Pass-through to Patients: What Matters to Public Managers in the Veterans Health Administration

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Abstract

This paper investigates how public health care managers allocate marginal resources under capitated payment and how this affects clinical utilization and outcomes. When U.S. Veterans Affairs hospital networks receive a windfall of funding, they increase spending on direct care cost centers, resulting in more physician and nurse hours. Spending on major overhead cost centers as well as spending on the offices of the systems directors does not increase. This is accompanied by an increase in care utilization. A one percent increase in funding leads to a one percent increase in inpatient stays, some of which is driven by an increase in unique patients, and a one percent increase in outpatient visits. The spending does not cause a change in rates of death after acute myocardial infarction or rates of hospital readmissions.

JEL Classifications: I1, J4, L2, L3

Keywords: health care financing, capitation, management of public firms, provider decision-making, health care productivity

1 Introduction

How does spending affect health outcomes? This is important as health care spending continues to increase. But this effect likely varies depending on how providers choose inputs (Chandra and Skinner, 2012; Chandra, Colla and Skinner, 2023). This paper focuses on how health care managers choose inputs in public firms under capitation, a contractual or organizational arrangement that is an alternative to commonly studied arrangements like fee-for-service or prospective payment. Despite its rare appearance in empirical research, it is an important design to study as it represents one extreme end on the spectrum of contract designs, the

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agent-risk-baring end, and as such has been considered for its supposed potential to improve efficiency in industries with asymmetric information.

I study whether health care providers under capitated payment provide more care when their constraint is loosened. I study a natural experiment in which the U.S. Veterans Health Administration increased its funding of its care networks – managerial hierarchies overseeing multiple VHA health care systems within a contiguous geographic region – in a way that was unrelated to managerial effort or physician effort or skill in those networks. I find that receiving greater funds resulted in networks using more physician hours and nurse hours, and I estimate that the number of hours increased gradually over several fiscal years. I also estimate that a percentage point increase in funds resulted in an increase in direct care by the VA. This increase in inputs coincided with an increase in outputs. A one percentage point increase in funding resulted in a one percent increase in inpatient stays and a one percent increase in outpatient visits. The magnitude of this effect of an increase in *overall allocations* on services performed is similar to the estimate in Clemens and Gottlieb (2014) of the effect of an increase in *marginal reimbursement incentives* on services performed. The effect was most pronounced among stays and visits designated as medical or surgical. The funding increase did not affect 10-day hospital readmissions rates or rates of 30-day mortality after admission for an acute myocardial infarction.

This paper contributes to our understanding of the objectives of public managers and of health care managers. I find that managers in VHA largely pass on their increased budgets to patients in the form of more direct care, translating into more nursing and physicians. This results in more admissions and visits, as well as more unique patients admitted. Management of public entities has been a focus of economists. Kornai (1979) studies managers of public firms operating under soft budget constraints in socialist economies and shows that the soft constraint leads to shortages. Duggan (2000) finds that public hospitals behave differently from both for-profit and not-for-profit private hospitals in such ways that are consistent with the public hospitals facing soft budget constraints. In my context, the VHA likely faces a soft budget constraint in the long run, as funding for veterans is a high-profile political priority in the U.S..[1] It is also likely a resource-constrained rather than a demand-constrained system, in Kornai's terminology: most of its funding comes from Congress rather than consumer-paid prices, and in this paper I find that increase a VHA network's funding causes it to increase its staff inputs and to increase its volume of medical care. Kornai's work has been invoked recently in the popular press to explain how politicians' competing priorities for comprehensive public services and for lower taxes can explain shortages and crowding in publicly provided services in health care and other sectors (The Economist, 2023). Timmins (2002) uncovers how managers

[1]The U.S. Department of Veterans Affairs was one of the first federal agencies whose appropriations for Fiscal Year 2024 were passed by Congress (Morgan and Walker, 2023), and it was one of the few agencies whose appropriations were passed before the fiscal year began and a political showdown over appropriations threatening a government shutdown occurred.

of municipal water works in California weigh their conflicting objectives to serve their customers and to serve tax payers. I'm studying managers of public hospital systems and regional conglomerates of public hospital systems. The objectives of health care managers and providers has been a long-running interest in health economics. Pauly and Redisch (1973) build theories that non-profit hospitals act as quantity maximizers in order to fulfill a mission to the public, acting as if they have lower marginal costs than for-profits. Hackmann (2019) estimates that non-profit nursing homes put more weight on their objective to provide care to more individuals than for-profits do. Eliason, Grieco, McDevitt and Roberts (2018) estimate long term care hospitals' objectives and elasticities to simulate their discharge decisions under counterfactual reimbursement policies. Garthwaite, Graves, Gross, Karaca, Marone and Notowidigdo (2019) find that hospital behave like insurers of last resort: when a hospital's regional uninsured rate increases, hospitals increase their uncompensated care at the expense of their profits. Still an open question is whether VHA's priorities which I uncover for marginal dollars reflect the managers' preferences, political pressures on managers, or statutory or bureaucratic limits to managers' discretion. In other settings, government officials are able to get around intentions of public programs to achieve their own objectives. For example, Baicker and Staiger (2005) show that state governments are able to expropriate increased Medicaid payment rates to public hospitals.

This also contributes to our understanding of how health care providers behave under capitation. Loosening the cap can either result in agents slacking off more, or they could use the new resources represented by the raised/loosened cap to either provide more services or exert more effort on the services that they provide. I estimate that increasing the cap results in more inpatient visits and more outpatient stays. While these are outcomes of an equilibrium of provider and patient decisions, this is plausibly largely a supply-side result. While I do not directly estimate productivity and thus cannot rule out an increase in slack, it appears that at least some of the resources are used to provide more patient care. Capitation has received little attention from empirical economics. Ho and Pakes (2014) find that among physicians referring patients to hospitals for a delivery, physicians with more capitated case mixes refer patients to lower-cost hospitals but not lower-quality hospitals. Gaynor, Rebitzer and Taylor (2004) study a managed care organization and find that physicians more exposed to bonuses for meeting a soft cap spend less. Increasing the capitation amount could be seen as akin to increasing the resources to health care providers. Finkelstein (2007) studies the introduction of Medicare, which results in large increases in revenue and admissions to hospitals and find it resulted in adoption of new technologies, though it did not reduce mortality rate Finkelstein and McKnight (2008). Medicare's introduction represents a rare, big push in health care. The shock that I study is more similar in magnitude to the kinds of changes in health care settings that governments and managed care organizations are more typical to consider. Responses to capitation has also been studied in

the context of health insurance. Medicare contracts out insurance to commercial firms for some beneficiaries who elect to do so through a program called Medicare Advantage or through the public prescription drug program Medicare Part D, and these contracts are capitated. Duggan and Scott Morton (2010), Duggan, Starc and Vabson (2016), and Cabral, Geruso and Mahoney (2018) study increases in capitated payments from Medicare to the commerical insurers and estimate the passthrough rates to beneficiaries in the form of lower premiums.

Capitation stands at one end of the contract design spectrum. Much more research has focused on the other end of the spectrum, fee for service (FFS), the middle of the spectrum, episode-based payment, and transitions from FFS to episode-based payment. Most closely related to this paper in terms of policy shock, Gross, Sacarny, Shi and Silver (2021) find that hospitals increase nurse employment, admissions, and length of stay when they received greater episode-based reimbursement rates due to a risk-adjustment granularization of Medicare rates. They study behavior of private, episode-based-reimbursed hospitals, whereas I study public, capitated hospitals. I also have more detailed administrative data on hospital operations and spending. The paper most closely related to this paper in terms of empirical targets and approaches is Clemens and Gottlieb (2014), which finds a similar physician supply elasticity as I do, exploiting changes in geographic boundaries for Medicare physician reimbursement rates. Increasing FFS and episode-based reimbursements have been found to increase investment in quality (Garthwaite, Ody and Starc, 2020; Cooper, Doyle, Graves and Gruber, 2022), reduce physicians turning away patients (Alexander and Schnell, 2019), affect discharge dates (Einav, Finkelstein and Mahoney, 2022; Eliason, Grieco, McDevitt and Roberts, 2018), and affect whether delivery is vaginal or by Cesarean section (Alexander, 2017). Allowing rural hospitals to claim cost-plus reimbursements rather than episode-based capitations led them to spend more on patient care, largely on clinical labor inputs, without leading to changes in quality (Carroll, 2023). When some hospitals gamed Medicare reimbursement rates, they used their windfalls partially for operations but also largely for executive pay and shareholders, in the cases of for-profit hospitals (Gupta et al., 2023).

Section 2 describes how funds are allocated within the Veterans Health Administration and the policy shock that I exploit to estimate the VHA's elasticity of supply. Section 3 describes the data. Section 4 describes the empirical methods to estimate the elasticities. Section 5 presents the estimated elasticities on inputs chosen with respect to a shock in funds. Section 6 presents some preliminary results on heterogeneous treatment effects by health care system size, and Section 7 motivates future analysis on spillover effects of this VA policy on veterans' use of Medicare-covered care by private providers. Section 8 concludes with a discussion of the results and ongoing work.

2 Resource Allocation within the Veterans Health Administration

The Veterans Health Administration runs hospital systems and clinics across the country, serving over 9 million beneficiaries. With few exceptions, beneficiaries must have been veterans of the U.S. military. They must sign up to be qualified for VHA benefits.

Congress makes annual appropriations to the Veterans Health Administration. This pot of money is divvied up by the VHA central office to the 21 - 22 networks. (In 2002, two networks were combined into the Minneapolis network.) These networks oversee the hospital systems within geographically continuous regions, as depicted in Figure 1. Prior to FY 1999, the central office divvied up annual allocations to networks in a somewhat ad hoc process that took strongly into consideration how many inpatient bed-days of care a network had. This was seen as inducing substitution from outpatient care for some conditions to inpatient care. A new formulaic system called the Veterans Equitable Resource Allocation (VERA) was implemented in FY 1999 that made risk-adjusted capitated payments to the networks. Each network j in fiscal year y was allocated funds according to

$$Allocation_{jt} = \underbrace{\sum_{i} (N_{i,j,t-2} \cdot P_{i,t})}_{\substack{\text{“VERA payment”} \\ \text{Risk-adjusted capitation}}} + \epsilon_{j,t} \tag{1}$$

where patient group i's "price," $P_{i,t}$ reflects i's share of total costs across networks as observed two years prior:

$$P_{i,t} = \frac{\sum_j MCAOCost_{i,j,t-2}}{\sum_j \sum_{i' \in \mathcal{I}} MCAOCost_{i'jt-2}} \cdot Author_t \tag{2}$$

and where $N_{i,j,t-2}$ is the number of patient type i receiving care in network j in year $t-2$, $MCAOCost_{i,j,t-2}$ is the managerial accounting cost of taking care of patient type i nationally in year $t-2$, $Author_t$ is Congressional authorization for total VHA funding, and ϵ are all other allocations – including special purpose funds, equipment and facility maintenance, research – which typically represent about 15% of a network's allocations in a year. $MCAOCost_{i,j,t-2}$ is determined by the central office by calculating the average cost of taking care of a patient for a year for each of the price group types, i. In sum, the allocation reflects the numbers of each type of patient in that network j's region of operation and how costly each patient type was relative to the other types on a national basis two years prior.

Note the importance of shares in this public, capitated organization. All of VHA receives a lump sum of funds from Congress, and that amount is divided up among the networks. This is implemented by setting the annual capitated "price" for each patient type to be that patient type's *share* of overall spending the

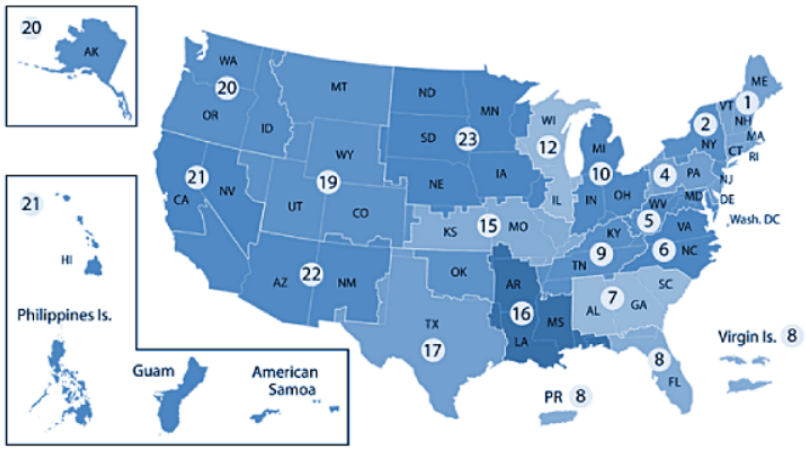


Figure 1: Map showing the geographic regions managed by each of VHA's Veterans Integrated Services Networks (VISNs) after FY 2002.

prior year, times the Congressional authorized sum. The "price" of each patient type does not reflect how costly that type was in a prior year but rather how costly that type was *relative to the other types*.

Individual patients are classified into a price group using based on encounter records two years prior to an allocation's implementation, and they are classified heirarchically: patients are placed into the highest priced category they qualify for. The original VERA policy had three patient types or "price groups" with respect to which the allocations were risk adjusted. Non-vested basic care patients were not part of a VHA primary care physician's panel of patients and visited VHA for care only occasionally. Vested patients were part of a primary care provider's panel and regularly used VHA's services, and complex care patients made substantial use of VHA services like long term care or inpatient mental health or substance use care services.

The policy I exploit in order to observe VHA responses exogenous variation in capitated allocations is the introduction of a more granularized form of risk adjustment for this allocation system. Starting in FY 2003, networks' allocations were risk adjusted with respect to ten patient types, rather than just three (Table 1). This was in response to complaints from networks that they were taking care of patients whose cost of care far exceeded the capitated amount (Wasserman et al., 2001; Bascetta, 2002). Networks do not have the same distributions of patients across risk adjustment types. Networks who had more patients in the higher-allocated categories received greater increases in funding from FY 2002 to FY 2003 than other networks. Table 2 list each of the networks and their general purpose VERA funds in FY 2002 under the old three-group risk adjustment regime, funds in FY 2003 under the new ten-group risk adjustment regime, the level change from one year to the next, and the percent change. The percent change in general purpose funds from the old regime to the new regime is the treatment variable in my analysis. As part of the new policy, VHA imposed a floor for the percentage increase in funds of 5%. After this there was still substantial variation in the percentage increase in funds under the new risk adjustment policy. Some networks received

VERA-3	VERA-10	Yearly Patient Allocation (in dollars)	
		VERA-3	VERA-10
Basic Non-Vested	Non-reliant care	197	263
Basic Vested	Minor medical	3,121	2,413
Basic Vested	Mental health	3,121	3,562
Basic Vested	Heart and lung	3,121	3,722
Basic Vested	Oncology, etc.	3,121	8,337
Basic Vested or Complex Care	Multiple problems		7,935
Complex Care	Specialized care	41,667	18,751
Complex Care	Supportive care	41,667	29,780
Complex Care	Chronically mentally ill	41,667	39,448
Complex Care	Critically ill	41,667	61,117

Table 1: Veterans Equitable Resource Allocation price groups under VERA-3 (FY1999 - 2002) and under VERA-10 (beginning in FY 2002). Numbers describe the VERA "price" assigned to a particular group. Patients are classified into the highest-price group they qualify for. Source: RAND Corporation (Wasserman et al., 2004).

increases as great as 12% while some others received the minimum increase limit of 5%. (Wasserman et al., 2004)

This system persists more or less to today. The risk adjustment is revised from year to year by the Allocation Resource Center, an office within the U.S. Department of Veterans Affairs' budget office, which at a minimum updates the cost and regional adjustments for the allocation system. Occasionally it adds conditions to VERA price groups and, more rarely, combines groups, but today's VERA system with 11 price groups looks very similar to that of FY 2003. Thus, large shocks in FY 2003 increases resulted in persistently increased levels over years. Therefore, while I primarily exploit the shock in FY 2003 funds to estimate elasticities in that fiscal year, I also use an event study-like approach to trace out the VERA-10 introduction's impact over time.

I treat a network's increase in FY2003 funding as unrelated to networks' objectives, efficiency, quality of management, and altruism. It is driven purely by how many of different kinds of VHA beneficiaries are in a networks' catchment area. Patients are classified into classes which in turn belong to a price group (Table 3). They are classified into the highest class that they qualify for. This classification is based on the VHA's Patient Treatment File, which is compiled from the details that VHA providers on patient encounters, including patient movement across stops and wards, patient diagnoses, drugs administered, procedures performed, and, in the case of long-term care, patient function. Upcoding (Dafny, 2005; Geruso and Layton, 2020) would be difficult in this setting. Classification is based on a patient's utilization at least two years prior to an allocation's implementation. Most price classes are based on coarse diagnoses. Those in the highest classification – largely long-term care patients – are placed additionally there based on reported daily function and bed days of care.

The prices for each group of a new year's VERA system is calculated by the Allocation Resource Center

Network	FY 2002 General Purpose ($ million)	FY 2003 General Purpose ($ million)	Increase ($ million)	% Increase (p.p.)
1 Boston	943	1,012	69	7.31
2 Albany	507	556	49	9.66
3 Bronx	1,059	1,112	53	5
4 Pittsburgh	956	1,077	121	12.63
5 Baltimore	576	618	42	7.28
6 Durham	882	991	109	12.37
7 Atlanta	1,072	1,159	87	8.09
8 Bay Pines	1,470	1,656	186	12.63
9 Nashville	849	927	78	9.21
10 Cincinnati	698	771	74	10.57
11 Ann Arbor	766	849	83	10.82
12 Chicago	899	978	79	8.84
15 Kansas City	718	761	44	6.09
16 Jackson	1,499	1,689	189	12.63
17 Dallas	850	937	87	10.19
18 Phoenix	732	803	71	9.77
19 Denver	483	528	45	9.36
20 Portland	840	903	63	7.46
21 San Francisco	948	1,062	114	12.07
22 Long Beach	1,083	1,220	137	12.63
23 Minneapolis	874	918	44	5
VHA Total	18,702	20,526	1,823	9.75

Table 2: Changes in Veterans Equitable Resource Allocation (VERA) funds to Veterans Integrated Networks (VISNs) from fiscal year 2002, when the old three-type risk adjustment regime was used, to fiscal year 2003, when the new ten-type risk adjustment regime was introduced. Source: VHA.

thusly. Each group's share of costs two fiscal years ago is calculated. That share is multiplied against the total Congressional authorization for the VHA network. That product is the price for the group. Costs, in turn, are calculated so: managerial cost accountants in each VHA health system from time to time survey care departments to assess how many hours of work by different staff types are performed for a given procedure, e.g., 30-minute orthopedic visit, 45-minute orthopedic visit. These input units are combined with input quasi-prices determined by observing accounting records on the dollars that a clinic spent on a staff type's budget line item. The cost for a price group is aggregated across health care systems by the Allocation Resource Center. Because a group's price is determined by its relative cost across health care systems, it would be very difficult for an individual network to manipulate the groups' prices.

VERA 10 Group No.	VERA Class No.
1. Non-Reliant Care: Basic Non-Vested / Vested	
	1. Employee/Collateral
	2. Pharmacy
	3. Compensation and Pension Exams
	4. Non-Vested
2. Basic Medical: Basic Vested	
	5. Ear, Nose, and Throat
	6. Other Acute Diseases
	7. Endocrine, Nutritional, Metabolic Disorders
	8. Central Nervous System
	9. Musculoskeletal Disorders
3. Mental Health: Basic Vested	
	10. Acute Mental Disease
	11. Addictive Disorders
4. Heart, Lung & GI: Basic Vested	
	12. Cardiovascular
	13. Gastroenterology Disorder
	14. Pulmonary Disease
5. Oncology: Basic Vested	
	15. Hepatitis C without Anti-viral Therapy
	16. HIV without Anti-retroviral Therapy
	17. Oncology
6. Multiple Problem: Basic Vested	
	18. Medical/Psychiatry +Substance Abuse
	19. Psychiatry + Substance Abuse
	20. Multiple Medical
	21. Post Traumatic Stress Disorder (PTSD) Acute
7. Specialized Care	
	22. Hepatitis C With Anti-viral Therapy
	23. HIV With Antiretroviral Therapy
	24. Chronic PTSD
	25. Home Based Primary Care (HBPC)
	26. Traumatic Brain Injury (TBI)
8. Supportive Care: Complex	
	27. Stroke
	28. Domiciliary
	29. Spinal Cord Injury (SCI) Para-old Injury
	30. SCI Quad-old Injury
	31. Blind Rehabilitation Service
	32. Community Nursing Home
	33. Long Term Care: Low Activities of Daily Living (ADL)
9. Chronic Mental Illness: Complex	
	34. Mental Health Intensive Case Management
	35. Other Psychosis
	36. Substance Abuse
	37. Schizophrenia & Dementia
10. Critically Ill: Complex	
	38. End Stage Renal Disease (ESRD)
	39. SCI Para-new Injury
	40. SCI Quad-new Injury
	41. Long Term Care: Clinical Complex
	42. Long Term Care: Behavioral
	43. Long Term Care: Physical
	44. Long Term Care: Rehabilitation
	45. Long Term Care: Specialized Care
	46. Transplants
	47. Ventilator Dependent

Table 3: A more detailed description of the patient classes composing each VERA price group in FY 2003. Patients are classified into the highest class they qualify for. Source: VHA.

3 Data

This paper estimates the effect of changes in funding of networks on changes in networks' spending and input choices as well as changes in equilibrium quantity and quality of care provided. The treatment variable is the percent change in VERA funds authorized to each network from fiscal year 2002 to fiscal year 2003, as already presented in Table 2. This information is provided in briefing books by the VHA's Allocation Resource Center (ARC).

The input choices I observed are the dollars spent on cost centers and budget objects and, for labor budget objects, hours worked. Spending and hours are observed at the level of observation of budget object by cost center by fiscal period (month) by VHA substation, and this is recorded in the VHA's Account-Level Budget Cost Center (ALBCC) accounting data.[2]

I measure utilization of VHA care and adverse outcomes related to readmissions using records of patient encounters in the VHA's corporate data warehouse (CDW). These records contain procedure codes, diagnosis codes, and patient demographics for every VHA patient encounter. If a patient is transferred between different care settings in VHA, a new patient encounter is recorded in the data. Every outpatient encounter is assigned a stop code, and every inpatient encounter is assigned a treatment speciality. These codes reflects the type of care provided and can roughly be thought of as coarse observations of the "department" or care setting where the care took place. The CDW also records episodes of care performed by other health care providers outside VHA such as community (i.e., non-VHA) hospitals or community nursing homes – and claimed for VHA reimbursement.

4 Methods

My goal is to estimate the supply elasticity with respect to funding changes. Following Clemens and Gottlieb (2014), my workhorse estimating equation is

$$\ln(y_{q,n}) = \sum_{q \neq \text{Q3 2002}} \beta_q VERAIncrease_n \times I_q + \alpha_n + \gamma_q \tag{3}$$

where y alternatingly takes on several health care inputs, utilization measures, and quality measures that I will detail later; q is the calendar quarter of the observation; n is the network, or VISN, of the observation; α_n is an indicator that the observation is of network n; and γ_q is an indicator for quarter q. β_q for $q >$ Q3 2002 is interpreted to reflect the proportional change in y from Q2 2002 to quarter q that results from a one

[2]VHA–Palo Alto's Health Economics Resource Center has guides on best research practices for using and interpreting this data.

percent increase in annual VERA funding. This quantity is the most well defined for Q4 2022 through Q3 2003, since these are the quarters where health care choices are directly affected by the FY 2003 allocation whose shock I am exploiting. Because the size of federal budgets including VHA's are largely dependent on the prior fiscal year's and because the VERA allocation formula only slightly changed from year to year after VERA FY 2003, β_q for $q >$ Q3 2003 are informative about the longer run decisions that followed from the VERA 2003 design even and thus are still of interest even though they do not reflect deep parameters. I include β_q for $q <$ Q3 2002 to probe the validity of my approach by testing for systematically different trends in $\ln(y)$ between networks that receive different funding shocks in 2002. I estimate this used fixed effects estimators and modeling standard errors under the assumption that the data is clustered at the network level.

I aggregate utilization and spending data to the calendar quarter because Congressional authorizations for the new fiscal year are not always on time. In those cases, VHA and other agency appropriations may change throughout the fiscal year until the final appropriations for that fiscal year are approved by Congress and the president.

5 Results

5.1 Passthrough to Patients: What Do VHA Networks Fund When They Have a Windfall?

This section shows that VHA network managers proportionately increase their spending on direct care and largely not on overhead when they receive a windfall. This direct care spending is largely on staff and not equipment.

I first run event study equation Equation (3) on dollars spent. I cannot reject that there were no systematic differences in spending *before VERA 2003* across networks that received different FY 2003 windfall amounts. I also cannot reject that there were no such pre-period differences in staff hours (Appendix Figure 7). This lends credence to the empirical strategy.

A one percent increase in VERA funds in FY 2003, the first fiscal year affected by the granularization of the capitation risk adjustment, resulted in a one percent increase in spending on direct care in-house within VHA. I cannot detect any statistically significant increase in care contracted out to non-VHA providers and facilities. Networks also did not increase spending on overhead cost centers like administrative support, engineering and the environment, and miscellaneous benefit services (Figure 2).

The effect of a funding increase on spending on non-capitalized equipment is noisily estimated but appears

to be zero. In more detailed results, this appears true for medical and scientific equipment, and for IT and communication equipment. The increase in direct care dollars is largely going to staff. Physician and nurse hours increase by one percent in response to a one percent increase in VERA dollars (Figures 2 and 3).

There do appear to be differential pretrends for hours of psychologists, social workers, and medical technicians. So far I have only performed informal analysis and have not yet performed honest diff-in-diff methods from Rambachan and Roth (2023), but such analysis might lead to the conclusion that the VERA-10-induced windfall led networks to decrease their use of psychologists and social workers. A greater increase in VERA funds did lead to greater increases in some overhead line items, specifically clerks and computer programmers and operators. However, spending on the office of the director of the network did not increase with VERA funds. Spending on care coordination cost centers did increase with the VERA-10 windfall. However, medical center directors did not take the opportunity to spend more on their own office. (Figure 3).

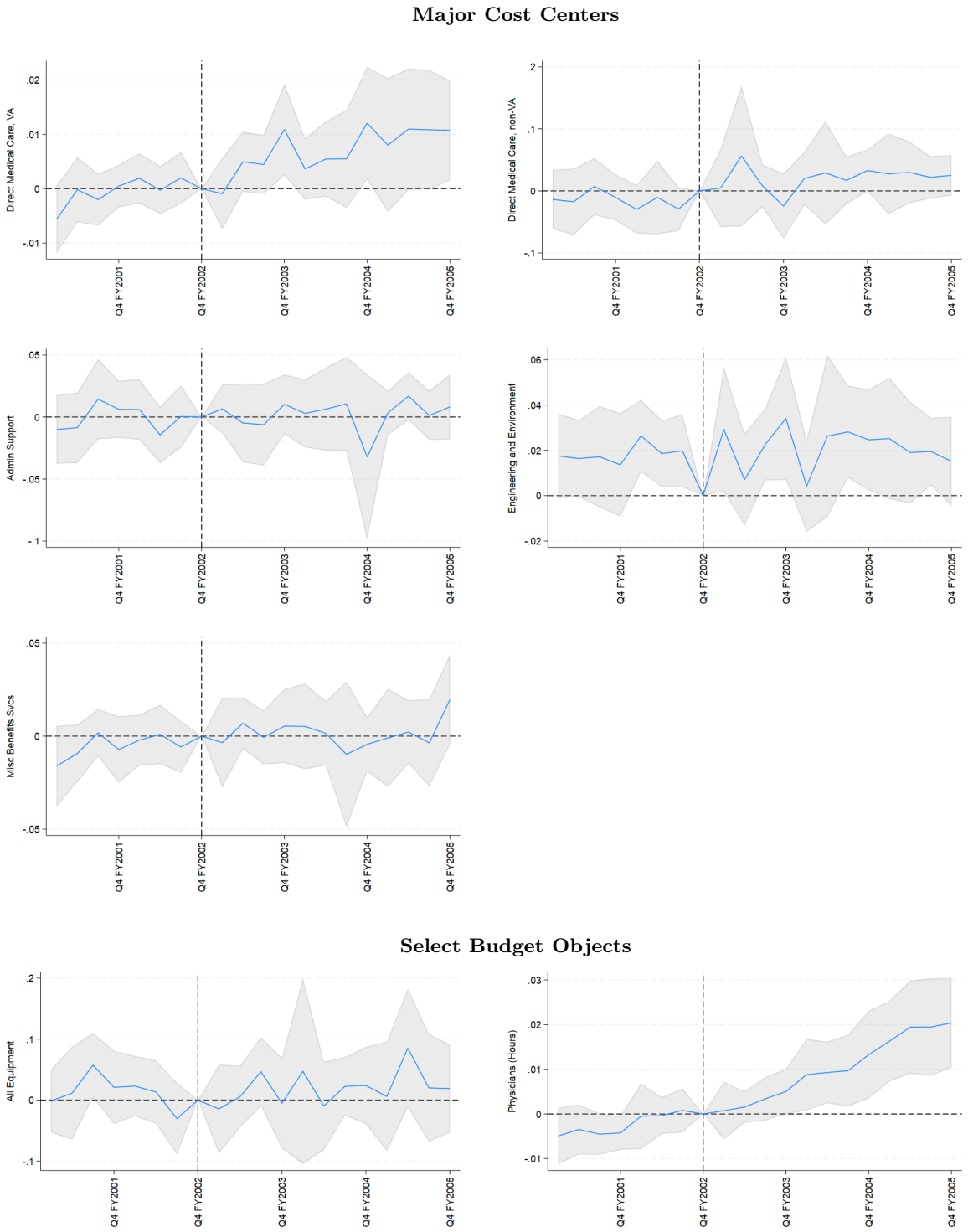


Figure 2: Estimates of elasticity of VHA spending (and in case of physicians and nurses, hours) with respect to the funding shock induced by the granularization of the allocation formula beginning in FY 2003. The point estimates are coefficients from a two-way fixed effects regression implementing an event study where the continuous treatment is how much a VHA network's funding changed during the reform of FY 2003.

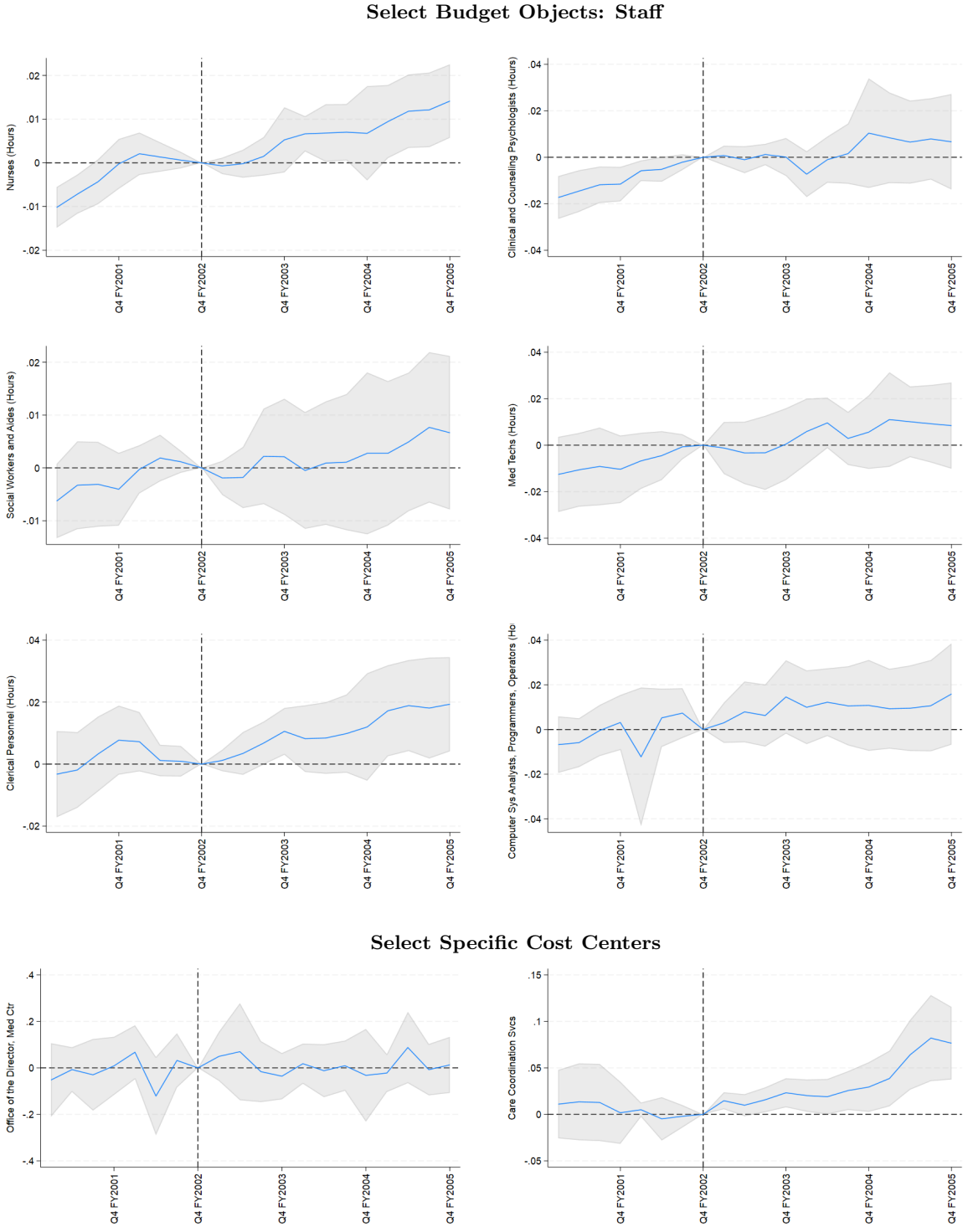


Figure 3: Estimates of elasticity of VHA spending (and in case of staff, hours) with respect to the funding shock induced by the granularization of the allocation formula beginning in FY 2003. The point estimates are coefficients from a two-way fixed effects regression implementing an event study where the continuous treatment is how much a VHA network's funding changed during the reform of FY 2003.

5.2 Do Health Care Managers Increase Access or Quality?

In this section, we see that the increased labor inputs induced by the VERA reform do translate into increased medical care activity, as measured in numbers of inpatient stays and outpatient visits. This new labor could be used to see patients more often, see patients who would not have come into VHA before, or spend more care on patients who are seen. I see evidence for at least the first two. A one percent increase in VERA funds results in a one percent increase in inpatient stays and a one percent increase in outpatient visits (Figure 4). The Appendix shows that the increase in inpatient visits is the same across major ICD-9 categories of patient diagnoses (Appendix Figure 8). I also see an increase in the number of unique patients seen in a given quarter. This means that VHAs are increasing on both their extensive and intensive margins across patients. I do not see an increase in admissions to VHA nursing homes (Figure 4).

In preliminary evidence, it appears that the increase in inpatient visits appears to be driven by increases in visits to medical wards and to surgery. I do not see evidence of increases on other wards, such as those designated neurology, psychiatry, or spinal cord injury. Among outpatient stop codes, an increase in funding led to an increase in surgical visits, which entails surgical consults. Outpatient visits for oncological medicine decreases. There is no change in diagnostic radiology, general surgery, or spinal cord injury stops (Appendix Figure 8).

The third margin on which VHA networks could adjust is to spend more resources on individual patient encounters. One potential consequence of such resource expenditure could be to improve quality of care, perhaps by being more attendant to patients in critical conditions or spending more time communicating with the patient. I do not yet see evidence of an increase in quality. Specifically, I do not see a change in survival after heart attacks (acute myocardial infarctions, AMIs) or in hospital readmissions after initial admission (Figure 4). I see similar evidence on the effect of *per enrollee* spending on quality. In lieu of direct evidence on whether hospitals are expending more resources per episode of care or visit, it is hard to pin down the story. It could be that hospitals are using more resources for each visit but those resources are not effective. Alternatively, it could be that hospitals are not expending more resources per visit. This could be due to the weights that hospitals put on volume expansion relative to quality improvement, or it could be that quality only improves with larger increases in resources than the VERA-10 introduction offered. Finally, it could alternatively be that hospitals improved quality on dimensions that I have not yet observed. For example, if staffing in VHA hospitals increased, there could have been a resulting decrease in ambulatory-sensitive conditions, which I do not observe in my current data set.

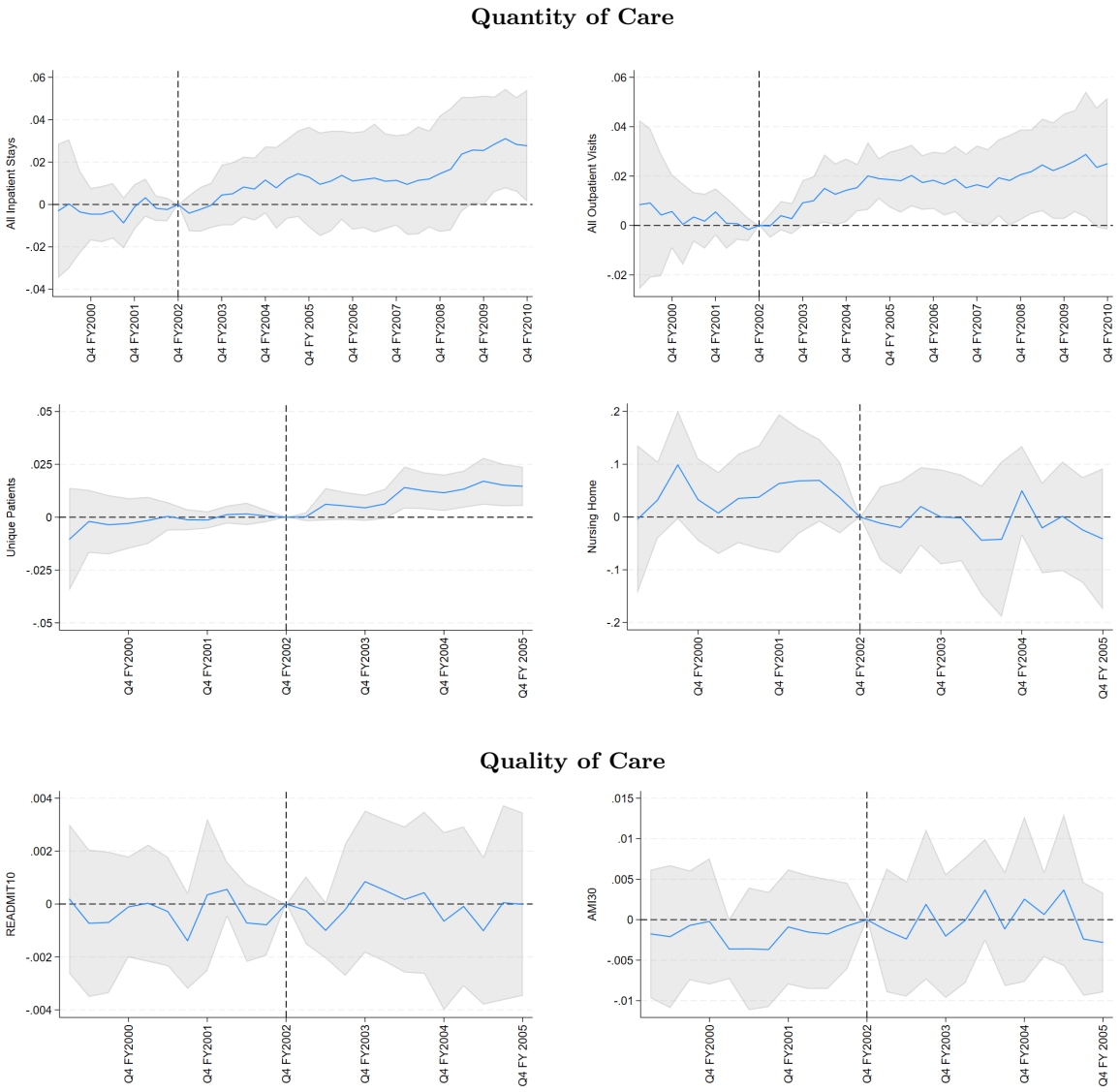


Figure 4: Estimates of elasticity of VHA spending (and in case of staff, hours) on quantity and quality of care with respect to the funding shock induced by the granularization of the allocation formula beginning in FY 2003. The point estimates are coefficients from a two-way fixed effects regression implementing an event study where the continuous treatment is how much a VHA network's funding changed during the reform of FY 2003.

6 Preliminary: Heterogeneity by Health Care System Size

This section investigates whether network (VISN) managers prioritize spending the marginal dollar on larger health care systems within their geographic region of management or on smaller ones, which may also correspond to systems that are more central and systems that are more peripheral. The purpose of this investigation is to see if VA managers prioritize allocating marginal resources to take advantage of agglomeration effects or to expand geographic access. These results are subject to further probing and further consideration

of the interpretation.

Recall that these large organizations of the VA that were allocated funds from the central authority each year – veterans integrated service networks, or VISNs – are each comprised of several health care systems that are in turn made up of a medical center, outpatient clinics, and labs. For example, VISN 12 is comprised of the health care systems in Chicago, Illiana, Hines, Iron Mountain, Madison, Tomah, and Milwaukee. VISN 21 is made up of health care systems in San Francisco, Palo Alto, Northern California (Sacramento), Fresno, Reno, Southern Nevada, Honolulu, and Manila. The prior analysis was conducted at the VISN level. Here I conduct event studies at the health care system level, using the same VISN-level treatment variable and partitioning the health care systems by whether they are in the bottom percentile of number of inpatient visits in 2003 or the top percentile.

Figure 5 and Figure 6 present the results. A given increase in VISN funding results in a greater increase in health care system-level spending and inputs in smaller systems than in larger systems. A one percent increase in VISN funding results in a 10 percent increase in system spending among small systems (left) and a two percent increase in system spending among large systems (right). The network-level funding increase also results in greater increases in physicians and nurse hours among small systems than large ones.

That being said, these larger increases in inputs in smaller systems do not seem to lead to greater increases in utilization. Large systems see one percent increases in inpatient visits in response to a one percent increase in network funding. Results in small systems are difficult to interpret due to what might be a spike in pretrends before the policy. Pretrends in outpatient visits are parallel in small and large systems. Small systems see a bigger increase in outpatient visits right after the policy, but puzzlingly, event studies at the system level do not show sustained increases in outpatient visits among small or large systems, even though the earlier VISN-level analysis shows that funding increases led to sustained increases in outpatient visits.

An explanation for the differential increase in hiring in smaller systems that is alternative to manager's prioritizing expanding geographic access is that it may be easier for VA to hire in low cost of living areas than in higher ones. On the one hand, higher cost of living areas are likely thicker markets, making it easier to hire, but on the other hand, the VA may have an advantage in wage setting in those places. As analysis by Todd Wagner shows, the geographic adjusters for setting salaries in VA are higher (more competitive) than CMS geographic adjusters are in low cost of living areas, and they are lower (less competitive) in higher cost of living areas.

Results on differential effects on spending on major cost centers is noisy and thus difficult to interpret (Figure 11). Small systems likely have greater increase in direct care spending. There is some evidence they have also have greater increases in contracted-out care, although noisy pretrends make this difficult to

establish.

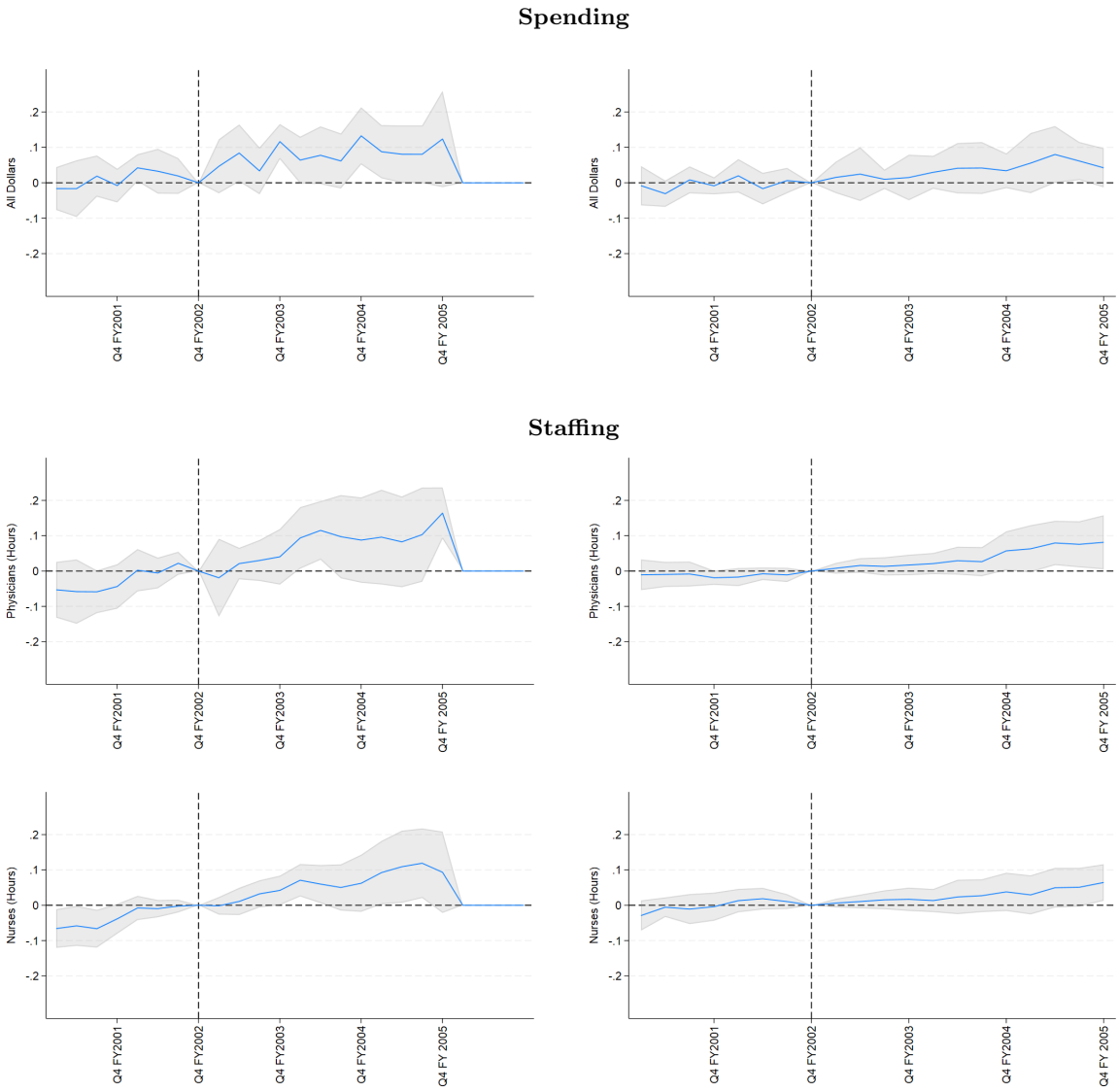


Figure 5: Results Split by Health Care Systems in the Bottom Tercile of Inpatient Visits (Left) and Top Tercile (Right)

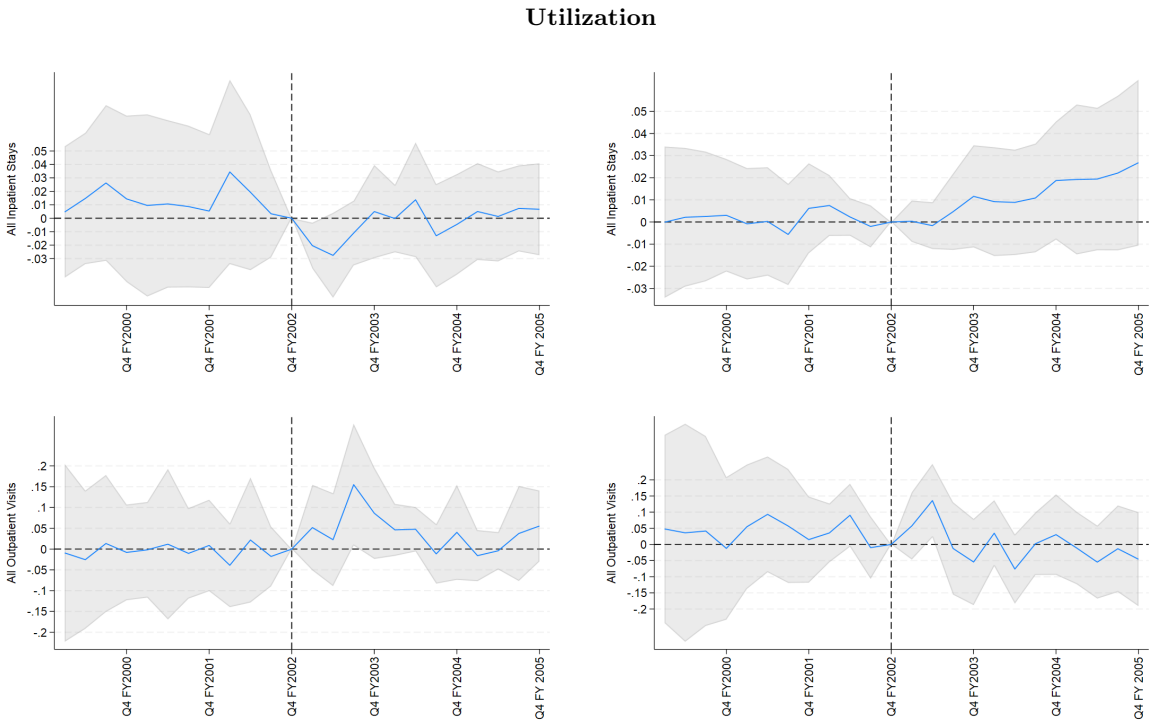


Figure 6: Results Split by Health Care Systems in the Bottom Tercile of Inpatient Visits (Left) and Top Tercile (Right), continued

6.1 Forthcoming: Changes in Specific Services

If VA managers use increases in funds to increase access, it should be asked whether this causes them to (1) increase their number of services, (2) whether it causes them to increase their numbers of services, and (3) whether it causes them to change services from contracted-out to performed in-house. I have already shown evidence of (1). Evidence speaking to (2) through (3) will be pursued next. Smaller health care systems may not have the scale to incur the fixed costs for some services like magnetic resonance imaging or chemotherapy. However, if increases in spending allow them to scale up, it may now be economical for them to bring those services in-house. VA may have an interest in providing these services in-house once financially feasible in pursuance of continuity and coordination of care that VHA often touts as its comparative advantage. Forthcoming analyses will look for evidence of such changes in services.

6.2 Forthcoming: Distance Traveled

If marginal resources are allocated to expand geographic access or to reduce patient travel times, then greater increases in funding should be correlated with greater reductions in average distance between patient residence and the point of service. I am currently compiling data allowing me to test this hypothesis.

7 Forthcoming: Substitution between Private Care and VA Care

This paper has shown that a one percent increase in funding for a VA health care "network" (the hierarchy above a health care system) results in a one percent increase in inpatient visits, partially driven by an increase in unique patients coming in for inpatient care, and a one percent increase in outpatient visits. I have acquired access to Medicare claims of VHA beneficiaries and will analyze how utilization at private providers decreases when a VA network receives more funding, in order to understand how much of the care increase that I observe is "new care" that would not have occurred in the absence of funding and how much of it is substitution from private care.

8 Discussion and Future Work

This paper has investigated what health care managers and providers care about in a setting that is understudied in two ways. The Veterans Health Administration is publicly managed, and its revenue is capitated. Exploiting a natural experiment where health care managers were given funding increases of different magnitudes unrelated to characteristics of health care managers or providers, I find that VHA networks spend windfalls on direct care, increasing physician and nurse hours, as well as care coordination dollars. I do not find increases in major overhead cost centers or in the cost center of Office of the Medical Center Director. VHA health care systems appear to spend marginal dollars on inputs to direct medical care, and this leads to increases in the quantity of care. Numbers of inpatient stays and outpatient visits increases, partially driven by increasing the number of unique patients seen. So far, I do not detect any increase in quality that results from increased funding.

I find that shock-induced increases in physician hours is not even across VHA health systems (which are systems of hospitals, clinics, and labs and are subordinate to networks in VHA's management hierarchy). In analysis presented in the Appendix, I partition my health systems-level data according to whether a system is in a metropolitan statistical area with a high health care employee to resident count ratio – in which case, I say it is in a thick medical labor market – or in a low health care employee to resident ratio. I find a large effect of funding increases on hiring in the thin markets but no effect in the thick markets (Appendix Figure 9). These thin labor markets are less densely populated and likely are lower cost of living areas. Internal VHA analysis by Todd Wagner shows that the geographic wage adjusters that the Centers for Medicare and Medicaid Services use to calculate physician reimbursements are more generous to providers in high cost of living areas than VHA weights are, but VHA weights are more generous in low cost of living areas. This all suggests future analysis into how differences in regulated wages affect hiring.

VHA's PAID dataset on individual employees' credentials, hours worked, and compensation would provide additional useful investigation for this line of inquiry.

Another important task underway is to understand the nature of marginal care, particularly whether it is care whose demand is elastic, as in Clemens and Gottlieb, or inelastic, and whether it is preventive, diagnostic, care of chronic conditions, or acute care. Preliminary results suggest surgical procedures and visits that lead to surgery are an important component of marginal care. I am also investigating the relative acuity or complexity of marginal patients and looking into the potential to analyze resource value units – which are tracked by VHA's managerial cost accountants – to measure changes in care intensity in response to the increase in direct care funding.

Clemens and Gottlieb also find that increases in physicians' marginal incentives induce adoption of new technology. I do not find an increase in new equipment spending, but it remains to be analyzed whether VHA's funding shock led hospital systems to change what types of staff they hire or how they specialize. Preliminary analysis of patient encounters does not immediately suggest a change in specialization. I divide VHA health systems into "simple" surgical systems, those that performed fewer than give coronary artery bypass graft (CABG) procedures in the quarter before the shock and "complex" systems that did perform at least five. I do not see differences between simple and complex systems in their shock-induced differential increase in appendectomies – a relatively simple procedure – performed in-house or contracted out to non-VHA hospitals, nor do I see differences in their differential increases in contracted-out CABG procedures. Simple systems do not systematically perform more CABG procedures after the shock (See Appendix Figure 10). Using VHA's PAID dataset on individual employees' credentials, hours worked, and compensation will allow me to investigate this further. I will be able to see whether different specialists are hired after the shock and whether wages for individual physicians and other staff increase.

Understanding the overall welfare of this funding shock requires understanding whether the increase in care utilization comes from patients who wouldn't have sought care otherwise or from patients who would have had care in private facilities. I intend to use VHA's dataset that links VA beneficiaries' encounters in the VHA with Medicare claims to investigate this.

The natural experiment studied in the paper allows rare analysis of managers and providers behaving under a capitated payment scheme and working in a public-owned firm. The evidence already presented in this paper suggests that public health care managers spend marginal capitated dollars on inputs to direct patient care and that providers respond to this increase in resources by providing more care. But this experiment also lends itself to more structural analysis of agents under capitation and under public management. First, a coauthor and I are adapting a sufficient statistics approach from Acquatella (2022) to testing the optimality of a funding scheme's prospectivity to the VHA setting and testing whether VHA's

payments for outliers – patients whose annual cost exceeds a threshold – is optimal. Second, comparing responses of VHA systems to the VERA shock studied here to hospital systems reimbursed by Medicare or commercial insurance and shocked by a Medicare policy change such as that studied by Gross et al. (2021) could help tease out how much of VHA's response is related to its public status. Such an approach could draw on Hackmann (2019), who exploits a shock to Medicaid reimbursement policy towards nursing homes to estimate structural parameters of non-profit and for-profit nursing homes objective functions.

Finally, analyzing a related VHA reform that occurred years later would provide further insights into organization of large enterprises. Around 2010, VHA required networks to allocate funds to their constituent health systems according to a VERA-like formula. Prior to that, networks had no restrictions on how they distributed their VERA funds to systems. Studying this policy change will answer central questions from organizational economics about the degree to which centralization improves efficiency by discouraging favoritism or worsens efficiency by discouraging the use of local information.

References

Acquatella, Angie, "Evaluating the Optimality of Provider Reimbursement Contracts," April 2022.

Alexander, Diane, "Does Physician Pay Affect Procedure Choice and Patient Health? Evidence from Medicaid C-Section Use by Diane Alexander," July 2017.

_ **and Molly Schnell**, "The Impacts of Physician Payments on Patient Access, Use, and Health," July 2019.

Baicker, Katherine and Douglas Staiger, "Fiscal Shenanigans, Targeted Federal Health Care Funds, and Patient Mortality," *The Quarterly Journal of Economics*, February 2005, *120* (1), 345–386.

Bascetta, Cynthia, "Changes Needed to Improve Resource Allocation to Health Care Networks; Statement of Cynthia A. Bascetta to the Subcommittee on National Security, Veterans Affairs, and International Relations, Committee on Government Reform, House of Representatives," Technical Report, Government Accountability Office May 2002.

Cabral, Marika, Michael Geruso, and Neale Mahoney, "Do Larger Health Insurance Subsidies Benefit Patients or Producers? Evidence from Medicare Advantage," *American Economic Review*, August 2018, *108* (8), 2048–2087.

Carroll, Caitlin, "Public Investment and Health Care Quality: Evidence from Rural Hospital Subsidies," 2023.

Chandra, Amitabh and Jonathan Skinner, "Technology Growth and Expenditure Growth in Health Care," *Journal of Economic Literature*, July 2012, *50* (3), 645–680.

_ **, Carrie H. Colla, and Jonathan S. Skinner**, "Productivity Variation and Input Misallocation: Evidence from Hospitals," August 2023.

Clemens, Jeffrey and Joshua D. Gottlieb, "Do Physicians' Financial Incentives Affect Medical Treatment and Patient Health?," *American Economic Review*, April 2014, *104* (4), 1320–1349.

Cooper, Zack, Joseph Doyle, John Graves, and Jonathan Gruber, "Do Higher-Priced Hospitals Deliver Higher-Quality Care?," Technical Report w29809, National Bureau of Economic Research, Cambridge, MA February 2022.

Dafny, Leemore S., "How Do Hospitals Respond to Price Changes?," *American Economic Review*, December 2005, *95* (5), 1525–1547.

Duggan, Mark, Amanda Starc, and Boris Vabson, "Who Benefits When the Government Pays More? Pass-through in the Medicare Advantage Program," *Journal of Public Economics*, September 2016, *141*, 50–67.

_ **and Fiona Scott Morton**, "The Effect of Medicare Part D on Pharmaceutical Prices and Utilization," *American Economic Review*, March 2010, *100* (1), 590–607.

Duggan, Mark G., "Hospital Ownership and Public Medical Spending," *The Quarterly Journal of Economics*, November 2000, *115* (4), 1343–1373.

Einav, Liran, Amy Finkelstein, and Neale Mahoney, "Producing Health: Measuring Value Added of Nursing Homes," August 2022.

Eliason, Paul J., Paul L. E. Grieco, Ryan C. McDevitt, and James W. Roberts, "Strategic Patient Discharge: The Case of Long-Term Care Hospitals," *American Economic Review*, November 2018, *108* (11), 3232–3265.

Finkelstein, Amy, "The Aggregate Effects of Health Insurance: Evidence from the Introduction of Medicare," *The Quarterly Journal of Economics*, February 2007, *122* (1), 1–37.

_ **and Robin McKnight**, "What Did Medicare Do? The Initial Impact of Medicare on Mortality and out of Pocket Medical Spending," *Journal of Public Economics*, July 2008, *92* (7), 1644–1668.

Garthwaite, Craig, Christopher Ody, and Amanda Starc, "Endogenous Quality Investments in the U.S. Hospital Market," June 2020.

_ **, John Graves, Tal Gross, Zeynal Karaca, Victoria Marone, and Matthew J. Notowidigdo**, "All Medicaid Expansions Are Not Created Equal: The Geography and Targeting of the Affordable Care Act," *Brookings Papers on Economic Activity*, 2019, *2019* (2), 1–92.

Gaynor, Martin, James B. Rebitzer, and Lowell J. Taylor, "Physician Incentives in Health Maintenance Organizations," *Journal of Political Economy*, August 2004, *112* (4), 915–931.

Geruso, Michael and Timothy Layton, "Upcoding: Evidence from Medicare on Squishy Risk Adjustment," *Journal of Political Economy*, March 2020, *128* (3), 984–1026.

Gross, Tal, Adam Sacarny, Maggie Shi, and David Silver, "Regulated Revenues and Hospital Behavior: Evidence from a Medicare Overhaul," July 2021.

Gupta, Atul, Ambar La Forgia, and Adam Sacarny, "Turbocharging Revenue: What Do Healthcare Providers Do With Windfall Gains?," 2023.

Hackmann, Martin B., "Incentivizing Better Quality of Care: The Role of Medicaid and Competition in the Nursing Home Industry," *American Economic Review*, May 2019, *109* (5), 1684–1716.

Ho, Kate and Ariel Pakes, "Physician Payment Reform and Hospital Referrals," *American Economic Review*, May 2014, *104* (5), 200–205.

Kornai, J., "Resource-Constrained versus Demand-Constrained Systems," *Econometrica*, 1979, *47* (4), 801–819.

Morgan, David and Josephine Walker, "US House Approves First 2024 Spending Bill, Delays a Second," *Reuters*, July 2023.

Pauly, Mark and Michael Redisch, "The Not-For-Profit Hospital as a Physicians' Cooperative," *The American Economic Review*, 1973, *63* (1), 87–99.

Rambachan, Ashesh and Jonathan Roth, "A More Credible Approach to Parallel Trends," *Review of Economic Studies*, September 2023, *90* (5), 2555–2591.

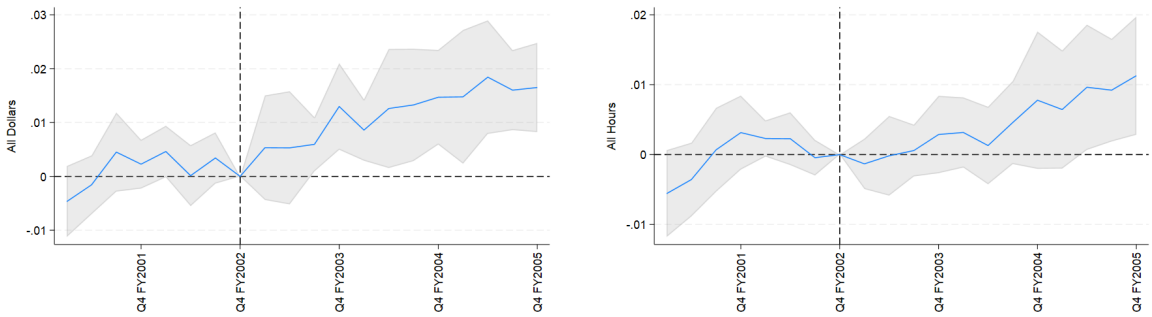
The Economist, "How Rationing Became the Fashion under the Tories," *The Economist*, October 2023.

Timmins, Christopher, "Measuring the Dynamic Efficiency Costs of Regulators' Preferences: Municipal Water Utilities in the Arid West," *Econometrica*, 2002, *70* (2), 603–629.

Wasserman, Jeffrey, Jeanne S. Ringel, Barbara O. Wynn, Jack Zwanziger, and Karen A. Ricci, "An Analysis of the Veterans Equitable Resource Allocation (VERA) System | RAND," Technical Report 2001.

_ **,** _ **, Karen A. Ricci, Jesse D. Malkin, Barbara O. Wynn, Jack Zwanziger, Sydne J. Newberry, Marika Booth, and Afshin Rastegar**, "Understanding Potential Changes to the Veterans Equitable Resource Allocation (VERA) System: A Regression-Based Approach," Technical Report, RAND Corporation May 2004.

A Appendix: Additional Results



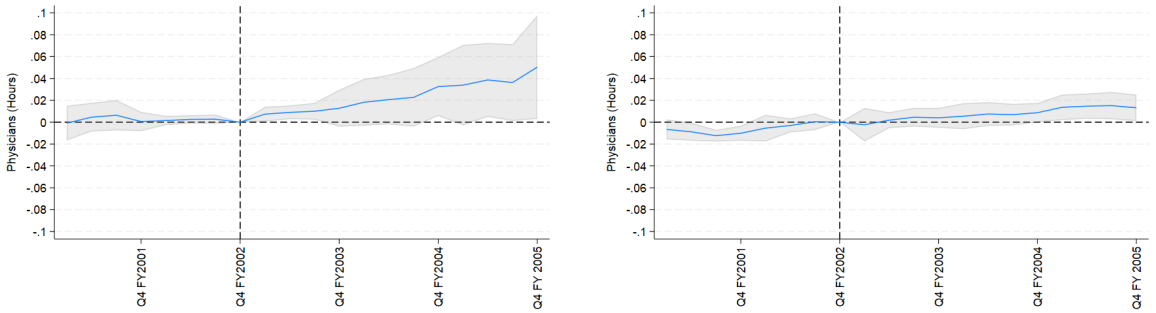
(a) All Actual Dollars

(b) All Actual Staff Hours

Figure 7: Estimates of elasticity of VHA budget authorization on overall spending and hours of staff. The left panel is included to look for evidence of differential pretrends and as a sanity check on the accounting data and measurement of the policy shock. The point estimates are coefficients from a two-way fixed effects regression implementing an event study where the continuous treatment is how much a VHA network's funding changed during the reform of FY 2003.

(a) Inpatient **(b)** Outpatient

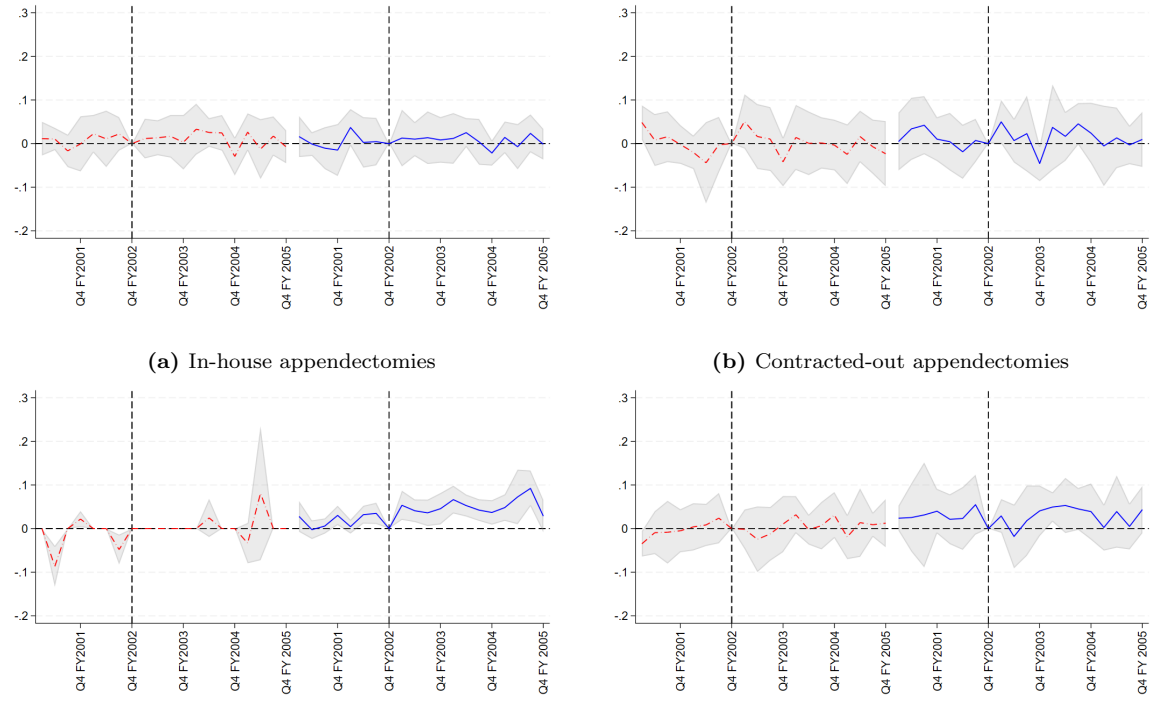
Figure 8: Estimates of elasticity of VHA spending on quantity and quality of care with respect to the funding shock induced by the granularization of the allocation formula beginning in FY 2003. Top row display estimates of effects of spending shocks on proportional increase in inpatient stays (left, a) and outpatient visits (right, b) among patients with particular diagnoses the previous year. The middle and bottom rows show estimates of effects on proportional changes in number of visits by treatment specialty or stop code.



(a) Low health care employment–population ratio

(b) High health care employment–population ratio

Figure 9: Estimates of elasticity of VHA physician hours with respect to the funding shock induced by the granularization of the allocation formula beginning in FY 2003. Regressions are run at the hospital system level of observation and run on subsamples of hospital systems in (left) thin labor markets and in (right) thick labor markets.



(a) In-house appendectomies

(b) Contracted-out appendectomies

(c) In-house CABG procedures

(d) Contracted-out CABG procedures

Figure 10: Estimates of elasticity of procedures performed with respect to the funding shock induced by the granularization of the allocation formula beginning in FY 2003. Regressions are run at the hospital system level of observation and run on subsamples of hospital systems that are (red, dashed, left) "simple" (performed less than 5 coronary atery bypass graft (CABG) procedures in Q4 FY 2002) and hospital systems that are (blue, solid, right) "complex" (performed at least 5 CABG procedures in Q4 FY 2002).

A.1 Spending on Major Cost Centers

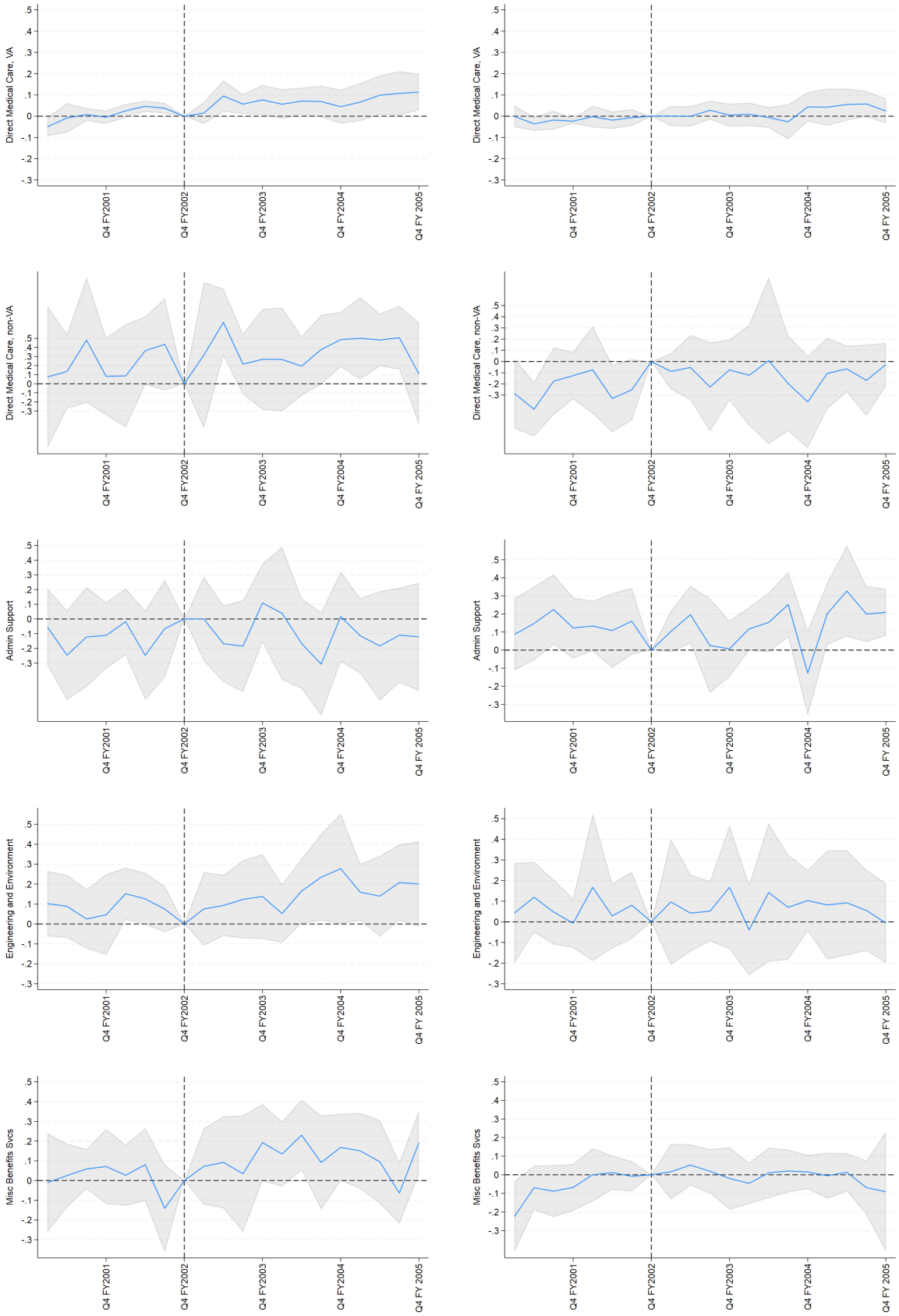


Figure 11: Results Split by Health Care Systems in the Bottom Tercile of Inpatient Visits (Left) and Top Tercile (Right)