Value Creation in Public Enterprises: An Empirical Analysis of Coordinated
Organizational Changes in the VA Hospital System

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ABSTRACT

As part of a federal government initiative to increase effectiveness and efficiency, the United States’ VHA (Veterans Health Administration) recently radically restructured its organizational design and management processes. This study uses clinical, workload and financial data from the 1992-1998 period to examine the effect of this reform on performance. Several previous government attempts to introduce private sector management practices, such as management by objectives (MBO) or program planning and budgeting system (PPBS), have been largely unsuccessful. In contrast to prior reforms, the current restructuring introduced coordinated changes in the VHA’s organizational structure, performance measurement, and reward systems that are aligned with organizational strategic objectives. Our results document that, following the reorganization, the VHA’s cost per patient has significantly decreased, while various quality measures have improved. Our analysis suggests that reduction in excess capacity and the more intense use of remaining capacity are among the primary explanations for how the VHA achieved the observed cost reductions. These findings suggest that coordinated changes in organizational structure, performance measures and incentives aligned with strategy may be valuable in public enterprises where control mechanisms are more limited than in private sector settings.
1. **INTRODUCTION**

This study examines how coordinated changes in the organizational structure and management control systems of a large government agency affected the efficiency and quality of services provided. Governments have introduced a number of control system reforms in recent years, both in the US and worldwide (Cavaluzzo and Ittner 2004; Atkinson and McCrindell 1997; Hood 1995). However, as Ittner and Larcker (1998) note, much less is known about the effect of such management innovations in government than in the private sector.

We use longitudinal data from the Veteran's Health Administration (VHA) to examine the proposition that coordinated changes in organizational architecture (OA), i.e., performance measures, reward systems and the allocation of decision rights, are more likely to achieve organizational objectives than are uncoordinated, independent changes to individual control system components (Baker and Wruck 1989, Wruck and Jensen 1994, Brickley, Smith and Zimmerman (BSZ) 1995; 1996). Empirical studies on private sector firms provide evidence on the interdependence of key management control components as well as their relationship with specific knowledge and the environment. The VHA's reform documents many of these same principles in a governmental context.

The VHA is the VA's (Veterans Affairs) healthcare system and the United States' largest integrated healthcare system. Over the last 25 years, the VHA has attempted a variety of uncoordinated reforms at many levels of its management control system. These attempts have been widely viewed as unsuccessful, as evidenced by mounting criticism from the media and government reports (Iglehart 1985; 1996; Hollingsworth and Bondy 1990; CFSVHC 1991; Fihn 2000). In response, the VHA recently implemented recommendations from the National Performance Review (National Performance Review (NPR) 1993) and the Government Performance Results Act (USGAO (GPRA) 1993) to decentralize decision making and implement other concurrent control system changes. The application of NPR and GPRA principles in the VHA offers an interesting opportunity to study the value of coordinating changes in organizational architecture in a governmental setting.

We use clinical, workload and financial data from 1992 to 1998 to examine the effect of the VHA's 1996 reform on the targeted objective of improving efficiency. The strong and consistent patterns of efficiency improvements documented in this study provide support for the theoretical proposition that balancing and coordinating the various elements of OA can
effectively move an organization towards performance targets. These results are consistent with studies of private enterprise by Baker and Wruck (1989), Wruck and Jensen (1994), Treml and Lehn (2000), and Ittner and Larcker (1995). The results are also consistent with our conjecture that previous government reforms or implementations of innovative management practices achieved limited success in part due to lack of consideration of the whole organizational architecture in their implementation (Downs and Larkey 1986; Ittner and Larcker 1998; Wildavsky 1984).

Section 2 reviews recent governmental reform efforts and presents the OA theoretical framework. Section 3 relates the VHA's reorganization to the dimensions of the OA structure and to the context of wider governmental reforms and then states our research question. Section 4 describes our data, variables and model. We present the analysis and results in section 5 and the conclusions in section 6.

2. BACKGROUND

Recent Government Reform

The latest U.S. federal government reorganization effort originated in 1993 with the release of the National Performance Review (NPR) report. The NPR aims to "create a government that works better and costs less by empowering employees to put customers first, cutting the red tape that holds back employees…". The NPR advocates:

- Strategic-based management by simplifying and clarifying goals to guide (but not dictate) operations;
- Decentralization of decision-making authority and bureaucracy reduction;
- Decision-maker accountability with market and output-based performance measures and incentive contracts.

Enacted in July 1993, the GPRA (Government Performance Results Act) mandates that all federal agencies develop strategic plans with quantified goals and report on the progress towards those goals (USGAO 1997). The NPR and GPRA thus attempt to focus agencies on objectives and hold them accountable for results (National Performance Review 1993).

Applying the NPR and GPRA in the Veterans Health Administration (VHA)

The NPR report initially targeted ten agencies, including the Veterans Health Administration (VHA) (National Performance Review 1993a). Mounting criticism of the quality and efficiency of care provided by VHA hospitals, as well as changes in the
healthcare market and in the veteran patient population, created strong pressure for a major reorganization of the VA’s healthcare system (Lindsay 1975; Farber et al. 1977; Iglehart 1985; 1996; CFSVHC 1991). The NPR thus provided the push for a complete transformation of the VHA’s operations.

The VHA’s 1996 reorganization aimed to reduce the operating cost of care per patient, serve more patients, and improve the quality of care (Kizer 1995; 1996). The reorganization sought to replace a hospital-based healthcare system with an integrated system of patient-centered hospital networks. To do this, the VHA attempted to shift the locus of decision making and accountability closer to the veterans. We next describe the VHA’s reorganization in terms of the organizational architecture framework, which includes: (1) the decision-making structure, (2) the performance measurement system, and (3) the incentive reward system.

**Theoretical Framework: Organizational Architecture**

Organizational architecture (OA) is a managerial economics framework for analyzing organizational design (Brickley, Smith and Zimmerman 1995; 1996). The three components of the OA framework, i.e., assignment of decision rights, choice of performance measures and the reward systems are interdependent and their successful integration is hypothesized to be a primary determinant of value creation. Baker and Wruck (1989) document that coordinated organizational changes are associated with improvements in value in leveraged buyouts. Wruck and Jensen (1994), Ittner and Larcker (1995), BSZ (1996) and Treml and Lehn (2000), among others, document that the successful implementation of innovative management techniques such as TQM (Total Quality Management) and JIT (Just In Time) depends on the broader organizational context, including appropriate performance measures and reward structures (BSZ 1997), as well as the organization’s economic environment and strategy.

The assignment of decision rights reflects Hayek’s (1945) contention that collocation of decision rights with the relevant specific knowledge is a critical determinant of organizational success. For example, in rapidly changing and technological environments, decentralized

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1 Jensen (1983), Jensen and Meckling (1992) and Milgrom and Roberts (1992) take a similar approach to designing management control systems in organizations. Similarly, Ittner and Larcker (2001, page 355) observe that “…managerial accounting and control should be viewed as a complete organizational control package consisting of accounting information systems, performance measurement and reward systems, and organizational design, with the choice and performance consequences of these practices a function of the firm’s external environment, organizational objectives and strategies”.

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organizations, structured around products, services, customers or a geographical area, may be better suited to respond quickly and efficiently to market demands and technological change.

The performance evaluation system involves the choice of measures and performance standards to coordinate the efforts of decentralized decision makers, provide feedback to top management for evaluating progress towards strategic objectives and to employees for learning, and to establish a basis for assigning rewards and/or penalties.

Ittner and Larcker (1998) argue that the choice of performance measures is one of the most important challenges facing organizations. Cavalluzzo and Ittner's (2004) study of performance systems in government agencies emphasizes the link of performance measurement with key OA components. They find that top management’s use of performance information and their decision-making accountability are associated with greater performance measurement system development and use.

Reward systems seek to motivate employees to be more productive, to focus on organizational objectives, and to learn (Wruck 2000). A broad consensus from a variety of disciplines concludes that the presence of incentives influences behavior. For example, Banker, Potter and Srinivasan (2000) document that the introduction of an incentive plan including non-financial performance measures in a hotel chain significantly increased performance.

A limited number of empirical studies examine the interaction of organizational architecture components in private sector settings. Results from Nagar’s (2002) study of organizational architecture changes in retail banking, and Demers et al.’s (2003) study of Internet firms support the association of performance measures and rewards systems with the allocation of decision rights. Treml and Lehn (2000), Wruck and Jensen (1994), and Demers et al. (2003) find support for the proposition that changes in the allocation of decision rights are determined by the cost of knowledge transfer and the location of specific knowledge.

We next describe the VHA’s reorganization in terms of the OA framework, relate the reorganization to previous governmental reforms, and state our research question.

3. THE CONTEXT OF THE VHA'S REORGANIZATION

The VHA's Reorganization and OA

Kenneth W. Kizer, then Undersecretary for Health in the VA and the architect of the VHA’s reorganization, described it as “the first step in the transformation of the VHA to a
more efficient and patient-centered health care system” (Kizer 1995, p. 1). As Thibodeau (2004) documents in more detail, the following is a summary of the major changes in the VHA’s OA:

(1) Decentralization of decision authority with the creation of a new hospital network structure, the Veterans Integrated Service Network (VISN), in which network managers allocate resources within the geographical area of the network.

(2) Network managers are accountable based on performance evaluations and they receive rewards aligned with targeted objectives and consistent with their decision span.

Specific changes include:

(a) Introduction of performance-based incentives through:
   i. Network Directors’ Performance Contracts (NDPCs) (DVA 1998a);
   ii. The Veterans Equitable Resource Allocation (VERA) a “capitated” (i.e., based on the number of patients treated) budget allocation formula (DVA 1997c);

(b) The creation of a performance measurement system with the following characteristics:
   i. Clear performance standards;
   ii. A mix of internal and external performance standards;
   iii. A mix of organizational-wide and VISN-specific performance targets;
   iv. Performance measures reflecting value drivers in the healthcare industry. Targeted annual measures include:
      a. Cost drivers: total beds in operation, bed days of care per patient, percentage of surgical procedures in an ambulatory setting, number of individual patients served by VA hospitals;
      b. Quality measures: patient satisfaction, clinical practice guidelines, end of life planning, follow-up after mental illness treatment, waiting times and industry indicators of various detection and prevention procedures including the Chronic Disease Index (CDI), the Prevention Index (PI) and the Addiction Severity Index (ASI);
   v. Targeted measures and results widely communicated throughout the organization;
   vi. Network and VHA headquarters directors using the performance measurement system to:
      a. Monitor network and hospital management performance;
      b. Guide operational decisions;
      c. Coordinate decisions across hospitals within and across networks.
The transformation of the VHA began in 1996 with the creation of hospital networks, the Veterans Integrated Service Networks (VISNs), the introduction of the Network Directors' Performance Contracts (NDPCs) and performance measures across the organization, as well as the development of a new budget allocation methodology. Figure 1 contrasts the VHA's OA before (pre-1996) versus after (1996 and later) the reorganization. Figure 2 summarizes the timeline of major events surrounding the VHA's reorganization.

--- Insert Figures 1 and 2 here ---

Prior to the reorganization, approximately 173 VHA hospitals operated essentially independently from each other except for some degree of highly centralized coordination. Under that system, VHA headquarters retained most of the authority for decisions such as the allocation of beds and the services provided by individual hospital facilities (Kizer 1995; CHSPR 1991). In particular, the Center for Health Services and Policy Research’s analysis noted that “managers at all levels of the organization lack the authority needed to effectively perform assigned tasks”, including ”the authority to reallocate hospital beds among services to meet the needs of their patients” (p.34) creating a “lack of flexibility to local variation” (p. 17).2 Finally, the CHSPR analysis also criticized the persistent micromanagement that characterized the system as Farber (1977) and Lindsay’s (1975) detailed studies had noted earlier.3

The reorganized VHA employs 22 geographic networks of hospitals and gives network directors greater authority over operating decisions. Interviews confirmed that VHA facility staff are encouraged to coordinate and integrate services with other facilities in their network.4 As a result, facilities within a network will consolidate services, refer patients to one another and share information. Less efficient units in one hospital may be closed if another facility within the network can provide the service more efficiently or with higher

2 The CHRP also noted an historical “lack of coordination between clinical, administrative, and Information Resource Management Staff within facilities, and limited mutual planning and evaluation between facilities in the field and VACO (VA Central Office)” (p. 43) leading to confusion and duplication. For example, two directors described “sending duplicates of everything” because they did not know who is responsible for what between Regional Field Offices and the Regional Support Offices in Central Office (p. 27).
3 For example, the authors note the construction of new hospital facilities in areas where capacity already exceeded demand while failing to provide more beds in places where demand exceeded capacity, the hiring of political appointees in top management, as well as the funding of facilities based on political influence.
4 During the period from November 1997 to December 1999, we conducted over 30 semi-structured interviews on site or by telephone with personnel at various levels and positions across the VHA, including administration, management and clinical personnel at the VHA and network levels. We also obtained information less formally via observation and interaction with these individuals in the course of collecting data.
quality. Services may also be outsourced if private sector providers can provide the service at a lower cost (Kizer, 1995). One manager even described the integration as “Kizer’s greatest accomplishment”.

A variety of evidence across networks supports the claims of increased latitude in regional management. For example, individual Networks have adopted various operational and control strategies for managing hospital facilities. Individual networks have also consolidated facilities across networks based on local circumstances (Lukas et al. 1998; USGAO 1997, DVA 1998b). Hence, a variety of governance, management, communication and oversight structures can now be found across VISNs.

In line with the new organizational system and the VHA’s philosophy of putting the patient first, the new resource allocation system attempts to shift dollars to match patients’ needs. More specifically, the allocation of resources among networks and hospitals is based on the number of unique patients served, which has replaced a regional funding allocation mechanism based on prior years’ allocations and service levels (DVA 1997c). The patients are veterans who either have service connected injuries/illnesses or meet income criteria and were not dishonorably discharged. The service connected condition could mean, for example, that a veteran developed schizophrenia while in the military or lost a limb in combat. Such veterans can obtain care at no cost in a VHA hospital, or alternatively, they can obtain care from private sector providers if they have insurance or can pay themselves. Kizer (1995) concluded that the VHA must therefore respond to this competition by attracting such veterans who could potentially seek care elsewhere. The total number of patients treated is the base of the resource allocation methodology as well as one of the measures targeted by the NDPC performance measures (DVA 1998a).

The integration of resources within a network is one of the key objectives of the decentralization of authority to regional hospital networks. Interviews with managers from one network suggest that previously there was relatively little cooperation or resource sharing among neighboring hospitals. One line manager described how hospitals had historically operated relatively independently from one another except when competing for resources. He noted that as a result, he generally did not interact with physicians of nearby hospitals for

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5 For example, in the ongoing process of this reorganization, one network recently implemented a balanced scorecard tailored to its needs (Biro et al., 2003). As another example, some VISNs have adopted rather flat structures while others have adopted a hierarchical, though small, authority structure within the network. The individual structures apparently reflect such local factors as the number of facilities, the leadership style of the VISN director and the culture of the people in place (Charns et al. 1997).
research or patient care because they were viewed as competitors. He further observed that the new resource allocation system has effectively forced some degree of communication and cooperation among hospitals within a network.

Also supporting the new organizational structure, the VHA’s new management performance evaluation system is part of a broader performance monitoring process in which the VHA's hospital networks and directors are accountable for objective measures, linked to wider strategic targets. The VHA organizes approximately twenty performance measures into three domains - cost, access and quality - all related to the new strategic objectives. Previously, the VHA had measured performance extensively (DVA 1992a; 1992b), but had not related these measures to organizational strategy. A number of interviewees at the VISN level with 10 or more years of experience indicated that prior to the reorganization, the VHA initiated a number of quality improvement initiatives that were not integrated into operations or into the performance evaluation process. As a result, these program initiatives had relatively little influence on their work.

In contrast, the same individuals indicated that they believed that after the 1996 reorganization, VHA employees generally displayed a genuine interest in the monthly performance reports to understand how they are doing relative to their performance objectives and relative to other networks. The increased attention to the measures appears to be attributable in part to the focus on a relatively small number of key measures, their integration into the NDPCs as well as the timely communication of network performance results across the VHA. These performance reports highlight progress and problems, thus enabling network managers to focus employees’ efforts.  

The preceding description shows that following recommendations of the National Performance Review (NPR) and the enactment of Government Performance Results Act (GPRA) in 1993, the VHA's reorganization moved decision rights to lower levels in the organization and coordinated these changes with a focus on specific performance measures that were incorporated into the incentive reward system for directors. In contrast, previous government and VHA-specific initiatives to improve efficiency and/or effectiveness focused on piecemeal rather than coordinated changes in the overall control mechanisms. These

6 Indeed we observed one network manager extracting such data from the VHA’s web-based system, and using it to highlight areas of relative strength and weakness for their subordinates.
7 There is no evidence to our knowledge that VHA top management was aware of the organizational architecture literature or that they made any specific reference to it in designing their organizational change process.
changes appear to have positively influenced the employees’ attitude towards their work, potentially leading to an improvement in performance.

To the extent that the OA approach captures conditions likely to promote successful change, and holding other circumstances constant, the VHA’s more comprehensive reorganization should be more successful than previous reform efforts. At the same time, we note that most of the previous empirical evidence on the success or failure of the OA framework comes from for-profit organizations, where value creation is clearly identified with shareholder wealth. Various institutional features of government enterprises may limit the success of applying the OA framework in this setting. We now discuss the potential influence of such institutional features in the context of governmental reforms.

Institutional Features of Public Enterprise and Governmental Reform Initiatives

In private sector organizations where share ownership is transferable, firms that survive will generally be those that have appropriately adapted their governance and control systems to changes in the environment such as technology, competition and regulation (Kole and Lehn 1999). Firms adapt because firm owners bear the consequences of their actions (Jensen and Meckling 1976; Alchian 1965). The transferability of share ownership provides an incentive for owners to monitor and control management behavior, allows managers who own stock to benefit from the increase in share value generated by their efforts, and creates the threat of takeover for under-performing firms, thus disciplining management (Grossman and Hart 1980; Demsetz and Lehn 1985).

Public enterprises do not face these same disciplining forces. Rather, they are created and maintained by a political process driven not by private wealth maximization but by the legitimacy concerns of politicians who seek to be re-elected. Transferable ownership rights are replaced by a collective and imposed ownership structure. Taxpayers as owners lack the incentives or means to monitor the progress of public enterprise management or to align managerial behavior with the stated objectives. In addition, various political incentives create commitment problems such as micromanagement (Lindsay 1975), political turnover (Wildavsky 1984; Light 1997) and political power struggles (Moe 1990), as well as legitimating behavior by elected officials (March and Olson 1983; Dirsmith et al. 1980).  

8 Micromanagement occurs when top management controls operational decisions on a regular basis and frequently overrides local decision-making authority.
The weak monitoring incentives, along with the political process in which public enterprises evolve, create a particular institutional environment that may constrain the evolution of public enterprises relative to their private sector counterparts. Governmental reforms may thus fail to create efficient resource allocation because of poor organizational architectures due to micromanagement or other political constraints. As Wildavsky (1984) argues in the case of PPBS (Program Planning and Budgeting System), these constraints may even override the goodwill of reformers and managers. For example, the VHA has a long history of apparently unsuccessful management reforms (Fihn 2000; Iglehart 1996; 1985). Micromanagement apparently prevailed in the VA’s healthcare system during the 1970s. For instance, the Farber Commission’s (1977) report and Lindsay (1975) highlight and criticize (1) the construction of new hospital facilities where there were already too many beds while failing to provide more beds in places where they were needed, as well as (2) the acceptance of patients whose disabilities were not service connected, when these patients could get care elsewhere.

More broadly, the effect of these constraints is evidenced by a number of studies that document the relative inefficiency of public versus private enterprises (Caves and Christensen 1980; Savas 1977; Lindsay 1975), as well as by a series of apparently unsuccessful US government-wide and targeted reforms throughout the twentieth century (US Executive 1912-14; Arnold 1976; 1974; March and Olson 1983; Light 1997). These initiatives may have failed in part because they were largely one-dimensional, targeting only one aspect of the organizational architecture without regard for the interdependence among the various elements (Ittner and Larcker 1998; Downs and Larkey 1986; Wildavsky 1984).

Research Question

The 1996 reorganization decentralized the VHA’s operations and concurrently introduced a performance-based management system including the Network Directors’ Performance Contracts (NDPC) incentives. If the current VHA and government-wide reform has effectively assigned authority for operational decisions to local managers, and if strategy,

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9 Widely publicized innovative performance management initiatives in the US federal bureaucracy such as ZBB (Zero Based Budgeting), Merit Pay, MBO (Management by Objective), and PPBS (Program Planning and Budgeting System) survived only for a short period (Dismith et al. 1980; Wildavsky 1984; Downs and Larkey 1986).

10 However, we note that prior to the VHA’s reorganization, some federal social programs had begun to incorporate performance measures and incentives in their programs. For example, Barnow (1992) describes the role of performance standards in the Job Training Partnership Act, which also included the provision of incentives based on the performance measures.
performance expectations and performance realizations are communicated to local managers, then the new organizational structure and related mechanisms may have reduced the problems identified by the Farber Commission (1977) and Lindsay (1975). However, if centralized management or other political forces have maintained a sufficiently strong hold on important decisions, then the benefits of the purported decentralization and performance communication may be lost.\footnote{For example, anecdotal evidence suggests that if Veterans Service Organizations (VSO) are unhappy with the reallocation of funds to regions where more veterans now reside, they may be able to influence the budget process and how that budget is allocated.}

Systematic analysis of the VHA's performance on the annual performance measures in network directors’ contracts (NDPCs) reveals substantial improvement on most performance measures in each of the years since their introduction in 1996. However, data on most of these measures are not available prior to the reorganization. Furthermore, attainment of these targets does not necessarily imply that the VHA will achieve its more fundamental strategic objectives. Therefore, our basic research question is whether the VHA’s reorganization achieved the VHA’s fundamental objective of improving the efficiency of service while maintaining or improving the quality of patient care.

In terms of efficiency, the VHA's reform seeks to reduce the operating cost per patient (DVA 1997a; 1997b). Thus, using data from all of the VHA’s hospital facilities over the seven-year period from 1992 to 1998, we examine whether the level of the VHA's operating cost per patient changed between 1992-1995, prior to the reorganization, and 1996-1998, after the reorganization.\footnote{Cost per unit of output, i.e., cost per patient, is an accepted aggregate measure of efficiency that has been used in previous studies of public sector performance (e.g., Caves and Christensen 1980; Davies 1971).} To the extent that the targeted measures in the NDPCs are value drivers of fundamental organizational objectives, aggregate measures of efficiency should reflect corresponding improvement.

Before describing our data and analysis, we note that in addition to the effect of various institutional features that may inhibit the effect of organizational change in a governmental environment, other considerations may also operate against the VHA achieving real efficiency improvements. First, for various reasons, the financial and non-financial measures used in VHA managers’ contracts may be both noisy and not fully congruent with the VHA’s fundamental mission (Feltham and Xie 1994). Second, anecdotal evidence suggests that some portion of the improvement on certain non-financial measures reflects only improved documentation of procedures rather than actual improvements in the related activities. Third,
anecdotal evidence also suggests that the new incentive system has induced “gaming” behavior to improve measured performance without changing the underlying economic efficiency of VHA operations. For example, the VHA uses the ratio of outpatient to inpatient medical and surgical procedures to encourage shifting treatment to less costly outpatient settings. In the drive to show improvement on this performance measure, discussions with some physicians indicate a pattern of delaying procedures until the patient left the hospital, and then recalling the patient for multiple outpatient visits. Rather than reducing cost, such gaming of the performance measures is likely to increase costs because the costs of additional tests for a patient already in the hospital will often be lower than the cost of generating multiple additional outpatient visits. Hence, in such cases performance measures might improve while cost per patient actually increased.

4. DATA, VARIABLES AND MODEL SPECIFICATION

Data

We use individual VA hospital facilities (VA Medical Centers or VAMCs) as our unit of analysis. The data include financial, workload and clinical measures on VAMCs from September 30, 1992 through September 30, 1998. We extracted most of the data from internal VA information systems. Our complete panel data set contains facility-level annual data on 138 VAMCs over the seven-year period, for a total data panel of 966 observations. We obtained other measures, such as the GDP deflator, the Wage Index, and the Case Mix Index (CMI) from public sources, including the Bureau of Economic Analysis and the Centers for Medicare and Medicaid Services (CMS, formerly HCFA, the Health Care Financing Agency).

Variable Definitions

Cost per patient

Our primary dependent variable, COST\textsuperscript{ADJ}/PAT, is the VHA annual medical care cost per patient. The numerator of the cost per patient measure is the inflation adjusted operating cost incurred during the fiscal year by each hospital facility. To compute this measure, we

\[ \text{COST}^{\text{ADJ}} = \text{COST} \times \left(1 + \frac{\text{GDP Deflator}}{100}\right) \]

\[ \text{PAT} = \text{Number of Patients} \]

\[ \text{COST}^{\text{ADJ}}/\text{PAT} = \frac{\text{COST}^{\text{ADJ}}}{\text{PAT}} \]

\[ \text{GDP Deflator} \]

\[ \text{Wage Index} \]

\[ \text{Case Mix Index (CMI)} \]

\[ \text{Bureau of Economic Analysis} \]

\[ \text{Centers for Medicare and Medicaid Services (CMS, formerly HCFA, the Health Care Financing Agency)} \]

\[ \text{The panel of 138 observations contains the VA hospital units that were operating following mergers that occurred between 1996 and 1998 and described in Section 5. We aggregated the data in the years prior to the merger under the new combined hospital identity to form a comparable panel of hospital units across the seven years. Our analysis excludes a small number of Independent Outpatient Clinics, Independent Domiciliary and VA operated clinics that are included in the total of 173 facilities operated by the VHA at the start of the reorganization. These are very small units for which the data were not available.} \]
extracted annual medical care expenditures data from the VA’s financial information system. We aggregated the total non-capital operating expenditures for medical care. This measure includes the cost of direct medical care in each veteran hospital and costs incurred for care outsourced to non-VA hospitals, as well as the cost of care in nursing home and domiciliary care. We exclude depreciation and allocated corporate overhead.

The denominator of our cost/patient measure equals the total number of unique individual patients who were treated at a VHA facility at least once during that fiscal year either as an inpatient or as an outpatient.\textsuperscript{14}

VHA strategic documents focus on this same cost/patient measure in evaluating efficiency of operations (Management Science Group 2001). The measure includes only those patient care costs that are under the control of the VHA managers who are the targets of the VHA’s reform incentives described in section 3, similar to the cost definition in Banker, Potter, and Srinivasan (2000).

Column 3 of Table 1 (descriptive statistics discussed in the following section) shows $\text{COST}^{\text{ADJ}}/\text{PAT}$, the resulting annual inflation-adjusted average medical care cost per patient over the 138 hospital facilities in our sample.\textsuperscript{15} The average annual adjusted cost per patient ranges from approximately $4,100 to $4,700 throughout the sample period with an overall average of $4,477. These figures are comparable to corresponding results reported internally by the VHA (Management Science Group 2001).

\textbf{Year dummy variables}

To estimate the effect of the VHA reorganization on the cost per patient measure, we use a series of dummy variables for the years 1993 to 1998. We expect to see the primary effect of the reorganization, which was initiated in 1996, in that year and later. However, because plans for the reorganization began in 1994, we anticipate that dummy variables for 1994 and 1995 may also be negative and significant.

\textsuperscript{14} Research on healthcare costs frequently measures patient volume based on total inpatients adjusted for the estimated volume of outpatients, often because of data limitations with respect to outpatient care (for further discussion, see Management Science Group 1993).

\textsuperscript{15} To adjust for changing price levels, we use the chain weighted Gross Domestic Product (GDP) deflator. To validate our results, we also used the employment cost index (ECI) in state and federal hospitals as a deflator. Although this index does not account for all costs, it is more specific to the sector and labor expenses account for an average of 65% of total costs in the sample period. Results using ECI as a deflator are generally very similar to the reported results using GDP as a deflator.
Case mix index (CMI) and wage index (WI)

We use a CMS-style case mix index (CMI) to control for variations in costs that are due to a hospital’s particular patient mix, and the CMS wage index (WI) to control for geographic wage-rate variations.

Case mix index (CMI)

The CMI (Case Mix Index) measures the average severity of illness of patients in a hospital facility for Medicare reimbursement purposes. Because of the particular characteristics of the veteran population, the VHA’s Management Science Group computed a unique case mix index for the VHA facilities (Management Science Group 1993). The resulting CMI is the average DRG (Diagnostic Related Group) weight for patients 65 and older receiving acute care services (i.e., medical, surgical and neurological bed sections/services). This measure is typical of case mix controls used in medical care studies, and although it does not control for variations in outpatient treatments, it remains as the standard measure of illness severity in healthcare research. Iezzoni (1997) finds that along with age, the case mix index is a useful risk adjustment measure, consistent with the results in many other studies that conclude it is a significant explanatory variable for healthcare costs (e.g., Carey and Burgess 1996; Management Science Group 1993; Dranove 1998).

Wage index (WI)

The CMS create the area wage index (WI) to control for mean hourly hospital compensation in each labor market area relative to the national average hourly wage. We obtained the data from the VHA's Management Science Group and from the CMS's website. We use the annual wage index as an independent variable in the model to control for geographic input price variations, following prior research (Dranove 1998), including costs in VHA hospitals (Carey 1997; Management Science Group 1993).

Controls for policy shift from inpatient care

We include two controls for the VHA’s ongoing policy of shifting care from an inpatient to an outpatient basis. Although the 1996 VHA reorganization also prescribed such a shift away from inpatient care, this general trend appears to have predated the 1996 reorganization. Hence, to exclude the possibility that our results are attributable to policies that would have taken place even without the 1996 reorganization, we include two measures to capture the effect of this policy of shifting toward greater reliance on outpatient care. We add these
control measures to obtain conservative estimates of the effects of the 1996 reorganization. The first measure captures the percentage of outpatient care relative to inpatient care, while the second reflects the relative importance of outpatient care to total patients.

**OUTPAT/INPAT**

The first measure, OUTPAT/INPAT, is the annual ratio of outpatient visits to inpatient discharges for a given facility. The numerator is the total number of outpatient visits, and includes multiple visits by the same patient. The denominator is the total number of inpatient discharges. The measure counts the number of discharges, so an individual discharged twice during a given year is counted twice in the denominator.

**OUTPAT/USER**

The second measure is OUTPAT/USER, which again uses total outpatient visits in the numerator. However, now the denominator is the total count of all individual unique patients treated by the VHA on an inpatient, outpatient, nursing home or domiciliary care basis in a given year. This measure counts any specific patient only once in the denominator, whether the patient was seen in a VHA hospital once or multiple times. This is the same denominator as that in the cost per patient measure described earlier. For example, a patient with three outpatient visits would increase the numerator by three but would only increase the denominator by one. Another patient with two inpatient discharges would count once in the denominator but would not increase the numerator.

OUTPAT/INPAT and OUTPAT/USER represent alternative measures of the VHA’s ongoing policy of moving patient care from an inpatient to an outpatient setting. We report results using both measures together in the model for ease of exposition, but we note that the results do not change qualitatively when we include only one of these measures in the model.

**Control for unobservable factors and time series data**

The 138 hospitals in our sample are organized into 22 different hospital networks or VISNs (Veterans Integrated Hospital Networks). To control for characteristics specific to each individual network, we run the regression model including intercept dummies for each of the 22 VHA hospital networks. We also run alternative regression models with the one-year lagged cost per patient (LAG1(COST\text{ADJ}/PAT)) as an independent variable to account for the level of previous year costs. In light of the endogeneity and the collinearity of the lagged cost with the other independent variables, we run the regression models with and
without the lagged cost variable. Finally, inspection of the PACFs (partial autocorrelation functions) and ACFs (autocorrelation functions) suggests that the data follows an AR1 (autoregressive model with first-order autocorrelated errors). To control for the serial correlation of error terms in our time-series data, we ran models using the Prais-Winsten estimator. The regression estimates and statistics obtained from the Prais-Winsten estimator are generally similar to those obtained from OLS regressions. However, given the significance of the autocorrelation coefficient, which ranges from .08 to .18, we report the more precise Prais-Winsten estimates.

**Model**

To analyze the effect of the VHA’s reorganization on cost per patient, we regressed the hospital-level inflation-adjusted cost per patient on the set of dummy variables for the years 1993 to 1998 and our control variables, as described above. We ran variations of the following basic model using pooled time series data from 138 VAMCs.

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16 We also ran models with dummy variables for each individual hospital facility. The results concerning the independent variables remained largely unaffected by the inclusion of the facility level dummies.
\[
(COST^{ADJ}/PAT)_{i,t} = \alpha + \beta_1 D1993 + \beta_2 D1994 + \beta_3 D1995 + \beta_4 D1996 + \beta_5 D1997 + \beta_6 D1998 + \phi_1 CMI_{i,t} + \phi_2 WI_{i,t} + \gamma_1 (OUTPATS/INPATS)_{i,t} + \gamma_2 (OUTPATS/USERS)_{i,t} + \delta \text{LAG1}(COST^{ADJ}/PAT)_{i,t} + \Sigma \phi_j \text{VISN}_j + \epsilon_{i,t}
\]

\[i = 1, \ldots, 138 \text{ individual VAMCs (hospitals)}\]
\[t = 1, \ldots, 7 \text{ years in the sample period (1992 to 1998)}\]
\[j = 1, \ldots, 22 \text{ VISNs, where each VISN is a network of VHA hospitals}\]
\[(COST^{ADJ}/PAT)_{i,t} = \text{Inflation adjusted annual operating costs per individual patient (user) of VAMC } i \text{ in year } t\]
\[D1993 = \text{Dummy variable equal to 1 for observations in 1993 and 0 otherwise}\]
\[D1994 - D1998 = \text{Defined as per D1993}\]
\[CMI_{i,t} = \text{Case Mix Index of VAMC } i \text{ in year } t\]
\[WI_{i,t} = \text{Wage Index of VAMC } i \text{ in year } t\]
\[(OUTPATS/INPATS)_{i,t} = \text{Ratio of total outpatient visits to total inpatient discharges in VAMC } i \text{ in year } t\]
\[(OUTPATS/USERS)_{i,t} = \text{Ratio of total outpatient visits to total unique users in VAMC } i \text{ in year } t\]
\[\text{LAG1}(COST^{ADJ}/PAT)_{i,t} = \text{One year lagged inflation adjusted annual operating costs per individual user of VAMC } i \text{ in year } t\]
\[\text{VISN}_j = \text{Dummy variable for VISN (network) } j\]

We also ran the same regressions using a percent change specification rather than a level specification for the dependent variable. The percentage change specification yielded qualitatively similar results to the basic levels specification, so we focus on the levels specification for ease of interpretation.

5. RESULTS

Descriptive Statistics and Correlations

Table 1 presents descriptive statistics for the 138 hospital facilities in the sample. The decline from 1996 to 1998 in both the cost per patient and the standard deviation of cost per patient, as reflected in Table 1, is consistent with Kizer’s expectation that the VHA’s reorganization would significantly reduce costs (see Kizer 1995). Kizer also expected the
overall VHA organization to improve on multiple measures of performance because individual VISNs would focus on improving areas of weaker performance. The results are consistent with VISNs with higher costs reducing their average cost per patient while other VISNs’ corresponding costs remained stable, leading to lower means and lower standard deviations across facilities.

--- Insert Table 1 here ---

Table 2 reports the correlations among the dependent and independent variables. The patterns are generally consistent with those in the subsequent regression analyses.

--- Insert Table 2 here ---

Regression Estimates
Table 3 reports the results from our basic levels specification, as well as four alternative models using inflation-adjusted cost per patient as the dependent variable, with corresponding regression statistics at the bottom of each column. We first summarize the overall results and then discuss the specific regression details that are the basis of those results.

--- Insert Table 3 here ---

The adjusted $R^2$s for the five models in Table 3 range from 0.455 (basic model in column 1), to 0.953 in column 3, reflecting the models’ ability to explain a significant portion of the variation in cost per patient. The estimated coefficients on the dummy variables for the years 1996-1998 are always negative and statistically significantly different from zero for all five models. The corresponding results for 1995, the year preceding the reorganization, are negative and statistically significant in three of the five models, while the 1994 and 1993 intercept dummies are not statistically significantly different from zero in any of the models. These results are consistent with the VHA’s change in OA reducing the VHA’s operating cost per patient following the reorganization with some evidence that a limited amount of cost reduction occurred in 1995 before the change was fully implemented in 1996.

These results hold after controlling for a set of factors that are also likely to have influenced the level of the VHA’s operating costs during the period of interest, including the case mix (CMI), the wage index (WI), the policy shift toward outpatient care (OUTPATS/INPATS and OUTPATS/USERS), VISN-specific effects and lagged cost per patient. With these controls included, the effect of the VHA’s 1996 reorganization on cost
per patient is economically significant and it appears to have increased over the sample period. We now discuss the specific results in Table 3 that support the preceding conclusions.

In the basic model in column 1 of Table 3, the estimated coefficients on the post-OA dummy variables for the years 1996-1998 are all negative and statistically significantly different from zero at the 1% level. The estimated coefficients for the 1993-1995 dummies are not significantly different from zero. The results in columns 2 and 3 show that adding either VISN dummies (column 2) or VISN dummies and a lagged cost variable (column 3) leaves the preceding results concerning the significant effect of the 1996 reorganization unchanged except that the dummy for 1995 becomes significant in column 3. Similarly, the results in columns 4 and 5 show that the significant results of the reorganization in reducing the annual cost per patient in the three years after the reorganization (1996-1998) are robust to dropping the outpatient ratio control variables (column 4) or the VISN dummies (column 5).

Based on the basic model in column 1, we estimate that the reorganization yielded a reduction in annual operating cost per patient of $407 in 1996 which increased to $641 in 1997 and to $959 in 1998, all measured relative to 1992 costs. These results show that the estimated magnitude of the OA effect is clearly economically significant. For example, applying the estimated total OA cost reduction in 1996 of $407 per patient to the VHA’s 3.26 million total patients (Table 4) yields an annual estimated savings of over $1.3 billion, which increases to $959 per patient or approximately $3.1 billion in 1998. That amount represents roughly 19% of the VHA’s annual budget of $16.6 billion in 1998.

--- Insert Table 4 here ---

These regression estimates are robust to a variety of alternative specifications. Models 4 and 5 (Table 3) demonstrate that significant cost savings from the reorganization persist with or without VISN specific dummies, and with or without the lagged cost per patient variable, although the estimated savings are smaller when the lagged cost variable is introduced.\(^{17}\) The case mix index (CMI) is positive and statistically significant in all models, but the wage index (WI) is only statistically significant in the first two models. The parameter estimate on

\(^{17}\) As expected, diagnostic statistics reveal that the lagged value of the dependent variable shows some signs of collinearity with other variables in the regression.
the OUTPATS/INPATS measure is consistently negative, reflecting the expected cost savings in shifting care from an inpatient to an outpatient setting, although the magnitude of the estimated effect is not large. The coefficient estimates on the OUTPATS/USERS measure is significant and positive in all the models, reflecting a cost increase from a relative increase in outpatient interventions or visits for each unique patient (user). The positive coefficient may be reflecting primarily the variation in the intensity of outpatient treatment. That is, as individual patients return more often for outpatient care, the VHA’s outpatient costs will increase.

Robustness and Validity Checks

There is no evidence of heteroskedasticity or significant skewness. Inspection of the condition index and VIF (Variance Inflation Factors) of the regressors does not reveal any serious multicollinearity among the variables in the regression other than that of the lagged cost, as noted earlier. We also ran the model without potential outliers with similar results. Our basic model specification thus appears reasonable.

We next consider whether the levels specification results are robust to an alternative differences specification. Prior research has introduced a differences specification in an effort to reduce the bias in estimates from spurious correlations and omitted variables (Banker et al. 2000). However, studies such as Kothari and Zimmerman (1995) also provide support for the levels specification. Therefore, we repeated the analysis of the five models in Table 3 after redefining the dependent variable as the percent change in the average cost per patient, and redefining the control variables as percentage changes. We show the results of this analysis in Table 5.

--- Insert Table 5 here ---

The general results remain unchanged with the changes model having a lower overall explanatory power than the levels model, as expected. The control variables retain the same signs and general significance levels as in the levels models. Likewise, coefficient estimates on the effect of the reorganization in 1995 to 1998 (D1995 – D1998) remain highly statistically significant with the expected negative signs, as before. We note that although D1994 is now also negative and significant, statistical tests indicate that the absolute magnitude of the cost reduction in each of the years 1995-1998 is greater than that in 1994 (p<0.01). Finally, the estimated effects continue to be economically significant, as indicated by the coefficient estimates that range from -.06 to -.09 for D1995 to D1998 in our basic
model in column 1, reflecting cost reductions of approximately 6-9% annually. Alternative models yield similar results with the models with lagged costs showing lower estimates by one percent or so for each coefficient.

In summary, the regression estimates reveal a statistically and economically significant cost per patient reduction in the year of the OA reorganization (1996) and in the following two years. These estimates are robust to alternative specifications and validity checks. Before discussing the VHA-specific factors that may explain the observed reduction in cost per patient, we next consider whether industry-wide trends could explain the cost reduction.

**Comparison of VHA Costs to Control Sample Costs**

Some portion of the observed reduction in VHA operating cost could potentially stem from ongoing cost reductions in the national delivery of healthcare, independent of the VHA’s 1996 reorganization. Although managed care efforts to reduce the cost of healthcare have been implemented initially in non-governmental settings, such changes are likely to also be transferred to governmental organizations such as the VHA in a variety of ways. To examine whether such national trends can account for some or all of the observed effect in the VHA, we constructed a control sample of patients who were treated in non-governmental hospitals during the same years covered by our VHA sample.

The 364 observations in our control sample consist of California not-for-profit hospitals. The control sample includes all non-governmental, non-religious, not-for-profit, short-stay, stand-alone hospitals, after deleting those involved in any merger or acquisition activity during the sample period of 1992-1998.\(^{18}\) California hospitals are generally in the forefront of managed care changes, and hence should reflect the latest industry trends. The control sample features the same not-for-profit feature as the VHA sample, while being subject to a different set of regulatory and organizational constraints. For these hospitals, we construct estimates of the operating cost per patient over the sample period of 1992-1998 in 1980 dollars. The data are based on the following definitions.

The dependent variable is Operating Cost per Adjusted Patient, calculated as: Total Operating Cost*(Proportion of Revenue from Inpatients/Total Inpatients admitted). The Proportion of Revenue from Inpatients is calculated as: Inpatient Revenue/Total Revenue. We regress this cost measure on the 1993-1998 year intercept dummy variables as in our basic models. We include the following control variables: Wage = Total Wages Paid/

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\(^{18}\) The data panel is not balanced because some hospitals have missing data.
Full Time Equivalent Employees; Inpatient Revenue/Total Revenue; Medicare Patients = Medicare Discharges/Total Discharges; Medi-Cal Patients = Medi-Cal Discharges/Total Discharges; Beds = Total Available Beds; LOS = Average Length of Stay of Inpatients.

Table 6 reports the results of an OLS regression of the average annual cost per patient for the control sample on the year dummies and alternative combinations of control variables. For comparison with the earlier VHA results showing a significant cost reduction following the reorganization, the key result is that none of the year dummies are significant. This indicates that the control sample reflects no comparable cost reduction during approximately the same period as our VHA observations. This result indicates that our control sample reveals no evidence that the observed reduction in VHA operating costs is attributable to ongoing healthcare industry trends during the same period. Instead, the control sample results are consistent with the VHA’s reorganization being responsible for the documented cost reduction.

--- Insert Table 6 here ---

**Potential Sources of the VHA’s Reduction in Cost per Patient**

The VHA’s reorganization and shift towards greater reliance on outpatient care resulted in their closing many unused beds. Bed capacity fell from 89,000 beds in 1990 to 47,000 beds in 1998, with 31% of this reduction occurring between 1996 and 1998. More importantly, the VHA also closed facilities as hospital networks consolidated resources and merged hospital units. By 1998, facility integrations had generated significant savings (Lukas et al. 1998). From a high of 173 facilities at the start of the reorganization, by 1998, the VHA was operating the same system with 20% fewer facilities. Full Time Employee Equivalents (FTEEs) also declined, although at a lower rate, from 196,000 in 1995 (200,900 in 1994) to 179,000 by the end of 1998. These developments are in line with arguments in Jensen (1993) that when capital markets do not discipline firms for investing in excess capacity, internal control systems and governance mechanisms must perform that role.

Secondly, data on a variety of operational measures (not reported here) point strongly to the VHA’s more efficient use of resources across its networks of hospitals following the reorganization. We observe significant reductions in patient admissions, average length of stay, and bed days of care. Combined with increases of similar magnitude in the percentage

19 The error terms do not show any signs of autocorrelation.
of procedures performed in an ambulatory (outpatient) setting, these measures reflect a shifting towards greater reliance on lower cost outpatient care. Concurrent shifts in dollars from inpatient to outpatient services support these data.

Finally, other data reveal that the VHA also used its remaining capacity more intensely after the reorganization. From 3.26 million in 1994, the number of users of the VHA system increased by 14.1% to 3.7 million by 1998 (Table 4).

The preceding discussion suggests that the VHA’s reorganization has achieved reduction in variable and fixed capacity costs. The reduction in excess capacity and the more intense use of the remaining capacity are among the potential explanations for how the VHA achieved the reported reductions in cost per patient. However, we next consider the possibility that some part of the cost savings could also stem from a shift in the VHA’s service mix following the reorganization. Specifically, the reorganization may have created incentives for VHA networks and facilities to attract new, low-cost patients, and thus reduce the average cost per patient by shifting the patient mix towards more new, low-cost patients, and hence a smaller percentage of existing, higher-cost patients.20

Anecdotal evidence indicates that the VERA (Veterans Equitable Resource Allocation), the VHA’s “capitated” budget allocation mechanism introduced with the reorganization, created a strong incentive for network and hospital managers to recruit new, low-cost patients. This incentive existed because VERA allocates funds to networks based on the number of individual patients treated annually. By using this approach to allocate funds, VERA created an incentive for networks to attract new, low intensity patients for whom the network would receive allocated funds in excess of the average treatment cost. In fact, evidence suggests that some networks apparently “gamed” the system to obtain positive benefits from the VERA formula by recruiting such new, low-cost patients.

The Appendix describes how we estimated the potential effect on our results in Table 3 of such a shift by the VHA towards more low-cost patients. After adjusting for such a potential shift in service mix, the VHA’s reorganization yielded a smaller, but still significant cost reduction per patient. For example, the total annual cost reduction of $960 per patient in 20

The general phenomenon of intentionally attracting participants with particular individual characteristics into government programs in order to maximize certain performance measures is well known, and is referred to as “cream-skimming” or “creaming” (Barnow 1992). Heckman, Heinrich, and Smith (1997, 391) discuss the use of performance measures in federal job training programs. They present evidence that such selection strategies as cream-skimming by enrolling the most talented job seekers (rather than the most disadvantaged) may actually promote efficiency because the program’s value added may also be greatest for the most talented individuals.

20
1998 (column 1 of Table 3) becomes $500 per patient under our best estimate that 9.4% of the post-reorganization increase in patients are low intensity users. The revised 1997 estimated cost reduction per patient is $182. These estimated effects amount to annual cost reductions of $618.5 million in 1997 and $1.9 billion in 1998.

We note that increasing the number of veterans served, whether low-cost or high-cost, is consistent with the VHA mission so long as the patients are eligible for care. Further, after adjusting for the potential effect of service mix changes on the cost per patient in the post-reorganization period, the OA reorganization continues to generate an economically significant reduction in cost per patient. Also, as discussed previously, these cost per patient reductions were generated by more efficient and intense use of resources. However, the VHA’s ultimate goal is to improve both efficiency and effectiveness, that is, to deliver higher quality patient care at lower cost. To assess the total effect of the change in OA on the VHA’s operations, we next evaluate changes in quality associated with the reorganization.

**Effects of the Reorganization on Quality**

This section provides evidence that the VHA generally did not sacrifice quality of care to increase efficiency over the sample period. In fact, there is considerable evidence that quality improved significantly on many measures during the period following the VHA reorganization.

We consider two categories of quality measures. First, we examine the quality indicators in the Network Directors Performance Contracts (NDPCs), measures for which we have data at the network level. Second, we examine six additional quality measures which are not included in the NDPCs, reasoning that such measures may provide a more conservative test of the impact of the OA change on quality because VHA managers do not have direct contractual incentives to improve the second set of measures.

The first set of quality measures, those included in the Network Directors’ Performance Contracts (NDPCs; listed in section 3), represent widely accepted industry standards of process and outcome quality. They include patient satisfaction survey results and statistics on clinical practice guidelines, patients followed by a primary care physician, end-of-life planning procedures, follow-up after mental illness treatment, Chronic Disease Index (CDI), the Prevention Index (PI) and the Addiction Severity Index (ASI). However, because the VHA did not collect data on these measures prior to the reorganization, we cannot compare results before versus after the reorganization.
For the post-reorganization period the results are very clear, and for brevity we simply describe them here by noting that virtually all of these quality indicators showed considerable improvement during the 1996-1998 period. VHA hospitals attained VHA-wide annual targets for 1997 and 1998 on five of these eight measures. While not attaining annual targets based on industry standards on the PI and CDI measures, VHA hospitals roughly doubled their performance on these measures and attained 75% to 95% of their annual targets. The VHA also made important improvements on customer satisfaction measures, attaining the industry targeted benchmarks by 1998.

The second set of measures includes other important quality indicators tracked by the VHA and recognized as important in the healthcare industry, but not included in NDPC incentive measures. We focus on six such measures for which the VHA compiles data at the facility level adjusted for patient case-mix and age. The six measures are: mortality rate, three measures of required follow-up treatments (substance abuse, psychiatric care, medical and surgical interventions) measured by rates of non-return, as well as rates of acquired bed-pressure sores and dehydration in nursing homes. On all these measures, the lower the rate, the better the performance.

Using available facility-level data before and after the reorganization (from 1990 up to 1997), Thibodeau (2003) conducted a time-series analysis of whether the reorganization significantly influenced the six quality measures, after controlling for external factors including the average case-mix-index (CMI) and wage index (WI) at each facility. The regression results indicate that two of the six measures improved subsequent to the reorganization (substance abuse readmission rate, psychiatric care readmission rate), three measures did not change significantly (mortality rates, acquired bed-pressure sores, acquired dehydration rates), and one measure reflected a decline in performance (medical/surgical readmission rate).

Thus, while the evidence on quality reveals that the VHA’s care deteriorated for one measure and remained unchanged for several measures, it improved substantially on most dimensions. The overall evidence and analysis in this study thus indicate that the VHA’s reorganization yielded efficiency gains as evidenced by important reductions in the cost per patient without significant quality degradation. Cost reductions remain positive and economically significant even after filtering out potential service mix effects. Furthermore, 21 Detailed analysis is available in Thibodeau (2003).
our analysis of a control sample of hospitals suggests that VHA cost reductions were not driven by industry-wide trends during the same period.

6. CONCLUSION

There is little empirical evidence on the effect of the implementation of innovative management techniques in the public sector (Ittner and Larcker 1998). Therefore, the efficiency improvements documented in this study represent new evidence that generally supports the theoretical proposition that coordinating and adapting organizational changes to align with strategic goals can move public sector organizations towards targeted metrics. These results are similar to those found in studies of private sector OA changes by Baker and Wruck (1989), Wruck and Jensen (1994) and Treml and Lehn (2000). Ittner and Larcker (1995) also observe that by aligning the elements of the OA components, organizations will have more success with the implementation of new management policies such as Total Quality Management (TQM). Our results on the importance of coordinating performance measurement and reward systems with organizational structure and strategy in not-for-profit and public sector organizations supports the proposition that one explanation for the general ineffectiveness of previous government reforms was the failure to make coordinated changes in the entire organizational architecture (Ittner and Larcker 1998; Downs and Larkey 1986; Wildavsky 1984).

Finding that a bureaucracy can adapt its OA in response to external changes to create efficiency gains is also consistent with Cavaluzzo et al. (1998), who document efficiency gains in response to competition. Finally, documenting the success of the VHA, a large bureaucracy targeted for its perceived lack of quality and efficiency, demonstrates the potential for significant improvements in efficiency when the government is committed to reform and changes in performance measures and incentives are coordinated with changes in organizational structure and strategy.

The first major limitation of this study concerns the measure of efficiency over time. First, potentially important variations in product mix caused by the reorganization may confound the interpretation of the observed reduction in the cost per patient following the reorganization. In this study, we estimated the potential bias of the product mix shifts towards an increase in low intensity patients on our initial estimate of cost per patient reductions. We conclude that after isolating the potential bias from increases in low intensity patients, the reorganization still produced significant efficiency gains.
Nevertheless, extensions of this study could first address the problem of measuring efficiency across time by identifying the service mix shift caused by incentives in the reorganization. This would improve our understanding of the effect of the reorganization on the cost to care for regular and complex care patients as opposed to low intensity patients. To the extent that the VHA does not serve low intensity patients at the expense of priority veterans, then adding this clientele to the product mix is likely to be valuable. This may be the case if the VHA is using excess capacity to treat low intensity patients and if the quality of care provided to priority veterans is at least at the same level.

A second potential extension would examine efficiency improvements across the 22 VHA networks of hospitals. In particular, network managers had discretion with respect to the detailed strategies which they implemented. Analyzing how variations in such techniques are related to differential efficiency effects may provide additional insight into the process of organizational change in a governmental bureaucracy.

Finally, the analysis does not control for the possibility that the observed reductions in cost per patient could have stemmed from reductions in the VHA budget, imposed independent of the 1996 reorganization. That is, cost per patient may have fallen simply because excess resources were eliminated from the budget, not because of any effect of Kizer’s changes. However, if such a simple budget-cutting mechanism to improve efficiency were available in 1996 and later, it is unclear why it was not implemented earlier. This is particularly true given that quality measures generally improved or remained constant while efficiency improved.
APPENDIX – EFFECT OF A CHANGE IN SERVICE MIX ON COST PER PATIENT

The VHA’s reorganization created incentives for VHA hospitals to attract new, low-intensity users; i.e., veterans who had not been previously been using the VHA facilities and who could be treated at a relatively low cost if they began to use the VHA facilities for limited services. This appendix estimates the potential effect of such a shift in the VHA’s service mix toward low-intensity users on our estimates of cost reductions from the VHA’s reorganization.

The VHA identified 636,696 low-intensity patients, 18.4% of the 3,455,126 average annual patients served by VHA hospitals from 1996 to 1998 (DVA 2000).\textsuperscript{22} Using the VHA’s estimated annual cost of $104.53 for each low-intensity patient during the post-reorganization period of 1996 to 1998 (DVA 2000), we estimated the total annual cost to care for these low intensity users during that period at $66,553,833 (636,696 x $104.53). Subtracting this number from the VHA’s 1996-1998 average annual inflation adjusted operating cost of $14,976,555,237 gives $14,910,001,404. This is our estimate of the annual cost of care for the 2,818,430 non-low-intensity users (3,455,126 total users - 636,696 low-intensity users) from 1996 to 1998. Using that figure, we estimated the inflation adjusted cost per patient without the low intensity patients in the post-reorganization period at $5,290 ($14,910,001,404 / 2,818,430 non-low-intensity users). In comparison, from Table 1 we can calculate the average cost per patient for all patients during 1996-1998 at $4,316.

Assuming that the VHA had been treating no low intensity patients prior to the reorganization, the total 636,696 low-intensity patients would represent the service mix shift toward low-intensity patients due to the reorganization. In this extreme case, based on the above computations, our estimate of the average cost per patient (excluding low-intensity patients) in the post-reorganization period could be overestimated by as much as $974 ($5,290 - $4,316). This bias would be reflected in our estimated regression coefficients for D1996-D1998 in Table 3. Our basic model (column 1 of Table 3) estimates the annual cost reductions at $407 in 1996, $641 in 1997 and $960 in 1998. Adding the $974 to each of these coefficient estimates to adjust for the effect of the service mix change would produce positive coefficient estimates, suggesting that the reorganization increased rather than decreased the annual cost per patient.

\textsuperscript{22} Based on Table 4, there was an average of 3,455,126 patients during the years 1996 - 1998.
However, the VHA also treated low-intensity patients prior to the reorganization. The VHA 1999 and 2000 VERA booklets (DVA 1999; 2000) indicate that approximately 9% of all VHA patients prior to the reorganization were low-intensity users. Hence, if low-intensity users comprised 9% of the total VHA population prior to 1996, we estimate the percent increase in low-intensity patients due to the reorganization at 9.4% (18.4% - 9%). This reasoning yields an estimate of 324,782 new low-intensity patients (9.4% x 3,455,126) and a corresponding average annual cost of $33,949,446 (324,782 x $104.53). Subtracting $33,949,446 from the average 1996-1998 annual cost of all patients of $14,976,555,237 yields a new average annual cost estimate of $14,942,605,790. Dividing this number by the 3,130,344 estimated non-low-intensity patients (3,455,126 – 324,782), we obtain a new annual cost per patient estimate of $4,775 for the post-reorganization period. This figure indicates that the coefficients from Column 1 of Table 3 may be overestimated by $459 per patient ($4,775 - $4,316).

Using these estimates, we can adjust the OA coefficient regression estimates in Column 1 of Table 3. The estimated cost reductions of $407 in 1996, $64 in 1997 and $960 in 1998 become ($52), $182 and $500, respectively. These rough estimates suggest that even after taking out the effect of the reorganization on the change in service mix, we still observe cost per patient reductions from the OA in 1997 and 1998. Further, the magnitude of these cost reductions would still be economically significant after adjusting for the low-intensity patients, that is, $618.5 million in 1997 and $1.9 billion in 1998.
Figure 1 – The VHA's Organizational Architecture: Before and After

<table>
<thead>
<tr>
<th>Decision Rights</th>
<th>Performance Measures</th>
<th>Rewards</th>
</tr>
</thead>
</table>
| **Before 1996** | • Strategic and operational decisions defined and managed by headquarters;  
• Micromanagement of medical facilities under four regions.  
• Relatively independent (e.g., financial and quality) performance measurement systems;  
• Idiosyncratic and not used consistently in decision making;  
• Subjective performance evaluations.  
• Management performance evaluations and rewards not formally linked to performance;  
• Resource allocation to hospitals based on complex rules. |  |
| **1996 and after** | • Strategic decisions by headquarters;  
• Operational decisions by geographic network managers.  
• Performance measured on a defined set of performance measures and targets;  
• Performance measured regularly and consistently;  
• Performance system aligned with strategic goals.  
• Management contracts for network directors incorporate rewards based on performance targets;  
• Funds allocated to hospitals based on patient volume per network. |  |
Figure 2 – Timeline of Events Related to the VHA Reorganization

**PERIOD COVERED BY THIS EVENT STUDY**

**LEVEL**

|------|------|------|------|------|------|------|------|------|------|-------|

**GOV**

- **NPR**
- **GPRA**

**VA/ VHA**

- Kennedy Kizer becomes Under Secretary for Health of the VA.
- Develop a plan to reorganize the VHA.
- “Vision for Change”: Basic reorganization plan.
- “Journey of Change”**: first formal VHA wide strategic plan and report on results.
- “Prescription for change”: strategic objectives and actions.
- Beginning of the reorganization:
  - Strategic objectives;
  - Decentralization: VISNs;
  - Performance measures and targets defined;
  - Introduction of NDPCs and phase in of capitated resource allocation methodology.
- “Journey of Change II”: Follow-up and updating of JOC.
- “Journey of Change III” and updating of JOC II.
- Thomas Garthwaite replaces Kenneth W. Kizer as Under Secretary for Health of VA.
- VHA is pursuing reforms.
- Report from the Center for Health Services and Policy Research (CHSPR).
- Report from the Commission on the Future Structure of Veterans Health Care (CFSVHC).
- Report from the Commission on the Future Structure of Veterans Health Care (CFSVHC).
- “Vision for Change”**: first formal VHA wide strategic plan and report on results.
- “Journey of Change”**: first formal VHA wide strategic plan and report on results.
- Thomas Garthwaite replaces Kenneth W. Kizer as Under Secretary for Health of VA.
- VHA is pursuing reforms.

**REMARKS:**

1. The terms **GOV** and **VA** designate the level at which the events occurred:
   - **GOV**: Indicates events that occurred at the federal government level that had an effect on the VHA’s reform;
   - **VA**: Indicates events that occurred within VA or VHA.

2. The year indicated is the year ending in the VHA’s fiscal year. It overlaps two calendar years, beginning October of the previous calendar year and ending September 30 of the year indicated on the time line. This event study examines performance from 1992 to 1998, the period for which we have data.

3. **JOC**: Journey of Change.

4. **VISN**: Veterans Integrated Service Network.

5. **NDPCs**: Network Directors' Performance Contract.
Table 1 – Descriptive Statistics

<table>
<thead>
<tr>
<th>Year</th>
<th>Statistic</th>
<th>COST(^{ADJ*}) /PAT</th>
<th>CMI</th>
<th>WI</th>
<th>OUTPATS/ INPATS</th>
<th>OUTPATS /USERS</th>
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<tr>
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<td>1.0780</td>
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<td>Mean</td>
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<td>1.1007</td>
<td>0.9587</td>
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<td>0.9494</td>
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<td>Mean</td>
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<td>23.32</td>
<td>7.88</td>
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\(N=966\) except OUTPATS/INPATS where \(n=938\) as we exclude very high outlier facilities that distort the statistics for this measure. * Costs adjusted for inflation using the GDP.
Table 2 – Correlation Matrix

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<tr>
<th></th>
<th>(COST\textsuperscript{ADJ})/PAT</th>
<th>D1993</th>
<th>D1994</th>
<th>D1995</th>
<th>D1996</th>
<th>D1997</th>
<th>D1998</th>
<th>CMI</th>
<th>WI</th>
<th>OUTPATS/INPATS</th>
<th>OUTPATS/USERS</th>
<th>LAG1 (COST\textsuperscript{ADJ})/PAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(COST\textsuperscript{ADJ})/PAT</td>
<td>1</td>
<td>.038</td>
<td>**.063</td>
<td>.039</td>
<td>-.005</td>
<td>-.029</td>
<td>***-.112</td>
<td>***.113</td>
<td>**.373</td>
<td>*-.068</td>
<td>***.575</td>
<td>***.969</td>
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<td>***-.167</td>
<td>***-.167</td>
<td>***-.167</td>
<td>***-.167</td>
<td>***-.104</td>
<td>.009</td>
<td>-.031</td>
<td>***-.128</td>
<td>-.014</td>
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<tr>
<td>D1994</td>
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<td>***-.167</td>
<td>***-.167</td>
<td>***-.167</td>
<td>***-.167</td>
<td>***-.075</td>
<td>-.007</td>
<td>-.030</td>
<td>***-.095</td>
<td>.021</td>
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<tr>
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<td>***-.167</td>
<td>***-.167</td>
<td>***-.167</td>
<td>***-.167</td>
<td>***-.062</td>
<td>-.012</td>
<td>-.001</td>
<td>-.013</td>
<td>*.047</td>
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<tr>
<td>D1996</td>
<td>1</td>
<td>***-.167</td>
<td>***-.167</td>
<td>***-.167</td>
<td>-.021</td>
<td>-.006</td>
<td>.035</td>
<td>***.075</td>
<td>.022</td>
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<td>***-.167</td>
<td>***-.142</td>
<td>***.000</td>
<td>.018</td>
<td>***-.131</td>
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<tr>
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<td>***-.167</td>
<td>***-.167</td>
<td>***-.173</td>
<td>.005</td>
<td>.036</td>
<td>***.155</td>
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<td>OUTPATS</td>
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<td>/USERS</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

***, **, * Indicate that the coefficient estimate is significantly different from zero at the 1 percent, 5 percent and 10 percent level (one-tailed test) respectively.
Table 3 – Effect of the Reorganization on Inflation Adjusted Cost per Patient

\( \text{(COST}^{\text{ADJ/PAT})_{i,t} = \alpha + \beta_1 D1993 + \beta_2 D1994 + \beta_3 D1995 + \beta_4 D1996 + \beta_5 D1997 + \beta_6 D1998 + \phi_1 CMI_{i,t} + \phi_2 WI_{i,t} + \gamma_1 (\text{OUTPATS/INPATS})_{i,t} + \gamma_2 (\text{OUTPATS/USERS})_{i,t} + \delta \text{LAG1(COST}^{\text{ADJ/PAT})_{i,t} + \sum \phi_j \text{VISN}_j + \varepsilon_{i,t} \)

<table>
<thead>
<tr>
<th>Specifications</th>
<th>(1) Basic Model</th>
<th>(2) Adding VISN Dummies</th>
<th>(3) Adding Lagged Cost and VISN Dummies</th>
<th>(4) Model 3 less Outpatient Ratios</th>
<th>(5) Model 3 less VISN Dummies</th>
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</thead>
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<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<tr>
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<td>(0.24)</td>
<td>(0.28)</td>
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<td>n/a</td>
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<tr>
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<td>(1.30)</td>
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<td></td>
<td></td>
</tr>
<tr>
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<tr>
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<td>***(-4.84)</td>
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<tr>
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<tr>
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<tr>
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<td>***(-5.29)</td>
<td>***(-6.90)</td>
<td>***(-6.84)</td>
<td>***(-5.62)</td>
<td>***(-6.76)</td>
</tr>
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<td>***(-11.90)</td>
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<td>****(93.53)</td>
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<td>Yes</td>
<td>No</td>
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</table>

Prais-Winston regression estimates. Costs are adjusted for inflation using the GDP deflator.\(^{23}\) Values of "t" indicated in parentheses. ***, ** Indicate that the coefficient estimate is significantly different from zero at the 1 percent and 10 percent level (two-tailed test), respectively. “Yes” in the VISN line indicates that we added individual dummy variables for each VISN to control for the fixed VISN specific effects over time, while “No” indicates that the model does not include the VISN dummies.

\(^{23}\) We obtained similar results using either the GDP or ECI cost deflator described earlier. Regression coefficients and statistics from the Prais-Winston estimator are similar to those obtained from an OLS regression.
Table 4 – Total Annual VHA Patients

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<th>Average Patients per Hospital</th>
<th>Total VHA Patients</th>
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<td>1992</td>
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<td>1993</td>
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<td>1994</td>
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<td>3,188,549</td>
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<tr>
<td>1995</td>
<td>23,537</td>
<td>3,248,141</td>
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<tr>
<td>1996</td>
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<td>3,261,516</td>
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<tr>
<td>1998</td>
<td>26,853</td>
<td>3,705,717</td>
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</table>
Table 5 – Effect of the Reorganization on Inflation Adjusted Changes in Cost per Patient

\[
\% \Delta (\text{COST}^{\text{ADJ}}/\text{PAT})_{it} = \alpha + \beta_1 \Delta D1993 + \beta_2 \Delta D1994 + \beta_3 \Delta D1995 + \beta_4 \Delta D1996 + \beta_5 \Delta D1997 + \beta_6 \Delta D1998 + \phi_1 \% \Delta \text{CMI}_{it} + \phi_2 \% \Delta \text{WI}_{it} + \phi_3 \% \Delta (\text{OUTPATS}/\text{INPATS})_{it} + \phi_4 \% \Delta (\text{OUTPATS}/\text{USERS})_{it} + \phi_5 \% \Delta \text{LAG1}(\text{COST}^{\text{ADJ}}/\text{PAT})_{it} + \mu + \epsilon_{it}
\]

<table>
<thead>
<tr>
<th>Specifications</th>
<th>(1) Basic Model</th>
<th>(2) Adding VISN Dummies</th>
<th>(3) Adding Lagged Cost and VISN Dummies</th>
<th>(4) Model 3 less Outpatient Ratios</th>
<th>(5) Model 3 less VISN Dummies</th>
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<tbody>
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<td>0.03</td>
<td>0.01</td>
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<td>(5.38)</td>
<td>(3.30)</td>
<td>*(1.62)</td>
<td>*(6.92)</td>
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<td>*(11.34)</td>
<td>*(12.07)</td>
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<td>-0.12</td>
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<td>*(1.64)</td>
<td>*(1.51)</td>
<td>*(1.12)</td>
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<td>%ΔOUTPATS/INPATS</td>
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<td>0.42</td>
<td>0.43</td>
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<td>*(13.66)</td>
<td>*(13.02)</td>
<td>*(13.41)</td>
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</tr>
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<td>*(5.65)</td>
<td>*(5.43)</td>
<td>*(5.27)</td>
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</tr>
<tr>
<td>%ΔLAG1 (COST^{ADJ}/PAT)</td>
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<td>n/a</td>
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<td>0.00</td>
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<td>VISN</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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<tr>
<td>Adj R²</td>
<td>0.314</td>
<td>0.348</td>
<td>0.349</td>
<td>0.315</td>
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<td>828</td>
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<td>690</td>
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</table>

Prais-Winsten regression estimates. Costs are adjusted for inflation using the GDP deflator. Values of "t" indicated in parentheses. ***, **, * Indicate that the coefficient estimate is significantly different from zero at the 1 percent, 5 percent and 10 percent level (two-tailed test, respectively. “Yes” in the VISN line indicates that we added individual dummy variables for each VISN to control for the fixed VISN specific effects over time, while “No” indicates that the model does not include the VISN dummies.
Table 6 – Regression of Operating Cost per Adjusted Patient on Event Period for a Control Sample of California Hospitals

<table>
<thead>
<tr>
<th>Specifications</th>
<th>(1) Full Model</th>
<th>(2) Basic Control Variables Only</th>
<th>(3) Wage Control Only</th>
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<tr>
<td>Intercept</td>
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<td>-172.70</td>
<td>1,564.93</td>
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<td>***(-3.25)</td>
<td>(-1.29)</td>
<td>(6.03)</td>
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<td>D1993</td>
<td>13.33</td>
<td>10.65</td>
<td>201.19</td>
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<td>(0.06)</td>
<td>(0.47)</td>
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<td>10.82</td>
<td>72.54</td>
<td>319.94</td>
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<td>(0.08)</td>
<td>(0.64)</td>
<td>(0.84)</td>
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<td>D1995</td>
<td>59.84</td>
<td>82.52</td>
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<td>-49.48</td>
<td>-18.86</td>
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<td>*(1.78)</td>
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<td>Inpatient Revenue/Total Revenue</td>
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<td>***(10.84)</td>
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<td>Medicare Patients</td>
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<td>***(35.12)</td>
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<td>Adjusted R²</td>
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<td>.836</td>
<td>.004</td>
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</table>

OLS regression. Costs are in 1980 dollars. Values of "t" indicated in parentheses. *** ** * Indicate that the coefficient estimate is significantly different from zero at the 1, 5 and 10 percent level (two-tailed test), respectively.
REFERENCES


U.S. Executive. 1912-14. *Reports of the President's Commission on Economy and Efficiency: Correspondence with Public Accountants*. National Archives Manuscript Division, RG 51, Sec. 311.


