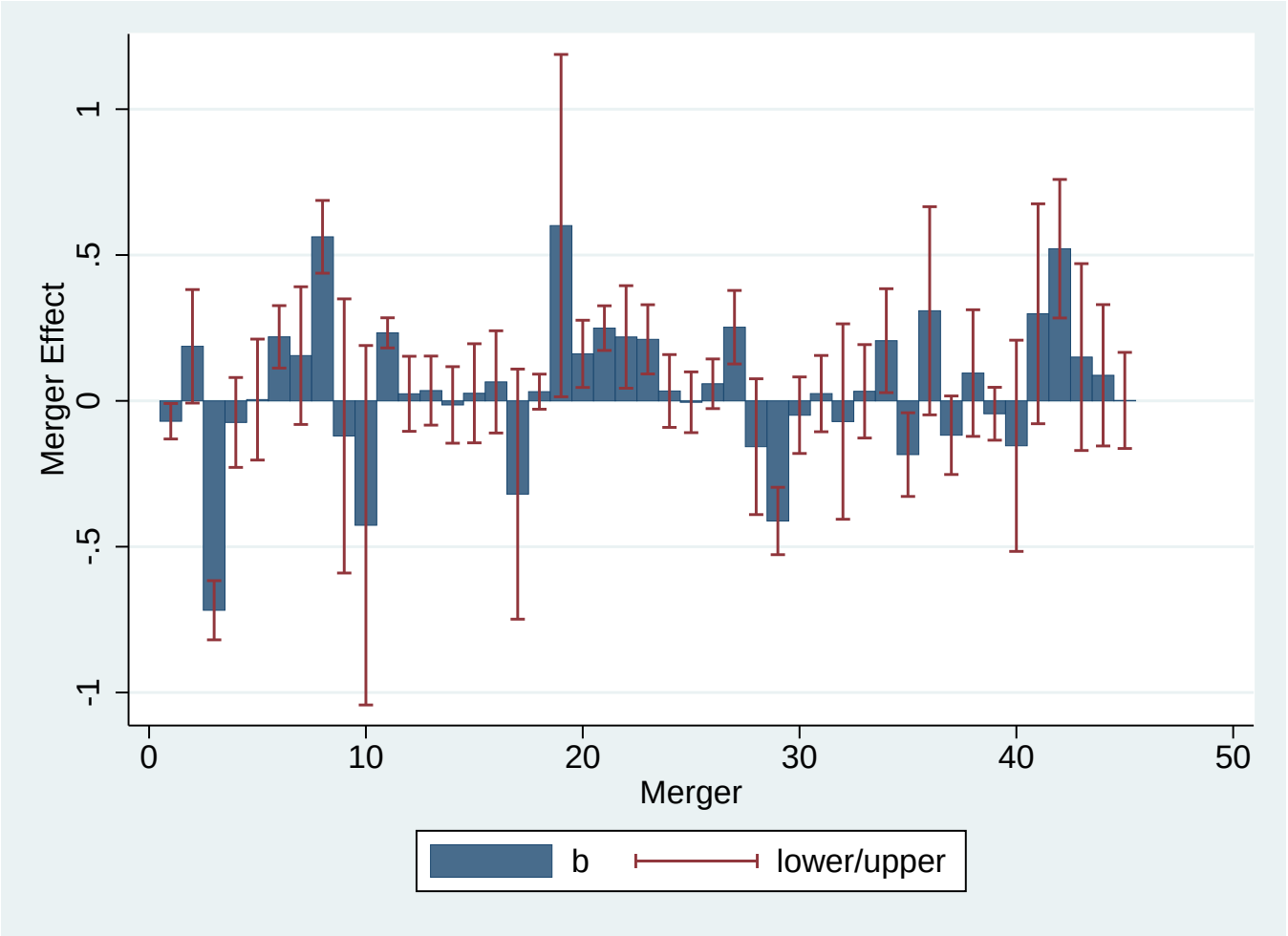

Figure 4: Percentage Change in Total Spending Due to Individual Mergers

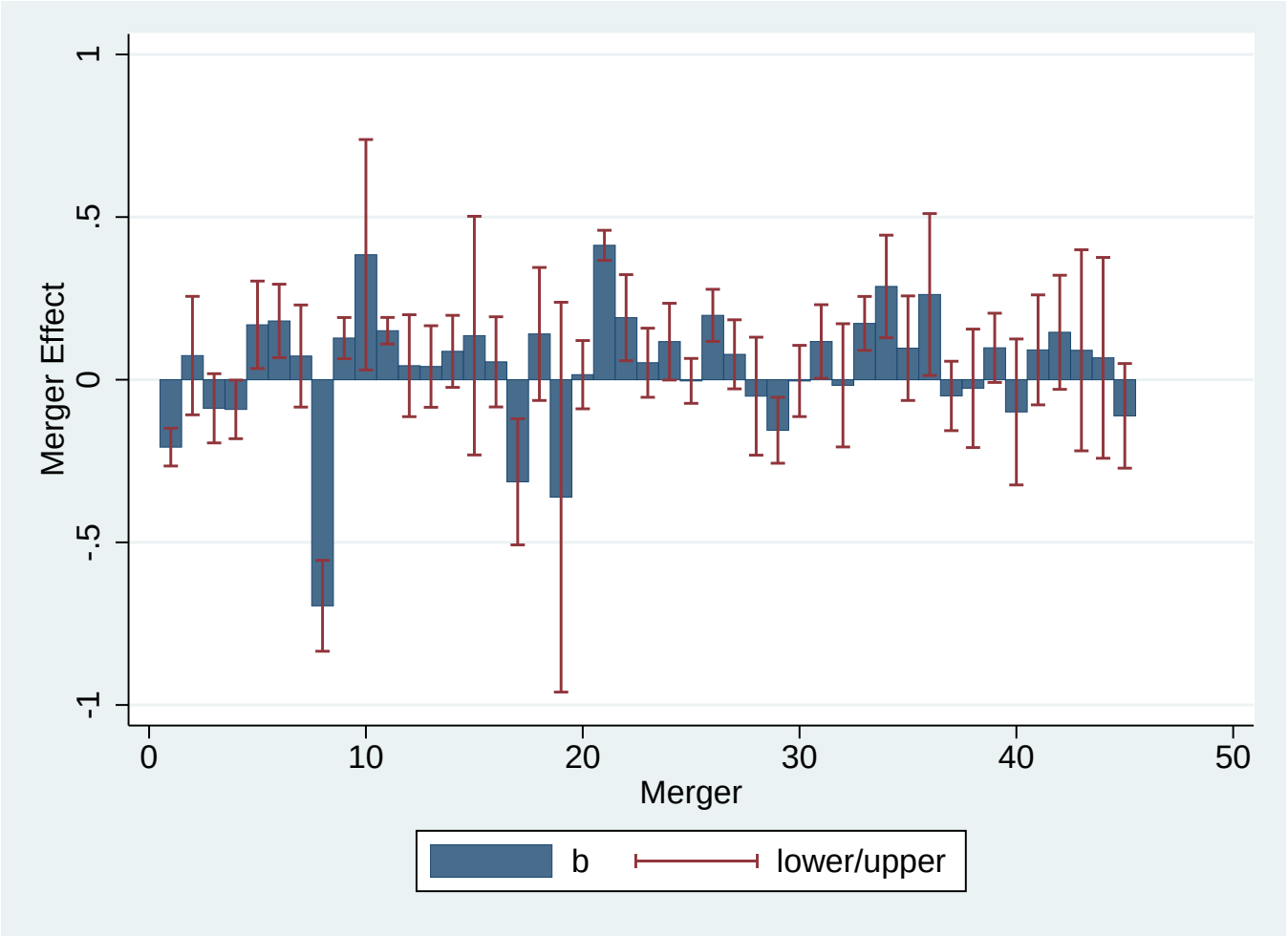

Figure 5: Percentage Change in Average Spending per Claim Due to Individual Mergers

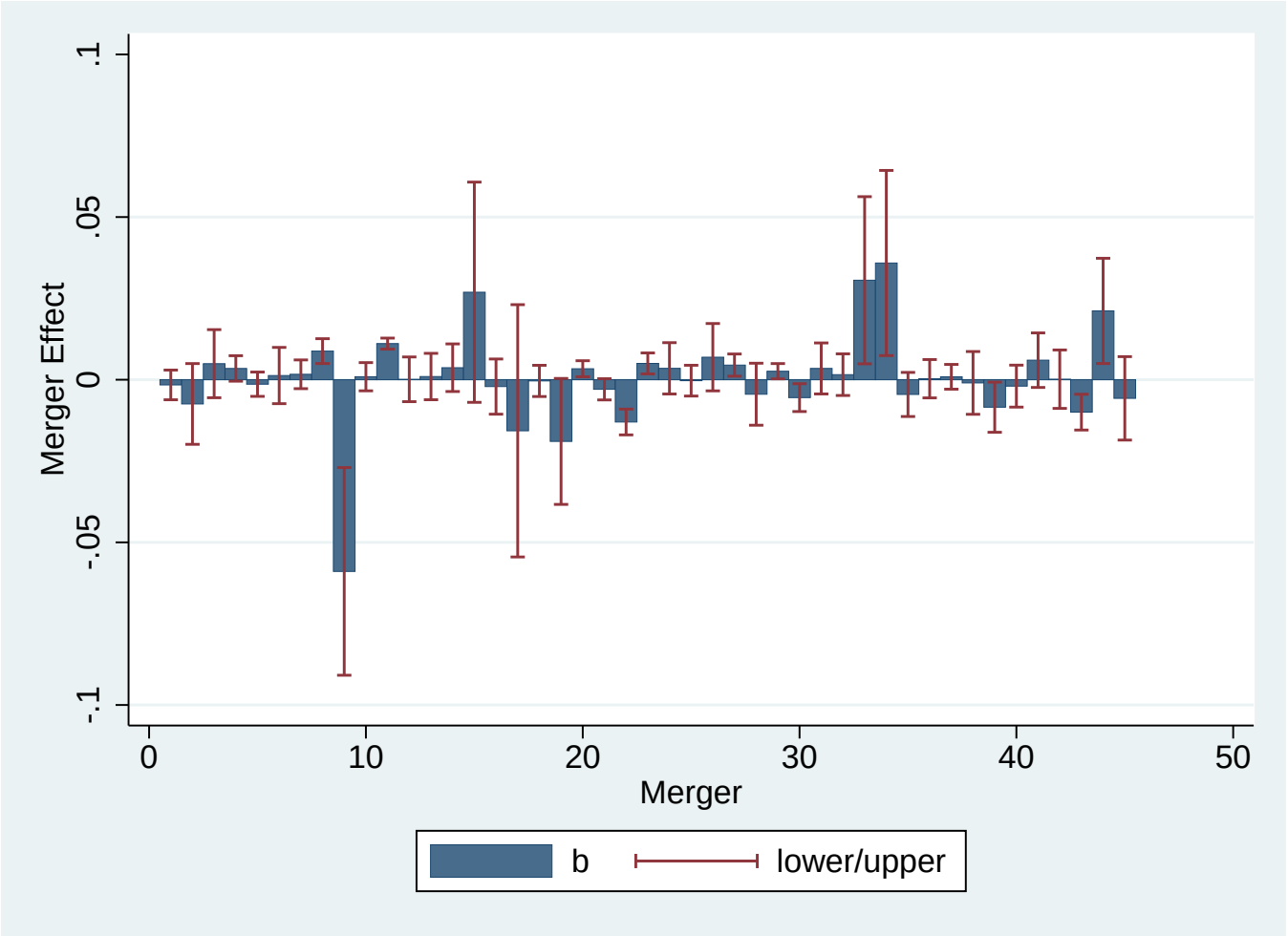

Figure 6: Percentage Change in Morality within a Quarter Due to Individual Mergers

A Additional Tables

Table A-1: Mergers Analyzed

Announcement Date	Target	Buyer
12-May-06	DiCuccio Practice	Butler Memorial Hospital
31-Jul-06	Orthopaedic Associates Ltd	Fort Healthcare
8-Aug-06	Montclair Hospital Medical Center	Medical Properties Trust, Inc.
15-Aug-06	CuraNet LLC	Henry Ford Health System
27-Oct-06	Alvarado Hospital Medical Center	Plymouth Health
2-Jan-07	Saint Mary's Regional Medical Center	Catholic Healthcare West
23-Jan-07	Graduate Hospital fo Lafayette	University of Pennsylvania Health
13-Feb-07	Heart Hospital of Lafayette	Heart Hospital of Acadiana
5-Mar-07	Family Medical Associates	Pacer Health Corp.
9-Mar-07	Greater Southeast Community Hospital	CJ Healthcare Ventures LLC
26-Mar-07	New York Institute of Same Day Surgery	Good Samaritan Hospital of Suffern
22-Jun-07	Mid Carolina Cardiology	Presbyterian Healthcare
13-Jul-07	MQ Associates, Inc	Novant Health
25-Jul-07	Advanced Healthcare	Aurora Health Care
25-Jul-07	Alta Healthcare System, Inc.	Prospect Medical Holdings, Inc
7-Aug-07	Aspend Medical Group	Allina Hospitals and Clinics
10-Oct-07	Golden Plains Community	Critical Access Healthcare, LLC
15-Nov-07	Medical Associates Health Center	ProHealth Care
16-Jan-08	Dakota Clinic, Ltd	Essentia Health
3-Mar-08	Hyde Park Internists, Inc.	Christ Hospital
13-Mar-08	Bayonne Medical Center, Inc.	Ijkg Propco LLC
23-May-08	Jefferson Hills Surgical	Jefferson Regional Medical Center
9-Jun-08	Four primary care practices	Christ Hospital
10-Jul-08	Comprehensive Cardiology Care Group	Aurora Health Care
4-Aug-08	Cardiovascular Consultants, Ltd	North Memorial Health Care
25-Aug-08	Consultants in Cardiology	Carilion Clinic
10-Sep-08	Ohio Heart & Vascular Ctr.	The Christ Hospital
26-Sep-08	MidOhio Cardiology and Vascular Assoc.	OhioHealth Corp.
7-Nov-08	North Oakland Medical	North Oakland Physicians Medical
28-Nov-08	Radiation Oncology of Souther Connecticut	Bridgeport Hospital
8-Jan-09	Northern Lake Medical Ltd.	Aurora Health Care
8-Jan-09	Penn Elm Medical Group	Scripps Health
18-Feb-09	HealthPlus Holdings LLC	Avanti Health System LLC
20-Apr-09	Oral and Maxillofacial	Trinity Health
1-Jun-09	Nelson Family Clinic	ThedaCare
6-Jul-09	Michigan Medical, PC	Spectrum Health System
27-Jul-09	Midwest Physician Group	Advocate Health Care, Inc.
27-Jul-09	Lowcountry Medical Associates	Roper St. Francis Healthcare
1-Oct-09	Asheville Cardiology	Mission Medical Associates, Inc.
30-Oct-09	Midwest Cardiology	HCA Midwest Health System
1-Jan-10	Austin Heart	St. David's HealthCare Partnership, LP
21-Jan-10	NEA Clinic	Baptist Memorial Health Care Corp
3-Feb-10	Southwest Community Health Center	Legacy Community Health Services
20-Apr-10	Prime Kare Home Health Services	Aspirus Keweenaw Home Services
26-May-10	Comprehensive Cardiology Consultants, Inc.	St. Elizabeth Healthcare