PUBLIC SERVICES UNDER PRIVATE MANAGEMENT*

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Theory predicts that outsourcing public services to the private sector can reduce costs and improve efficiency but can also induce cost-cutting and compromise quality. We assess the Brazilian Organizações Sociais de Saude model (OSS), which outsources management of public hospital services to the private sector while the state remains the residual claimant. We show that this enhances hospital production and operational efficiency without adverse effects on hospital quality and equity. Increased inpatient production addresses previously unmet demand, expanding local access to hospital care and reducing population mortality. Performance gains arise from improved operational efficiency achieved through increased hospital management capacity. This facilitates staffing adjustments, favoring higher-skilled personnel, dismissing lower-productivity staff, and adopting flexible, performance-tied employment contracts. Effects are larger among private organizations with more management experience, underscoring returns to managerial capacity. Our findings show that incentive-ownership structures can address the quantity-quality trade-off in public service delivery, even when contracts are incomplete and quality is hard to measure. *JEL codes:* I18, H11, M10.

I. Introduction

Governments worldwide have increasingly contracted out the provision of public goods and services to the private sector, using

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models that range from different forms of public-private partnerships to full privatization (Fabre and Straub 2023). The prevailing rationale is that private sector involvement enhances efficiency and expands access to public goods and services by overcoming government failures and leveraging managerial expertise (World Bank 1995). Economic theory, however, has long called for trade-offs and more nuanced predictions. On the one hand, the control of the surplus rights may induce firms to increase efficiency through innovation and cost reduction (Hart and Moore 1990). On the other hand, when contracts are incomplete and quality is hard to specify or enforce, outsourcing may introduce incentives for cost reductions at the expense of quality (Hart, Shleifer, and Vishny 1997; Shleifer 1998).

The provision of health care has long offered a prime example of this trade-off in theory. Due to incompleteness of contracts, potential non-contractible quality issues can arise, especially in more complex services, such as hospital care, where quality assurance is intrinsically difficult (Holmstrom and Milgrom 1991; Hart, Shleifer, and Vishny 1997). Recent empirical evidence supports these concerns. Knutsson and Tyrefors (2022), for instance, find that privately owned ambulances in Sweden outperform public ones on contracted quality measures, but perform worse on non-contracted outcomes such as mortality. Duggan et al. (2023) find that hospital privatization in the United States improves efficiency and profitability, but it may also reduce access for less profitable patients and compromise care quality. While these findings reinforce concerns about private sector participation in contractually challenging settings, theory can still call for ambiguity depending on the specifics of contract design and ownership incentives (Hart, Shleifer, and Vishny 1997; Besley and Ghatak 2001).

This article assesses the Brazilian Organizações Sociais de Saúde (OSS) model, a contractual approach that transfers specifically the management of hospital services to private nonprofit firms while retaining governmental control over surplus rights and ownership of assets. Under this hybrid arrangement, hospitals remain publicly funded, with contracts linking payment to achieving contractible targets. Firms are compensated based on preestablished contract values, cannot appropriate their surplus (budgetary savings), and must reinvest it in service improvements. Another feature of this model is that public hospitals do not charge fees, do not compete for patients, and remain universally accessible. These features limit incentives to restrict access for disadvantaged populations or to reduce costs at the expense of non-contractible quality. Instead, the OSS model primarily aims to improve hospital performance through better management practices, with private managers operating under civil legislation, which is more flexible than public administration laws, and exercising full control over workforce and procurement decisions. This unique setting allows us to assess whether and how a hybrid approach that combines public ownership with private management, under government control of surplus rights, affects input allocation, management practices, hospital performance, and health outcomes.

We use an array of administrative microdata sets on hospital inputs, outputs, and health outcomes to assess the performance of hospitals that transitioned from public to OSS management between 2005 and 2022. In addition, we leverage unique administrative microdata on physicians and nurses, including information on employment contracts, tenure, and specialization, and connect them with microdata on hospital admissions they handled. This allows us to investigate labor productivity at the worker level and changes in personnel management practices in an unprecedented way. Our empirical strategy leverages changes in hospitals' administration over time within a staggered difference-in-differences (DiD) framework. Following the approach employed in recent studies on privatization, ownership changes, and mergers and acquisitions (e.g., Olsson and Tåg 2017; Craig, Grennan, and Swanson 2021; Arnold 2022; Duggan et al. 2023; Olsson and Tåg 2025), we combine DiD with matching to construct treated and control hospitals that are comparable across a broad array of covariates. We also use estimators that account for treatment effect heterogeneity across hospitals and time (Callaway and Sant'Anna 2021). We document that pre-trends are statistically insignificant and close to zero across outcomes, and that the timing of the transition to OSS is uncorrelated with key hospital characteristics and their pretreatment dynamics. Our results are also robust to alternative modeling specifications, which include using different control groups, varying methods for adjusting covariate-specific trends, controlling for time-varying patient characteristics, and aggregating the analysis at the population level. These tests indicate that unobservable time-varying shocks, endogenous selection, and spillover effects are not expected to play a relevant role in our setting.

We begin by examining the effects of the transition to OSS management on hospital production and productivity, and then consider its implications for care quality, equity, and population outcomes. Our analysis yields five main findings. First, hospital admissions rise substantially, by 40% relative to baseline. The effects are similar across different types of care (e.g., clinical versus surgical), including those related to more and less deferable conditions. Second, OSS management improves hospital productivity. We observe a 23% increase in bed turnover and a 14% increase in occupancy rates, along with a reduction in the average length of stay. Third, these changes occur without any detectable deterioration in quality of care, as measured by risk-adjusted inpatient mortality and readmission rates. This holds when considering all conditions and when focusing specifically on acute cases, which typically require immediate care and are prone to high mortality. Fourth, we do not find any effects on the profile of patients, including their age, gender, income, and risk indicators. This allows us to discard patient selection and adverse effects on equity. Fifth, we find that increased inpatient production under OSS management generates population-level benefits. OSS hospitals expand access to hospital care for the local population, particularly in underserved areas, and this expansion leads to measurable health improvements. Municipalities with OSS-managed hospitals experience a 3% reduction in overall mortality.

We examine potential mechanisms. First, we investigate whether new managers expand the hospital's operating capacity and whether gains in hospital outcomes reflect such changes. We find that while OSS management increases bed capacity, the effect is small and, holding bed turnover constant, accounts for only a small fraction of the observed growth in output volume. Consistent with that, we find no evidence of expansion in capacity on technologically advanced equipment. These findings, together with the substantial increase in productivity, suggest that the gains stem from a more efficient use of resources than from scaled-up capacity.

Second, we investigate two potential pathways underlying efficiency gains. The first relates to innovation in management practices. This is particularly relevant for personnel organization, as OSS hospitals operate under greater flexibility in human resource management. We find that OSS introduces efficiency-driven changes in personnel management. OSS managers reshape the composition of physicians, prioritizing more qualified workers while shifting labor contracts away from rigid arrangements and toward independent contracts, where compensation can be tied to deliverables. Autonomy in personnel management leads to an increase in hiring, with reshaping of workforce and employment contracts as described, while separation rates of incumbent physicians increase immediately after the transition to OSS. This is concentrated among physicians in the lower tail of the baseline distribution of productivity, with exit rates decreasing monotonically as productivity increases. Finally, we document that overall hospital output per physician increases in the post-OSS period.

The second potential driver of efficiency gains is managerial capacity, independent of managerial flexibility. To explore this, we estimate whether effects vary with the organizational capabilities of the firms. Specifically, we examine heterogeneity in outcomes based on prior experience of firms in hospital management. We find that the effects on hospital output and productivity are significantly larger in hospitals managed by highly experienced OSS firms. Although both high- and low-experience firms expand hospital capacity by similar proportions, in hospitals managed by less experienced OSS, capacity expansion accounts for most of the observed increase in output. In contrast, in hospitals managed by highly experienced firms, capacity expansion explains only a small portion of the output gains, reinforcing the role of increased productivity. In line with this, we find that experienced firms are more likely to implement efficiency-driven personnel practices, such as hiring a more skilled workforce, separating from less productive doctors, and adopting more flexible employment arrangements. Importantly, we also find greater reductions in population mortality in municipalities where the transitioning hospital is managed by a highly experienced OSS.

This article speaks to fundamental questions about the optimal boundary between state and market in public service provision, which is a central debate in economics. Our setting provides a rare opportunity to examine how private managerial practices operate in public ownership constraints. We contribute to multiple strands of research. First, we add to the literature on ownership, which is rich in theory but remains scarce in empirical evidence.

Studies of different forms of public-private partnerships suggest that outsourcing tends to outperform public provision where quality is easier to measure and to enforce, such as water services (Galiani, Gertler, and Schargrodsky 2005) and food distribution (Banerjee et al. 2019), including cases where the management of services is outsourced, such as in education (Abdulkadiroğlu et al. 2016; Romero, Sandefur, and Sandholtz 2020).

Evidence is scarcer and points to mixed or negative effects in settings where quality is difficult to contract, including health care, and cases involving the private management of services, such as employment placement, welfare services, and detention facilities (Doyle 2007; Bennmarker, Grönqvist, and Öckert 2013; Cabral, Lazzarini, and De Azevedo 2013; Crépon et al. 2013). Evidence on outsourcing of care management through managed care organizations in the United States, where private insurers are granted autonomy to manage publicly financed care, generally points to adverse effects on access, utilization, or equity, reflecting cost-containment incentives, risk selection, and competition for profitable enrollees (Duggan 2004; Aizer, Currie, and Moretti 2007; Kuziemko, Meckel, and Rossin-Slater 2018). Closer to our setting, Duggan et al. (2023) study the privatization of hospitals in the United States and show that transfers to private firms increased profits while reducing staffing and service volumes, limiting access for low-income and Medicaid patients. These findings align with broader evidence comparing public and private health care providers, which often documents trade-offs between cost containment and service provision (Knutsson and Tyrefors 2022; Chan, Card, and Taylor 2023).[1] Unlike most settings, where different forms of privatization entail surplus appropriation and market-based incentives, OSS hospitals raise no revenue from patients and must reinvest any savings. Another relevant feature is that OSS hospitals do not face competition in the hospital market, a common feature in other contexts that tends to strengthen the case for contracting out (Gaynor, Moreno-Serra, and Propper 2013; Bloom et al. 2015; Chandra et al. 2016; Banerjee et al. 2019). We document increased efficiency without adverse effects on quality or equity, particularly for non-contractible outcomes

1. Solid empirical evidence on the performance of public versus private health care provision remains limited, with even fewer studies examining public–private partnerships and contracting out (see reviews by Loevinsohn and Harding 2005; Lagarde and Palmer 2009; Odendaal et al. 2018; Fabre and Straub 2023).

such as mortality, therefore diverging from results documented in settings where private entities retained control over surplus rights.[2]

Second, this article relates to the literature on the role of management in organizational performance. A strand of empirical research has established a causal link between management practices and higher firm-level productivity in the private sector (Bloom et al. 2013; Bruhn, Karlan, and Schoar 2018; Gosnell, List, and Metcalfe 2020) and in public organizations (Rasul and Rogger 2018).[3] Another stream of research documents that individual managers also matter for performance through their observable and nonobservable skills, with evidence from the private sector (Bertrand and Schoar 2003; Lazear, Shaw, and Stanton 2015; Hoffman and Tadelis 2021) and the public sector (Fenizia 2022; Best, Hjort, and Szakonyi 2023). Closest to our work, Muñoz and Otero (2025) find positive effects on hospital performance of a reform in Chile that introduced a selection system to recruit CEOs in public hospitals. In contrast, Janke, Propper, and Sadun (2019) assess the effects of CEO appointments in NHS hospitals in the United Kingdom and find little evidence of effects on hospital production.

Exploiting the OSS model, we assess the impact of private management within public organizations. We examine management practices, with a focus on personnel practices and worker-level productivity, and heterogeneity in manager capacity in the same setting. We document that private management, operating under civil legislation and autonomy, outperforms government management in terms of efficiency, without compromising quality or equity. However, by comparing managers' types, we find that private management is not a sufficient condition for higher performance. The benefits of expanded discretion in government organizations materialize primarily when it is paired with managers who are capable of translating autonomy into efficient practices. Our findings therefore directly speak to Fenizia (2022), Best,

2. If we consider the intuitive model and predictions of Hart, Shleifer, and Vishny (1997), the OSS hybrid approach can be viewed as a case of public ownership in which private managers face limited incentives for socially inefficient cost reduction, while retaining greater autonomy and a relatively stronger incentive to pursue quality-enhancing innovations than under direct government management.

3. For evidence on health care specifically, see McConnell et al. (2013), Bloom et al. (2020), and La Forgia (2023).

Hjort, and Szakonyi (2023), and Muñoz and Otero (2025), who show that the quality of managers and bureaucrats matters for public sector performance even within the rigid boundaries of public administrations. We find that even outside these boundaries, after relaxing public sector constraints and expanding managerial autonomy, improvements still depend on the quality of managers. Our results support the view that managerial capacity remains a central determinant of performance in public service delivery, within and beyond the constraints of public sector institutions.

Because the OSS model deliberately holds fixed features that typically change under privatization, such as asset ownership, control over surplus rights, and market competition, this article also helps explain how privatization can add value by bringing focus to the role of management practices and worker productivity, mechanisms that have not received as much attention in the literature (Megginson and Netter 2001; Brown, Earle, and Telegdy 2006; Arnold 2022; Olsson and Tåg 2025). To our knowledge, this study is the first to use an output-based measure of individual worker productivity and to directly connect changes in workforce composition to innovations in management practices and increases in firm-level productivity. In doing so, more broadly, we provide evidence on how rigid employment regulations and limited managerial autonomy affect firm performance. Holding ownership and market incentives fixed, we find that changes in management autonomy, when translated into innovations in management practices, can generate sizable productivity gains. These findings are consistent with rigid employment structures playing an important role in shaping performance differences across organizations, industries, and regions (Botero et al. 2004; Besley and Burgess 2004; Propper and Van Reenen 2010), and connect with a long-standing literature on productivity dispersion in health care (Propper and Van Reenen 2010; Skinner and Staiger 2015; Chandra et al. 2016; Chandra and Staiger 2020). At a more aggregate level, our findings indicate that differences in governance structures can lead to substantial variation in hospital efficiency, which is relevant given the wide variation in governance models observed across and within health care systems worldwide. At a more granular level, our results suggest that variation in managerial experience and in personnel practices are important drivers of variation in productivity across health facilities.

Finally, the contractual environment underlying the OSS model relates to a broader literature on nonprofit provision of public services, which has received more limited attention in property rights theories of ownership (Eggleston 2024). A central insight from different streams of this literature is that meaningful incentives can arise even when profit distribution is absent, particularly in settings where quality and effort are difficult to contract on (Glaeser and Shleifer 2001; Malani, Philipson, and David 2003). In such settings, reputational concerns and career incentives can substitute for residual claims. This perspective connects to a large literature on career concerns showing that managers exert effort in response to future employment prospects and reputation, even without explicit performance pay (Holmström 1999; Dewatripont, Jewitt, and Tirole 1999). The OSS model can be viewed as an institutional arrangement that combines these elements in a publicly financed, nonprofit framework.

The remainder of the article is structured as follows. Section II describes the institutional background. Section III describes the data, and Section IV lays out our empirical strategy. Section V details the effects of OSS on hospital performance. We investigate mechanisms in Section VI and discuss policy implications in Section VII. Section VIII concludes.

II. Institutional Background

The OSS emerged to address productivity challenges in Brazil's public health care system, the Sistema Único de Saúde (SUS). This single-payer, tax-funded system provides free health care at the point of service to the Brazilian population through public and private providers.[4] SUS has expanded health care access nationwide since its conception in 1988, leading to significant improvements in health outcomes and reductions in health inequalities (Bhalotra, Rocha, and Soares 2019; Castro et al. 2019). Despite these achievements, SUS faces ongoing challenges, such as the increasing demand from an aging population and rising health care costs (Rocha, Furtado, and Spinola 2021). Public hospitals have become a focal point in addressing these challenges,

4. Those who opt for private care receive health care services covered by out-of-pocket payments or private health insurance plans. Approximately 25% of the Brazilian population has private health insurance. Most of the demand for private insurance comes from employer-provided coverage.

as they account for a significant share of health care expenditures and offer considerable potential for improving efficiency (Botega, Andrade, and Guedes 2020).[5]

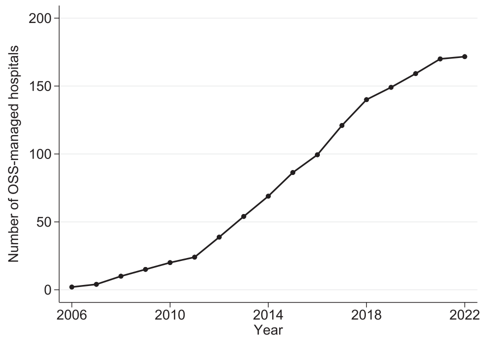
In response to these challenges, Federal Law 9,637 (1998) established the OSS model as part of broader efforts to modernize the public sector, enhance flexibility in public contracting and service provision, and address productivity constraints (Sano and Abrucio 2008; Barbosa and Elias 2010). At its core, the OSS model introduces a novel form of public-private partnership grounded in a hybrid governance approach that shifts the management of health services from direct government administration to nonprofit private organizations.

The adoption of the OSS model has expanded over time and geographically across Brazil. In 2005, 24 hospitals operated under OSS management, all of which had been under OSS management since their construction. New legislation allowed the transition of existing public hospitals to OSS management in 2006, marking a turning point in the expansion of the model. In 2006, the first hospital transitioned to OSS management (in the state of Bahia). In 2022, the model had been adopted in several regions, with OSS-managed hospitals accounting for approximately 9% of all public hospitals in Brazil. This includes both newly constructed and transitioned units, with the latter group making up approximately two-thirds of all OSS-managed hospitals. Figure I shows the growth in the number of OSS-managed hospitals that transitioned from direct government management between 2006 and 2022 and illustrates their geographical spread across Brazilian states. Online Appendix Figure A1 presents the evolution of the total number of hospitals managed by OSS, distinguishing between those established directly under OSS management and those initially managed by the state and that later transitioned to OSS.

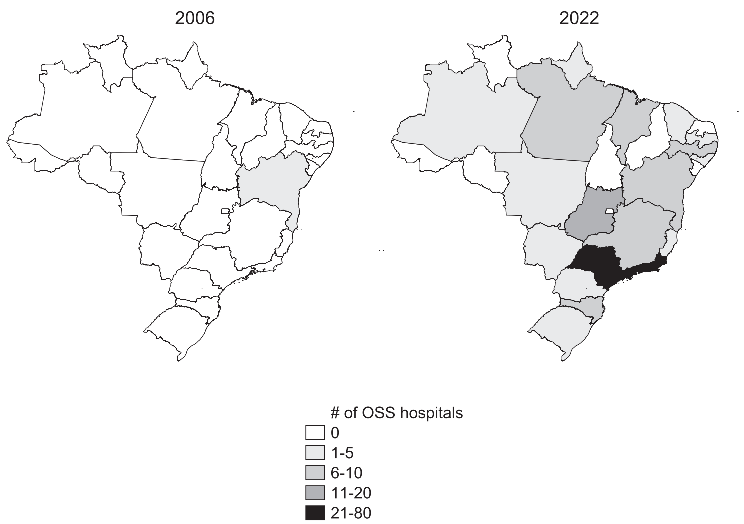
II.A. A Hybrid Governance Model

The OSS model transfers the management of public hospitals to nonprofit private organizations, while hospital funding and ownership remain public. We outline the building blocks of the

5. In Brazil hospitals account for nearly 35% of total public expenditure in health (Ministério da Saúde 2018).



(A) By Year



(B) By State

FIGURE I

Hospitals Managed by OSS Firms

This figure presents the distribution of hospitals managed by OSS firms between 2006 and 2022. Panels A and B present the distribution by year and Brazilian states, respectively. The sample includes public hospitals initially operated by governments that transitioned to OSS management.

OSS model and compare them to their counterparts under direct government administration.[6]

1. Hospital Selection and OSS Contracting. Federal legislation established the legal framework under which local governments may select and contract hospital management to OSS entities. Qualitative evidence indicates that in practice, hospital selection is driven by structural and administrative characteristics. Selection typically involves medium- and large-sized hospitals with complex services and large workforces, where rigidities under direct administration are most binding and where policy makers perceive greater scope for gains from managerial flexibility. Smaller hospitals often remain under direct administration, as the fixed administrative costs of OSS contracting are harder to justify at that scale. Importantly, there is no institutional mandate to target poorly performing hospitals.[7]

Once a hospital is selected for OSS contracting, governments initiate a public procurement process to select the OSS firm that will manage it. The process takes place through competitive bidding, where candidates are assessed based on operational cost estimates, previous experience, and work plans. Once selected, the OSS is hired through a renewable five-year contract, which specifies a global budget for managing the hospital and annual output targets used for payments on performance (La Forgia and Couttolenc 2009; La Forgia and Harding 2009; WHO 2014). Targets are set for different types of services, including inpatient surgical, clinical, urgent, and emergency care. Outputs are defined in measurable and verifiable units, such as admissions or procedures. Persistent underperformance may lead to contract termination. Qualitative evidence suggests that targets are set at aggressive levels, often exceeding the hospital's pre-OSS production standards. To examine this, we manually coded admission targets from original OSS contracts for 11 hospitals across nine states. Figure II shows that hospital admissions increase sharply after transition to OSS and largely remain within target ranges, avoid-

6. This outline draws on extensive documentary evidence (including contracts, procurement rules, audit reports, and budget legislation) and on semi-structured interviews with 21 key stakeholders (including policy makers, senior civil servants, scholars, OSS directors, hospital managers under both models, and clinical leaders). These interviews were used to clarify how contractual rules and incentives operate in practice.

7. Consistent with this, we show in later sections that transitions are not systematically related to pre-trends in outcomes.

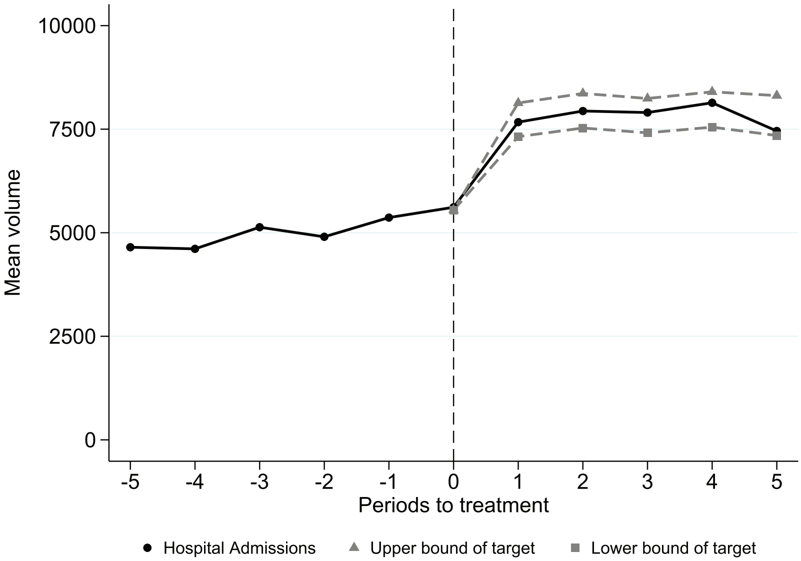


FIGURE II

Hospital Admissions and Volume Targets

This figure presents data from 11 hospitals in the treated sample. The vertical line marks the start of the OSS contracts. We manually extracted hospital admission targets from the OSS contracts and compared them with actual admission volumes, obtained from the Hospital Information System (SIH/Datasus). The contracts specify volume targets for all types of admissions. The lower bound of the target represents the threshold below which the hospital incurs penalties for failing to meet volume requirements, while the upper bound sets the maximum target for full incentive alignment.

ing penalty thresholds.[8] Performance is monitored through oversight by contracting health secretariats, independent annual compliance reviews, and financial and administrative audits.

The timing of the procurement and contracting processes reflects when legal, fiscal, and administrative conditions are in place, including legislative authorization. These processes are complex, and governments rarely transition many hospitals simultaneously. As a result, transition timing often varies due to idiosyncratic administrative and sequencing constraints, even

8. The lower bound defines the penalty threshold, and the upper bound corresponds to full incentive alignment. The hospitals included in the analysis are part of the treated sample and are representative in terms of size, staffing, and baseline performance.

across hospitals with similar size and characteristics in the same jurisdiction.

2. Management Discretion and Incentives: Public Versus OSS Administration.

i. Budget Allocation. Both OSS-managed and government-managed hospitals operate under comparable publicly financed global budget envelopes, which are set ex ante and finance all current expenditures, including labor, medical inputs, and administrative and management costs. What substantially changes under OSS is not the size of the budget but how resources can be allocated within that fixed envelope and the introduction of volume targets. In OSS-managed hospitals, budget is tied to performance, and its allocation is flexible, granting managers autonomy over spending.[9] Importantly, there is no separate management fee paid on top of this budget, and OSS organizations are legally prohibited from distributing savings or profits. Any budgetary savings must be reinvested in service improvements. In contrast, budgets in government-managed hospitals are not tied to performance and are earmarked ex ante by functional categories, with allocations determined by health secretariats (La Forgia and Couttolenc 2009). While managers retain autonomy over day-to-day operations (e.g., over service organization and reallocations within budget lines), earmarking limits managers' ability to reallocate resources in response to operational needs, with larger deviations requiring higher-level approval and being subject to ex post audits.

ii. Management Practices: Personnel. OSS-managed hospitals operate under civil labor laws, which grant flexibility in personnel management, including the choice of employment contracts, wage levels, job assignments, promotions, and dismissals (Malik, Schiesari, and Carrera 2021).[10] OSS-managed hospitals

9. Budgets can be renegotiated at contract renewal to account for changes in scope and inflation, but the bulk of funding remains fixed. Performance-related disbursements take the form of withholding or penalties when minimum targets are not met, rather than marginal revenue for additional output.

10. Hiring typically follows an interview process and a short probationary period. Dismissals are feasible during and after probation, subject to statutory notice and severance. During probation, termination can occur without prior notice. After probation, it can occur without cause, subject to notice and severance.

therefore set salaries and contract terms closer to market conditions, including higher pay for managerial roles and fewer constraints on separation. Managerial compensation is paid from the hospital's operating budget and does not include savings-based remuneration. By contrast, public administration laws impose stricter constraints on personnel management in government-run hospitals. Hiring requires lengthy public examinations,[11] followed by a three-year probationary period, after which dismissals are possible only in cases of severe misconduct. Promotions require formal selection processes, wage structures are rigid, with salary levels and career progression predetermined and unrelated to productivity (World Bank 2006). Although intrinsic motivation and professional reputation may matter, managers' incentives are relatively flat and embedded in hierarchical career systems characterized by strong job protection, predictable progression, and weak links between individual performance and compensation or retention.

iii. Management Practices: Procurement. In OSS hospitals, managers are responsible for procuring inputs (e.g., supplies, medicines, and services) under their own procurement and contracting policies. This autonomy enables flexibility in purchasing and faster responses to market conditions. By contrast, publicly administered hospitals follow public procurement regulations. These rules can generate inefficiencies through delayed payments, higher supplier prices, centralized purchasing which limit managerial discretion, often leading to missed purchasing opportunities, stock management issues, and disruptions in the availability of essential inputs (World Bank 2007).

iv. Market-Level Incentives. Both OSS-managed and directly administered hospitals provide services exclusively to SUS patients, do not compete for private patients, and are prohibited from charging user fees. The OSS model therefore does not introduce mixed-revenue incentives or market-based selection pressures that could affect access or patient composition.

11. The public service examination process includes obtaining government authorization, forming an organizing committee, selecting the examination board, drafting and publishing the public notice, and administering the exam. This process can be delayed or interrupted by legal challenges.

3. OSS Organizational Structure and Incentives. OSS organizations are legally autonomous nonprofit entities that contract with governments to manage public hospitals, are responsible for contract compliance, exercise control over hospital management, and oversee professional managers responsible for day-to-day operations.[12] In practice, OSS are often affiliates of nonprofit health care providers, including nonprofit foundations (often affiliated with medical schools and other educational institutions), philanthropic organizations acting in health and social assistance, and, to a lesser extent, nonprofits linked to for-profit business groups. These organizations may establish OSS entities as legally independent, nonprofit affiliates eligible to participate in OSS contracting.

Many such organizations rank among Brazil's largest health care providers and hold philanthropic certifications that grant tax exemptions. These certifications can be awarded to entities that allocate part of their services to SUS (Contreiras and Matta 2015; Morais et al. 2018). Fiscal incentives are therefore an important motivation for OSS participation, as services provided in OSS-managed hospitals count toward eligibility for tax benefits.[13] Beyond fiscal considerations, qualitative evidence points to additional motivations. First, organizations frequently frame participation as mission-driven, emphasizing reputational returns, institutional visibility, and contributions to public health. Second, OSS contracts are linked to the expansion of teaching, training, and research activities, with public hospitals serving as platforms for professional formation and organizational learning. Finally, managing multiple hospitals generates scale-related benefits, including centralized procurement and the accumulation of managerial expertise across facilities.

OSS organizations maintain their own administrative staff (managerial, legal, and accounting personnel), which are financed through overheads embedded in contracts or directly hired as part

12. Only accredited OSS are eligible to participate in procurement processes. OSS accreditation follows a qualification process that verifies legal compliance and prior experience managing health care services, typically requiring a minimum of five years of health care management experience.

13. For example, philanthropic hospitals are required to offer 60% of outpatient visits or inpatient admissions to SUS patients, free of charge at the point of use and financed through SUS reimbursement. OSS contracts help meet this requirement, as services delivered in public hospitals under OSS management count toward the mandated proportion.

of the hospital workforce and paid from the hospital's operating budget. When OSS entities are affiliated with nonprofit or philanthropic health organizations, they may also receive complementary administrative support and resources. None of these arrangements involve public funding beyond the contracted transfers. Although OSS organizations are legally prohibited from distributing profits, sustained poor performance threatens their continued role as public contractors. Discipline therefore arises through contract renewal risk, reputational concerns, and the ability to maintain or expand a portfolio of management contracts.

II.B. Conceptual Framework

We provide a simple conceptual framework to clarify how OSS management differs from direct public administration (DA) and how these differences translate into performance effects. We assume that hospital output is given by $Y = A(e)\,f(K, L)$, where K and L denote physical and labor inputs and $A(e)$ captures operating efficiency. Managerial effort e directly affects performance, for example, through better monitoring, coordination, and problem solving, with $A'(e) > 0$.

1. Management Discretion and Effort.

Hospital managers choose effort e jointly with organizational choices x (e.g., staffing composition, contract forms, procurement practices, scheduling, and internal organization), subject to an institutional feasibility set where $x \in \Omega_j$, with $j \in \{\text{DA}, \text{OSS}\}$. The OSS model does not change the hospital's public budget constraint $rK + wL \leqslant B$. Instead, it expands managerial discretion so that $\Omega_{\text{OSS}} \supset \Omega_{\text{DA}}$. Intuitively, discretion determines the range of margins through which managerial effort can be translated into implemented organizational change. When Ω is tight, effort improves performance only along a narrow set of margins. When Ω is broader, the same effort can be deployed across more consequential margins, increasing the marginal return to effort.

One can also interpret OSS discretion as affecting not only quantities (K, L) but the effective prices (r, w) at which inputs are obtained. Under direct administration, wages and procurement prices are largely fixed. Under OSS, managers' autonomy over hiring and procurement choices can lower the effective cost of labor or capital in the same budget constraint. In principle, allowing r and w to be endogenously affected by managerial choices reinforces the mechanism emphasized above. Greater discretion increases the return to managerial effort by opening additional operational margins through which effort can translate into performance.

2. Management Incentives and Effort. We assume the reduced-form utility for hospital managers $U_j(e) = \theta_j \Pi(Y) + \phi M(e) - c(e)$, where $\Pi(Y)$ summarizes performance-related rewards, such as career concerns, evaluations, and retention. $M(e)$ captures intrinsic or mission-driven motivation, $c(e)$ is the cost of effort, and θ_j indexes the strength of extrinsic incentives in regime j. Under direct administration, θ_{DA} is relatively low, reflecting weak links between performance and compensation or job security. Effort may therefore depend more on intrinsic motivation through ϕ. Under OSS management, $\theta_{\mathrm{OSS}} > \theta_{\mathrm{DA}}$, reflecting stronger career concerns and performance evaluation under private sector contracting. This framework highlights two reasons OSS management can improve performance under fixed budgets. First, stronger extrinsic incentives increase optimal effort. Second, expanded discretion raises the return to effort by enlarging the set of feasible organizational changes.[14]

3. OSS-Level Incentives and Capacity. It is important to distinguish incentives operating at two organizational layers. At the OSS organization level, poor performance jeopardizes their continued role as public contractors. At the hospital level, OSS organizations recruit and oversee professional managers who face standard labor market incentives and whose performance is evaluated by the OSS organization. Thus, OSS incentives are transmitted to hospitals through selection, monitoring, and retention rather than residual claims. Finally, OSS organizations may differ in managerial experience and organizational capacity. More experienced OSS entities may be better able to translate expanded discretion into effective organizational change, implying heterogeneous effects even under the same contractual framework. This motivates the heterogeneity analyses in later sections.

14. These two forces can interact. Even if intrinsic motivation is substantial under direct administration, a tighter Ω_{DA} can flatten the effort–performance relationship, while a broader Ω_{OSS} makes effort more productive and therefore more likely to be supplied.

4. Implications. This framework yields testable implications. First, holding budgets fixed, OSS management should increase output and productivity primarily through higher operating efficiency. Second, performance gains should be closely linked to margins over which discretion differs most strongly between regimes, particularly personnel management and procurement. Third, heterogeneity in effects should arise from differences in managerial capacity. OSS organizations with greater experience or organizational know-how should be better able to translate discretion and incentives into performance gains, even under identical contractual rules. Finally, if performance improvements stem from discretion and effort rather than rent extraction and patient selection, we should not observe deterioration in quality or equity.

III. Data

Our analysis is based on data at the hospital-by-year level covering the 2005–2022 period.[15] We combine administrative microdata on hospital resources, production, and performance from all Brazilian hospitals that provide services to SUS. We describe the construction of the main variables and the auxiliary data used in our analysis.

III.A. Hospital Performance

We use administrative microdata from the Hospital Information System (Sistema de Informações Hospitalares, SIH), which includes information on all hospital admissions in the entire public health system, covering both public and private facilities that provide hospital services to SUS. This data set provides patients' age, gender, postal code of residence, as well as comorbidities and cause of admission (using ICD-10 codes). In addition, SIH records the type of care provided (e.g., clinical, surgical, obstetrical), final outcomes (discharge or death), the date of admission and discharge, and the health facility code of the admission. We use these data to analyze the number and composition of hospital admissions.[16] In some analyses, we classify hospitalizations as sensi-

15. To mitigate the influence of the COVID-19 pandemic, we also perform analyses excluding data after 2019.

16. Reporting is mandatory and subject to routine audits by the Ministry of Health (Neto et al. 2016), which reduces the scope for underreporting or misclassification.

tive to emergency care (ECSC), as defined by Vashi et al. (2019). ECSC admissions refer to conditions that are generally severe and characterized by acute, largely unpredictable onset, making them less subject to discretionary timing or hospital selection, such as heart attacks, accidents, and viral pneumonia (Card, Dobkin, and Maestas 2009; Doyle et al. 2015).

We also use SIH data to construct widely used measures of hospital productivity and quality of care (Gaynor, Laudicella, and Propper 2012; Bloom et al. 2015; Doyle et al. 2015; Gupta 2021; Muñoz and Otero 2025), including bed turnover rates, bed occupancy rates, and average length of stay. These metrics represent the average number of discharges per hospital bed, the proportion of available hospital bed time effectively utilized, and the average number of hospital days spent by patients, respectively. Higher bed turnover and occupancy rates, along with a reduced length of stay, indicate increased productivity (Bloom et al. 2015). For quality of care, we measure inpatient death rates and readmission rates. The inpatient death rate is the share of hospitalizations that result in patient death. The readmission rate is the proportion of discharged patients who are hospitalized again within 30 days.

A potential concern is that changes in observed hospital performance may reflect endogenous patient selection. The Brazilian public health setting is particularly suitable for our analysis because the institutional design limits patient selection. Hospitals cannot reject patients or refer them to other hospitals at their discretion. Nonetheless, we implement a risk-adjustment procedure to minimize variation in hospital outcomes that is attributable to patient characteristics. Our approach follows the literature on quality measurement in education and health care (Chetty, Friedman, and Rockoff 2014; Chandra, Dalton, and Staiger 2023). In the first step, we regress a given outcome y_{it} for patient i in year t on the vector of patient characteristics $\mathbf{X}_{it}$ following equation $y_{it} = \beta\mathbf{X}_{it} + \mu_{ht} + \xi_{it}$, where $\mathbf{X}_{it}$ includes the patient's postal code, age-by-gender dummies, and indicators for admission diagnoses and comorbidities at the ICD-10 three-digit level. These covariates explain roughly 30% of the cross-patient variation in mortality. The model also includes hospital $\times$ year fixed effects μ_{ht}, so β is estimated using within-hospital-year variation, which reduces biases due to omitted factors correlated with patient outcomes and performance. In the second step, we calculate the risk-adjusted outcome as $y^*_{it} = y_{it} - \hat{\beta}\mathbf{X}_{it}$.[17]

All hospital outcomes that aggregate patient results use these risk-adjusted variables. We show that our results are robust to using either raw or risk-adjusted variables. In addition, we compute predicted mortality (obtained from regressing mortality on **X**) and use it as an outcome to assess whether the case mix changes along the severity dimension. Finally, we use predicted mortality to define a subsample of high-risk patients and reestimate the effects on mortality in this group. Focusing on high-risk cases further alleviates concerns about selective patient sorting and improve statistical precision (Silver 2021).

III.B. Hospital Inputs

We gather data from the National Registry of Health Establishments (Cadastro Nacional de Estabelecimentos de Saúde, CNES) to investigate the effects of OSS on hospital inputs. CNES is a database maintained by the Ministry of Health that records detailed information on all public and private health facilities in Brazil, encompassing their location, services, and human and physical resources. A major strength of these data is their universal coverage and frequent updating. Establishments that fail to update their records for more than six months have their authorization to operate revoked (Brazil 2014). From CNES, we extract data on the number of beds, medical equipment, and staff by area of practice for each hospital. In some analyses, we measure medical equipment and staff per 100 hospital beds, as they vary with hospital size and are used as standard indicators in the literature. Staff are defined as the number of full-time equivalent (FTE) employees.

More specifically on medical staff, the human resources module of CNES provides identified data on all physicians affiliated with health establishments in Brazil. We use these data to track physicians' employment links over time. The resulting linked data on physicians are universal by design, and mandatory reporting ensures comprehensive coverage and consistency. We use these

17. The variation in y^*_{it} is therefore equivalent to the variation determined by hospital quality and the idiosyncratic term. By estimating β controlling for hospital fixed effects, we eliminate the bias in $\hat{\beta}$ that comes from variation in outcomes across hospitals that is due not only to patient case mix but also to differences in hospital quality.

data to investigate employment arrangements as we observe employment contracts. The first type of contract is regulated by CLT terms, a regime typically used by the private sector.[18] This type of contract is much less rigid compared to others used by public organizations, but still provides benefits such as severance pay and social security for employees. The second is Estatutário, a regime typically used by public facilities for formal employee hiring. This regime is less flexible than CLT, particularly in terms of hiring and firing, as it emphasizes job stability for public servants, making termination difficult and often involving a lengthy public examination process for hiring. In addition, wages in the Estatutário regime are highly rigid. Their levels and progression are predetermined and cannot be linked to productivity measures. The third type of arrangement is independent contracting, where hospitals contract with physicians' own businesses. This type offers the most flexibility for hospitals, because physicians are not formally recognized as employees but as firms, and thus do not have the same employment rights and benefits. This arrangement allows both doctors and hospitals greater autonomy in determining the terms of their contracts.[19]

We further investigate the profile of physicians by gathering identified data from the Federal Council of Medicine (CFM), the National Commission of Medical Residency (CNRM), and the Brazilian Medical Association (AMB). The primary purpose of the CFM registry is to ensure compliance with regulatory standards for medical practice and maintain accurate and up-to-date records of all licensed physicians in Brazil. It includes information such as physicians' names, birth municipalities, registration dates (marking the start of their medical practice), and registration statuses (active or inactive). Because practicing medicine in Brazil requires a license issued by the CFM, the resulting records cover the universe of physicians who have ever practiced in the country. Using these data, we construct a measure of physician experience as the number of years since registration with the CFM. Data from the CNRM and AMB provide details on physicians who have completed residency programs and fellowships, respectively, including the completion dates. Because specialist practice in Brazil

18. CLT stands for Consolidação das Leis do Trabalho, which is the legal framework that regulates formal private employment relationships in Brazil.

19. There is a fourth category, labeled as "Others," referring to arrangements specific to interns and residents.

requires a specialty title issued or validated by one of these two bodies, these data provide verified information on the universe of specialists. We use these data to identify which physicians hold a specialty title.[20] By linking identified data from CNES and SIH, we also observe the total number of inpatient cases taken by each doctor. We use this information to investigate doctors' production per work hours.

III.C. Identification of OSS Hospitals

To identify the public hospitals managed by OSS, we use data from the Social Health Organizations Database Portal (BDOSS).[21] To ensure accurate categorization of OSS hospitals, the BDOSS relies on three sources of information: (i) the database constructed by Barcelos et al. (2022), which involves manual classification of OSS hospitals based on information from state and municipal health department websites, transparency portals, and the 2018 Municipal Information Survey by the Brazilian Institute of Geography and Statistics (IBGE); (ii) data from the Federal Audit Court (TCU) on governmental contracts with OSS;[22] and (iii) additional manual coding based on electronic platforms from state and municipal health secretariats, as well as information accessed through Brazil's Access to Information Law.

The BDOSS data set provides a unique identifier for each public hospital under OSS management and the year the OSS began operating the hospital. We identified 236 hospitals managed by OSS between 2005 and 2022 in the data and applied a few restrictions to define our final sample. First, we included only hospitals that transitioned from direct public administration to OSS management (the switchers). This step excludes 73 always-OSS hospitals and 27 other public hospitals that were not previously managed by the public administration. We also removed nine hospitals

20. In Brazil, physicians complete a six-year undergraduate medical degree and may practice as generalists upon graduation. Specialization requires additional training through medical residency (two to five years) or fellowships (one to two years), with only residency conferring an official specialty title unless fellowship graduates subsequently pass a specialist exam administered by the AMB.

21. This data set is managed by the Research Group on Health Economics and Crime at the University of Minas Gerais in collaboration with the Brazilian Institute of Social Health Organizations.

22. TCU is Brazil's supreme authority on public finances and government contracts, responsible for auditing and investigating contracts involving public funds, including those established with OSS.

with substantial missing data in the pretreatment period. These criteria result in a final treated sample of 127 hospitals, which corresponds to about 4.5% of the total number of public hospitals in Brazil.

III.D. The Control Group

To construct the control group, we start from the universe of public hospitals that remain under state management, nearly 2,800 facilities in total. Online Appendix Table A1 provides descriptive statistics for OSS hospitals (column (1)) and all public hospitals (column (3)). Consistent with the institutional background, OSS adoption is more likely in hospitals with a larger number of patients, those with more resources, and those located in southeastern Brazil. Given that the pool of potential control hospitals is large and heterogeneous, and that treated hospitals differ systematically in size, resources, and location, we use matching as an ex ante design choice to restrict the donor pool to hospitals that are more comparable along relevant characteristics. This improves comparability and reduces the scope for differential trends associated with observable and unobservable heterogeneity. It also facilitates interpretation, as the estimated effects reflect comparisons among more similar groups.

We sequentially match each treated hospital with one control hospital without replacement based on proximity in the propensity score. The propensity score is calculated separately for each treatment cohort using key hospital characteristics averaged over the five years before the onset of OSS management, including number of patients, number of beds, number of employees, available medical equipment, and the hospital's macro-region.[23] We do not match hospitals based on fine-grained geographic location to minimize concerns about spillovers. As a result, all treated hospitals are located in different cities from their matched controls. We also directly test for spillovers and show that they are not a concern in our setting.

23. Brazil is divided into five macro-regions, which cover its 26 states and the Federal District. Because we also investigate some of these variables as outcomes, one might worry about mean reversion if baseline levels reflect transitory shocks (Daw and Hatfield 2018). Defining baseline as the average over the pretreatment period (rather than a single period, especially not the immediately preceding one) mitigates this concern. We also obtain similar results when excluding the corresponding outcome from the propensity-score predictors (results available on request).

Matching significantly reduces differences in observable characteristics between the treated and control groups (Online Appendix Table A1, columns (1) and (2)), making it more likely that the matched controls approximate the trajectory treated hospitals would have followed in the absence of OSS adoption. In robustness checks, we show that our results are stable when using all state-managed public hospitals as the comparison group. The next sections further compare the treated and matched control groups in terms of pre-trends.

IV. Empirical Strategy

Our goal is to quantify the causal effects of the OSS model. We take advantage of the staggered transition from public to private administration across hospitals and over time in a DiD setup, which, when combined with matching, has been commonly used in the literature on privatization, ownership changes, and mergers and acquisitions.[24]

IV.A. Causal Estimand

Define G_g as a dummy variable equal to one if a public hospital switches to OSS management at period g. Let $Y_w(1)$ and $Y_w(0)$ measure potential hospitals' outcomes at time w with and without the OSS model, respectively. The main building block of our framework is the average treatment effect for hospitals that are members of group g at a particular year w, denoted by

$$ATT(g, w) := E[Y_w(1) - Y_w(0)|G_g = 1]. \tag{1}$$

We express our parameter of interest in terms of functionals of expression (1). In particular, we are mostly interested in

$$\tau_t := \sum_{g \in \mathcal{G}_t} P(G_g = 1) ATT(g, g + t), \tag{2}$$

which is the average treatment effect of the OSS model on hospitals' outcomes measured $t > 0$ periods after the transition to OSS management, among all groups of hospitals that joined the OSS model and are observed in period t.

24. See Gaynor, Laudicella, and Propper (2012), Olsson and Tåg (2017), Craig, Grennan, and Swanson (2021), Arnold (2022), Duggan et al. (2023), Olsson and Tåg (2025).

IV.B. Estimation Strategy

To estimate τ_t, we follow the tools proposed by Callaway and Sant'Anna (2021) in staggered designs. In summary, for any period g when a group of hospitals transitions to OSS, and for a fixed event time $t > 0$, we use standard 2×2 DiD to get an estimate for the treatment effect among hospitals of group g, t periods after OSS: $\widehat{ATT}(g, g+t)$. This is the result of comparing the average outcome evolution between periods $g-1$ and $g+t$ for hospitals that switched to OSS at g with the corresponding evolution of their matched comparison hospitals. To estimate the average effect for all groups of treated hospitals, t periods away from the year they switched to OSS ($\widehat{\tau}_t$), we aggregate these group-specific DiDs based on the relative sample size $\widehat{P}(G_g = 1)$ of each treated group following equation (2). We repeat this procedure and compute $\widehat{\tau}_t$ for each $t \in \{1, 2, 3, 4, 5\}$. This choice is primarily motivated by the typical duration of OSS contracts (five years). In addition, in this range, we can estimate dynamic effects without major changes in the composition of the treated group, as roughly 70% of the OSS hospitals have data covering up to five posttreatment periods. In robustness checks, we show that our results remain virtually the same in a balanced panel over the event times and when using the standard two-way fixed effects estimator.

Finally, to conduct asymptotically valid inference, we use a bootstrap procedure that computes simultaneous confidence bands for the entire path of group-time average treatment effects. Our inference procedure also accounts for the autocorrelation of the data by using clustered bootstrapped standard errors at the hospital level.[25]

IV.C. Identification

Our study design is based on a conditional parallel-trends assumption. We assume that treated and control hospitals in the same macro-region and with similar size and patient volume in the baseline would follow the same trend in outcomes in the absence of the OSS model. We support our identification strategy

25. Standard errors are virtually unchanged under alternative inference procedures: (i) clustering at the micro-region level, to account for spatial correlation in local hospital markets; and (ii) clustering at the matched-pair level, to account for the matching structure (Abadie and Spiess 2022). The similarity of the estimates suggests that neither source of dependence is quantitatively important in our setting. Results are available on request.

with empirical evidence and robustness checks. We estimate the effects of the OSS model using pretreatment periods, τ_t for $t < 0$, using the Callaway and Sant'Anna (2021) estimator of pretreatment effects. Finding coefficients statistically different from zero would indicate a violation of the parallel-trends assumption.[26] Throughout the article, we show that these placebo effects are statistically insignificant, supporting design validity. We conduct F-tests of the joint significance of the pre-trends and consistently fail to reject the null that all pretreatment coefficients are equal to zero.

We complement the pre-trends analysis by examining the determinants of OSS adoption and its timing, comparing treated and matched control hospitals in discrete-time survival models. We examine both baseline and time-varying characteristics. Online Appendix Table A2 reports the results. We find that relevant baseline covariates do not predict OSS adoption, confirming that treated and control groups are fairly balanced. Although identification only requires that groups exhibit the same trends (not the same levels) in the absence of treatment, this mitigates concerns about unobserved trends that depend on or correlate with baseline characteristics. Furthermore, we do not observe any correlation between OSS adoption and pretreatment variation in hospital inputs (beds, workforce, and medical equipment), production, and risk-adjusted mortality rate. This is true irrespective of whether we consider long-term or short-term changes in these variables. We also explore alternative specifications for our DiD model, such as different comparison groups and varying methods for adjusting covariate-specific trends. Reassuringly, point estimates remain stable across different specifications. These tests indicate that unobservable time-varying shocks are unlikely to play a significant role in our setting.

V. Effects on Hospital Performance

We present our main results in graphical form, plotting together in one figure pre- and posttreatment effects and their 95% confidence bands. We summarize the evidence in tables that re-

26. Because we do not match hospitals based on pretreatment trends or period-by-period pretreatment outcomes, the pre-trend tests for variables used in the matching remain informative rather than mechanically flat. Section V.E further shows flat pretreatment estimates in specifications with and without matching.

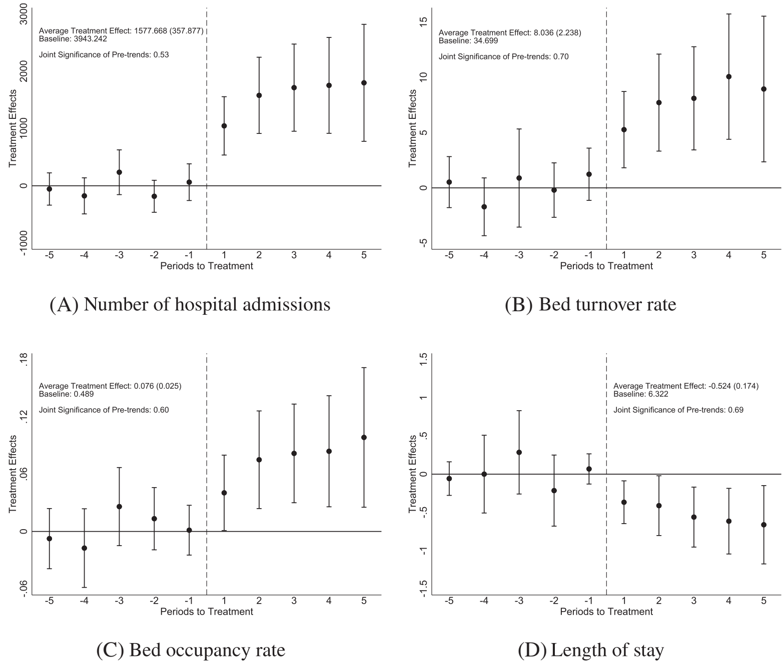


FIGURE III

OSS Effects on Hospital Production and Productivity Measures

This figure plots 95% confidence bands computed with a hospital-level clustered bootstrap and DiD estimates for the effects of the OSS model on the number of hospital admissions (Panel A), bed turnover rate (Panel B), bed occupancy rate (Panel C), and length of stay (Panel D). Length of stay is risk-adjusted using the procedure described in Section III. The average treatment effect is computed as the average of the DiD estimates for event times 1–5. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. The baseline corresponds to the sample mean for treated hospitals in the five years before OSS adoption. The figure also reports the p-value from an F-test of the joint significance of the pretreatment coefficients.

port the average of posttreatment effects two and five years after OSS. In the text, we generally interpret these average effects. All graphs and tables reporting results additionally display the p-value from an F-test of the joint significance of the pre-trends.

V.A. *Production Output and Productivity*

Figure III, Panel A, and Table I present OSS effects on hospital production. We observe that the transition to OSS manage-

TABLE I
OSS EFFECTS ON HOSPITAL PRODUCTION AND PRODUCTIVITY MEASURES

	2-year effect (1)	5-year effect (2)	Pre-trends test (3)	Mean at baseline (4)
Hospital admissions	1,312.274	1,577.668	.53	3,943.242
	(288.763)	(357.877)		
Surgical care	403.015	480.399	.86	1,182.867
	(124.191)	(147.480)		
Clinical care	299.228	532.096	.25	1,216.113
	(95.602)	(123.382)		
Obstetric care	344.927	316.217	.80	890.904
	(122.282)	(142.503)		
Other type of care	265.104	248.957	.19	653.358
	(95.084)	(115.083)		
Emergency-care sensitive	262.873	397.047	.53	894.956
	(75.801)	(101.398)		
Nonemergency-care sensitive	1,049.401	1,180.621	.55	3,048.287
	(232.274)	(289.110)		
Bed turnover rate	6.506	8.036	.70	34.699
	(1.888)	(2.238)		
Bed occupancy rate	0.058	0.076	.60	0.489
	(0.021)	(0.025)		
Length of stay	−0.390	−0.524	.69	6.322
	(0.157)	(0.174)		

Notes. This table reports the average effects of the OSS model on hospital production and productivity measures. Length of stay is risk-adjusted using the procedure described in Section III. Columns (1) and (2) report the average of the DiD estimates for OSS effects over event times 1–2 and 1–5 years after OSS adoption, respectively. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. Column (3) reports the p-value from an F-test of the joint significance of the pretreatment coefficients. Column (4) shows the mean of each variable in the five years before OSS adoption.

ment leads to a sharp increase in hospital admissions. The average impact amounts to 1,312 in the two years following the transition, and then to 1,577 after five years. This corresponds to an increase of 40% relative to the baseline. These results differ from those of Duggan et al. (2023), who found that hospital admissions declined by 8.4% after the privatization of state hospitals in the United States. Table I further shows that the positive effect on hospital admissions persists across different types of inpatient care, including surgical, clinical, obstetric, and other categories. All these categories experience a sharp increase following OSS, proportionate to their contributions to overall admissions at baseline. We also observe an increase of 397 admissions due to ECSCs following OSS (44% of baseline), while the impact on hospitalizations not due to emergency conditions is 1,180 (39%).

The rise in the number of admissions could stem from a broader increase in operational capacity or enhanced efficiency. To start investigating this, the remaining plots of Figure III and results from Table I examine the effects of OSS on productivity measures. We find that bed turnover increases by an average of eight additional admissions per bed annually, which is equivalent to a 23% increase from baseline. We also observe increases in bed occupancy by 7.6 percentage points, or 14% of the baseline. At the same time, the risk-adjusted patient length of stay decreases by 0.52 days, representing an 8% reduction from baseline.

To benchmark our estimates, we first turn to reforms that directly target hospital management and organizational capacity. Muñoz and Otero (2025) show that improving the quality of CEOs in Chilean public hospitals increases emergency room occupancy by about 17%. Evidence from the English NHS also points to sizable responses to management-related reforms. Bloom et al. (2015) show that increased competition, operating in part through improved management practices, reduces average length of stay by about 11%. A second set of benchmarks comes from market structure and competition reforms. Gaynor, Moreno-Serra, and Propper (2013) find that reforms expanding patient choice and reducing price dispersion in the English NHS increased hospital throughput and reduced length of stay by similar orders of magnitude. Conversely, reductions in competition due to hospital mergers lead to worse performance. Gaynor, Laudicella, and Propper (2012) find that merged hospitals reduce production by up to 14% and increase length of stay by 3%–5%. These effects provide a useful contrast because they operate through market pressure rather than internal managerial discretion. A third benchmark comes from payment and financial incentive reforms. Gupta, Martinez, and Navathe (2023) estimate that bundled-payment adoption reduces inpatient length of stay by about 10% among exposed hospitals, whereas Batty and Ippolito (2017) document reductions of 7%–9% after hospital fair-pricing laws. Earlier prospective payment reforms produced smaller but still meaningful effects. For instance, Acemoglu and Finkelstein (2008) and Farrar et al. (2009) estimate reductions in length of stay of around 3%.

These comparisons indicate that the productivity gains associated with OSS management, such as increases in admissions and bed turnover and reductions in length of stay, are comparable in magnitude to those generated by major payment reforms, competition-enhancing policies, and management interventions documented in the literature. Importantly, OSS achieves these gains under a fixed, publicly financed budget, without output-based reimbursement, changes in payment rules, or market competition, therefore distinguishing it from other policy tools.

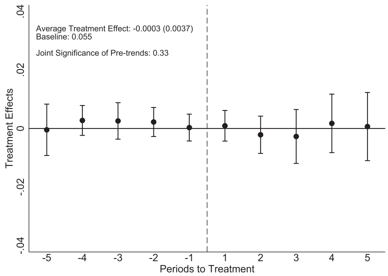
V.B. Quality of Care

Our results indicate that OSS management led to increased hospital production and productivity. Yet there are concerns regarding a potential reduction in the quality of care. Excessively high bed turnover and occupancy rates could burden staff and resources. In addition, shortened lengths of stay might indicate premature discharges, potentially leading to adverse patient outcomes.

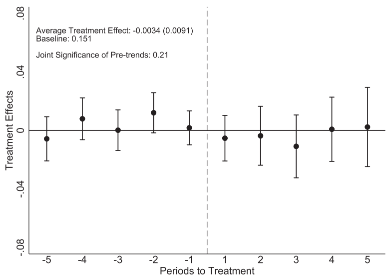
We address these concerns by investigating the OSS effects on inpatient mortality rate, an outcome that exhibits considerable variation across hospitals, arguably driven by differences in quality of care. To mitigate concerns that differences in mortality might reflect patient selection rather than quality, we use risk-adjusted mortality measures as described in Section III. A further challenge is that the vast majority of hospital cases do not involve life-threatening conditions. As a result, inpatient mortality may not be informative about care quality for many patients. This can be the case, for example, of young individuals admitted for superficial wounds, minor burns, fractures, or concussions. While common, these cases rarely involve significant mortality risk, and detecting effects would therefore require extremely large samples. To address this, we also study mortality in a subsample of patients at high risk of death, for whom small differences in care quality could translate into large differences in survival. We define these at-risk cases as patients in the top quartile of the predicted mortality distribution. The mortality rate in this subsample is approximately 15%. Focusing on patients at risk of mortality is also compelling because these cases often involve acute conditions that require immediate care, leaving little scope for selection.[27]

Figure IV and Table II present the main results. We find no evidence that OSS management affects inpatient mortality rate.

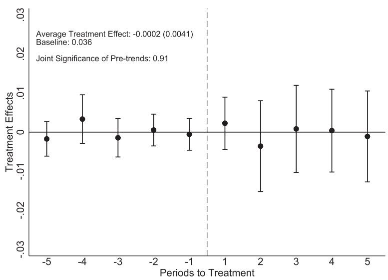
27. We find similar results when we instead define at-risk patients as those above the 80th, 85th, or 90th percentile of the predicted mortality distribution (Online Appendix Figure A2). The approach of studying mortality among patients with higher death risk follows recent work on the determinants of care quality (Batty and Ippolito 2017; Silver 2021).



(A) Inpatient mortality



(B) Inpatient mortality among at-risk patients



(C) Readmission rate

FIGURE IV

OSS Effects on Quality of Care Measures

This figure plots 95% confidence bands computed with a hospital-level clustered bootstrap and DiD estimates for the effects of the OSS model on inpatient mortality rate (Panel A), inpatient mortality rate among at-risk patients (Panel B), and readmission rate (Panel C). All the outcomes are risk-adjusted using the procedure described in Section III. At-risk patients are those in the top quartile of the predicted inpatient mortality distribution. The average treatment effect is computed as the average of the DiD estimates for event times 1–5. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. The baseline corresponds to the sample mean for treated hospitals in the five years before OSS adoption. The figure also reports the p-value from an F-test of the joint significance of the pretreatment coefficients.

TABLE II
OSS Effects on Quality of Care Measures

	2-year effect (1)	5-year effect (2)	Pre-trends test (3)	Mean at baseline (4)
Inpatient mortality rate	−0.0006	−0.0003	.33	0.055
	(0.0027)	(0.0037)		
Among at-risk patients	−0.0045	−0.0034	.21	0.151
	(0.0085)	(0.0091)		
Due to ECSC	0.0006	0.0030	.65	0.134
	(0.0068)	(0.0078)		
Readmission rate	−0.0007	−0.0002	.91	0.036
	(0.0042)	(0.0041)		
Due to ECSC	−0.0057	−0.0029	.26	0.042
	(0.0054)	(0.0056)		

Notes. This table reports the average effects of the OSS model on inpatient mortality and readmission rates. At-risk patients are those in the top quartile of the predicted inpatient mortality distribution. Predicted mortality is obtained by regressing observed mortality on a rich set of case-mix characteristics, including patients' ZIP code of residence, age-by-gender indicators, admission diagnoses, and comorbidities. ECSC refers to emergency care–sensitive conditions. All outcomes are risk-adjusted using the procedure described in Section III. Columns (1) and (2) report the average of the DiD estimates for OSS effects over event times 1–2 and 1–5 years after OSS adoption, respectively. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. Column (3) reports the p-value from an F-test of the joint significance of the pretreatment coefficients. Column (4) shows the mean of each variable in the five years before OSS adoption.

Point estimates for overall mortality and mortality among at-risk patients fluctuate around zero with no discernible pattern suggestive of a systematic deterioration in quality. Based on average effects, we see economically small and insignificant estimates (−0.0003 for overall mortality and −0.0034 for high-risk cases).[28] We complement these results with additional quality measures. Table II and Figure IV examine risk-adjusted readmission rates, which may capture complications and downstream health problems not fully reflected in mortality. We again find no evidence of quality deterioration over the event-time window, and the average effect is small (−0.0002) and statistically insignificant. Table II and Online Appendix Figure A3 further examine mortality and readmissions for ECSCs, while Online Appendix Table A3 inves-

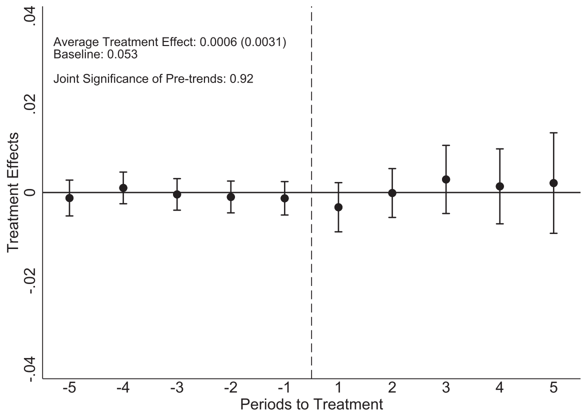
28. Although point estimates for mortality are small and statistically insignificant, confidence intervals imply that meaningful effects cannot be completely ruled out. Based on standard errors, we can exclude increases in overall mortality greater than roughly 9% and increases in mortality among high-risk patients (top quartile of predicted mortality) greater than about 7% at the 90% confidence level. Yet the event-study dynamics show no upward trend around the OSS transition, further supporting the interpretation that mortality did not deteriorate.

tigates mortality for particular high-mortality diagnoses (such as heart attack, stroke, and pneumonia), surgical admissions, and emergency room cases. Across all these outcomes, we find no statistically significant effects. The evidence, therefore, indicates that the transition to OSS management improved hospital production and efficiency without compromising quality of care.[29]

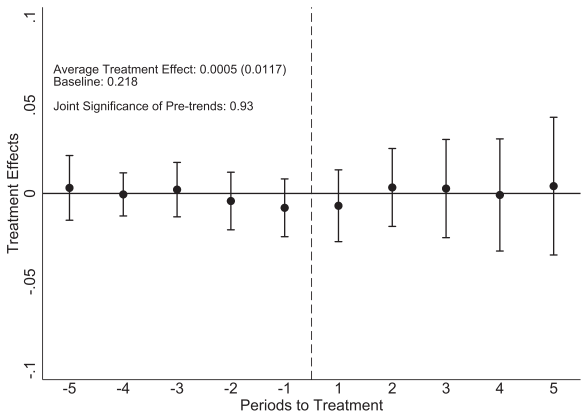
V.C. Patient Selection and Equity

We consider changes in the profile of patients and equity concerns. Figure V and Table III report the effects of OSS on predicted inpatient mortality, reflecting the clinical severity of the patient pool. Effects are tightly centered around zero and are not statistically significant. To address the possibility that average effects may mask heterogeneous effects across the distribution of risk, we also estimate effects on the share of at-risk patients, defined as those above the last quartile of the predicted mortality distribution. The estimated effect is again small (0.001 relative to a baseline of 0.22) and statistically insignificant. We also assess the robustness of the effects on predicted mortality across distinct prediction models that sequentially add different sets of covariates. The effect on predicted mortality remains consistently small and statistically insignificant across all specifications (see Online Appendix Table A4). Finally, Table III shows estimates of the effect of OSS on patient composition regarding specific characteristics. Results indicate that OSS is not associated with changes in the average age of patients, the distribution of patients across various age bins, the ratio of female patients, or the average income of patients' postal codes of residence. Together, our findings

29. One caveat when interpreting inpatient mortality is that it can mechanically decline if length of stay shortens. Several pieces of evidence indicate that this mechanism is unlikely to be important in our setting. First, we do not find increases in readmissions, which would be expected if patients were being discharged prematurely. Second, neither predicted mortality nor the share of high-risk patients changes after OSS adoption, indicating no shift toward healthier patients who would artificially lower in-hospital mortality. Third, as we report in the next sections, population mortality in the municipalities served by OSS hospitals declines rather than rises, ruling out higher post-discharge mortality. Combined, these findings suggest that the mechanical effect of shorter stays on inpatient mortality is likely to be minor.



(A) Predicted inpatient mortality



(B) Share of at-risk patients

FIGURE V

OSS Effects on Patient Risk Measures

This figure plots 95% confidence bands computed with a hospital-level clustered bootstrap and DiD estimates for the effects of the OSS model on predicted inpatient mortality (Panel A) and the share of at-risk patients (Panel B). Predicted mortality is obtained by regressing observed mortality on a rich set of case-mix characteristics, including patients' ZIP code of residence, age-by-gender indicators, admission diagnoses, and comorbidities. At-risk patients are those in the top quartile of the predicted inpatient mortality distribution. The average treatment effect is computed as the average of the DiD estimates for event times 1–5. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. The baseline corresponds to the sample mean for treated hospitals in the five years before OSS adoption. The figure also reports the p-value from an F-test of the joint significance of the pretreatment coefficients.

TABLE III
OSS Effects on Inpatient Profile Measures

	2-year effect (1)	5-year effect (2)	Pre-trends test (3)	Mean at baseline (4)
Predicted inpatient mortality	−0.002	0.001	.92	0.053
	(0.003)	(0.003)		
Share of at-risk patients	−0.002	0.000	.93	0.218
	(0.010)	(0.012)		
Average age	0.132	0.067	.37	37.522
	(0.528)	(0.614)		
% 0–4	−0.010	−0.008	.23	0.070
	(0.008)	(0.007)		
% 5–14	−0.011	−0.009	.50	0.081
	(0.008)	(0.008)		
% 15–24	0.015	0.013	.79	0.180
	(0.008)	(0.009)		
% 25–44	0.012	0.012	.00	0.278
	(0.009)	(0.009)		
% 45–64	−0.005	−0.007	.26	0.206
	(0.004)	(0.006)		
% 65+	−0.001	−0.001	.68	0.186
	(0.007)	(0.008)		
Share of female patients	0.007	0.005	.63	0.568
	(0.010)	(0.011)		
ZIP-code average income	44.851	47.568	.77	1,219.470
	(98.455)	(119.166)		

Notes. This table reports the average effects of the OSS model on patients' characteristics. Predicted mortality is obtained by regressing observed mortality on a rich set of case-mix characteristics, including patients' ZIP code of residence, age-by-gender indicators, admission diagnoses, and comorbidities. The share of at-risk patients is defined as patients in the top quartile of the predicted mortality distribution. Columns (1) and (2) report the average of the DiD estimates for OSS effects over event times 1–2 and 1–5 years after OSS adoption, respectively. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. Column (3) reports the p-value from an F-test of the joint significance of the pretreatment coefficients. Column (4) shows the mean of each variable in the five years before OSS adoption.

provide evidence that the transition into OSS management does not alter the profile of patients.

These results are important because they help rule out patient selection as a mechanism behind the OSS effects on hospital performance and quality, and mitigate concerns that the documented gains reflect moral hazard or distorted incentives leading to increases in spurious cases. If moral hazard were driving the results, one would expect predicted mortality or the share of high-risk patients to decline, which we do not observe. This evidence is reinforced by the results in the previous section, which show broadly proportional increases in admissions across different types of care (e.g., surgical versus clinical) and levels of urgency (emergency-sensitive versus nonemergency conditions). Moreover, our results indicate that the higher performance under OSS did not come at the cost of restricting access to specific types of patients or affecting equity, a typical concern in outsourcing events. As previously mentioned, the absence of patient selection is consistent with the institutional background. In principle, SUS hospitals face very limited scope for selective refusal of patients as they cannot reject patients or unilaterally refer them to other hospitals at their discretion. In addition, OSS hospitals can only provide care in the public system. This restriction precludes the possibility of selectively admitting higher-paying patients, differing from the U.S. context, where privatization led to reduced access to hospitals for low-income Medicaid patients (Duggan et al. 2023).

While the increase we document in admissions is large, it does not necessarily imply large compositional shifts. In Brazil, long-standing access constraints to specialized care have generated substantial unmet demand. Because OSS hospitals do not change intake rules or their contractual service portfolio, and because production targets are disaggregated by service line, there is limited scope for cream-skimming across diagnoses or severity levels. In that sense, we conjecture that easing operational bottlenecks likely cleared queues across a broad range of conditions and improved access to patients across different profiles.

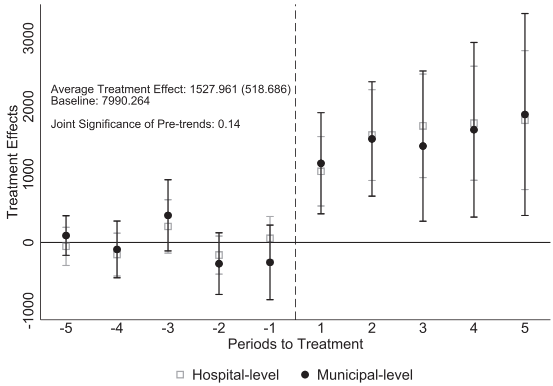
V.D. Population-Level Results

The results so far revealed substantial improvements in hospital production and productivity following the transition to OSS management, without any observable negative effects on quality or equity. A key remaining question is whether the additional output creates value for consumers or instead indicates inefficient overuse of resources. To address this, we extend the analysis to population outcomes at the municipal level, the primary geographic unit for health care access in Brazil's decentralized public health system. We adapt the empirical strategy by defining municipalities as treated if they host public hospitals transitioning to OSS management. To maximize statistical power and investigate potential spillovers throughout the entire territory, we include all municipalities with public hospitals in the analysis, not just those in the matched control group.[30]

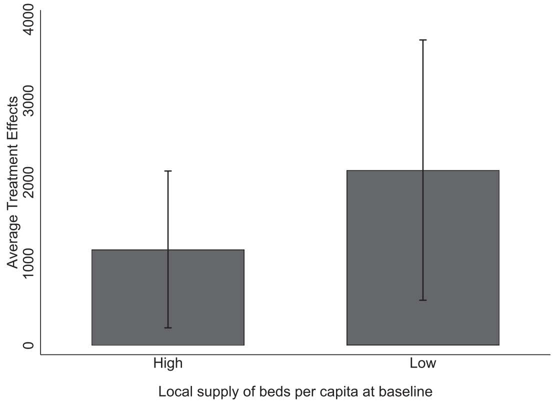
1. Hospital Admissions. We begin by examining the effect of OSS on municipal-level hospital admissions. Figure VI, Panel A displays these results, alongside the corresponding hospital-level estimates for ease of comparison. We find strong positive effects on municipal patient volume. The estimates indicate an average annual increase of 1,527 admissions, representing a 20% rise relative to baseline. These estimates closely match those from the hospital-level analysis, indicating that the OSS transition alone accounts for most of the aggregate increase in patient volume. This finding supports the interpretation that OSS improves access to hospital care at the local level, rather than merely reallocating patients from nearby facilities, and mitigates concerns that our results are affected by spillover effects.

To assess whether OSS hospitals expand access by addressing previously unmet demand, we estimate heterogeneous effects according to the baseline supply of hospital care at the local level. We split treated municipalities into two groups based on whether their baseline number of hospital beds per capita is below or above the median. Figure VI, Panel B reveals that in municipalities with a relatively higher scarcity of beds, OSS management increases patient volume by 2,150 admissions annually (a 33% rise from baseline). For municipalities with a high initial supply of hospital care, the estimated increase is significantly smaller, by 1,177 admissions or 13% relative to baseline. These results suggest that the increase in OSS hospital production primarily reflects improved access to hospital care, potentially from individuals whose demand had previously gone unmet due to hospital capacity constraints. This is consistent with existing evidence that insufficient access to specialized care has been a major constraint in Brazil's

30. The analysis includes 2,170 municipalities with public hospitals, of which 166 have at least one hospital under OSS management. After excluding public hospitals that were always under OSS management and those that switched but were not previously managed by the state, we are left with 71 treated municipalities. Online Appendix Figure A4 shows that the estimates are essentially unchanged whether we use all municipalities as controls or only the subset implied by the matched sample.



(A) Municipal-level hospital admissions



(B) Heterogeneity by bed supply per capita

FIGURE VI

OSS Effects on Population-Level Hospital Admissions

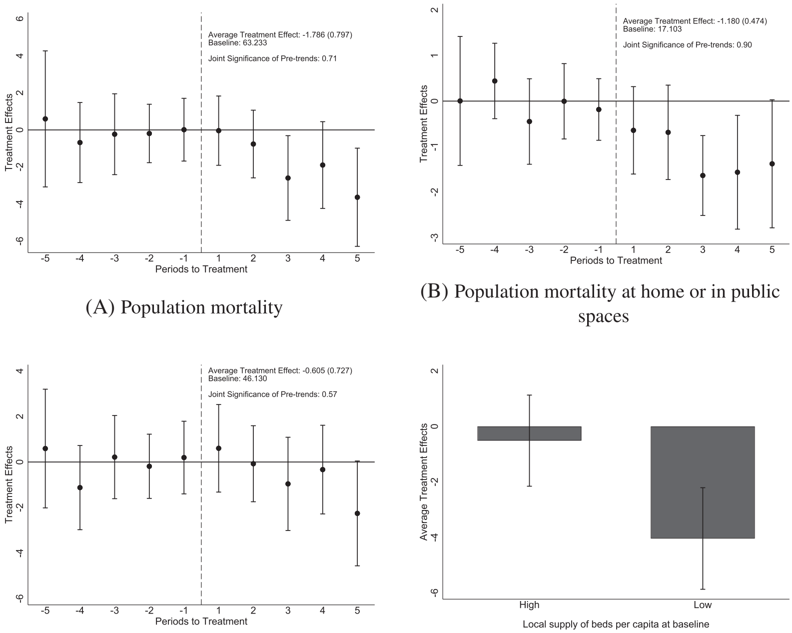
Panel A plots 95% confidence bands computed with a municipal-level clustered bootstrap and DiD estimates for the effects of the OSS model on municipal-level hospital admissions. The average treatment effect is computed as the average of the DiD estimates for event times 1–5. Standard errors in parentheses are computed using a municipal-level clustered bootstrap. The figure also reports the p-value from an F-test of the joint significance of the pretreatment coefficients. The baseline corresponds to the sample mean for treated municipalities in the five years before OSS adoption. For ease of comparison, the figure also displays the OSS effects on hospital-level admissions from Figure III. Panel B reports the average treatment effects and respective 95% confidence bands separately for municipalities with a high and low number of hospital beds per capita at baseline, where high and low groups are defined based on a median split of baseline beds per capita.

public health system (Castro et al. 2019; Ministry of Health, Brazil 2023).

2. Population Mortality. If the increased hospital production under OSS management indeed reflects the provision of services to previously unmet demand, and considering that this expansion occurs without any deterioration in hospital quality, then we should expect to observe improvements in population health. To test this, we examine the effect of OSS adoption on population mortality. Figure VII presents the results. We find that OSS is associated with a statistically significant reduction in mortality, particularly in the long run. On average, mortality falls by 1.78 deaths per 10,000 inhabitants, corresponding to a 3% decline relative to baseline (Panel A). The same figure shows that the reduction in mortality is concentrated in deaths occurring outside the health system (i.e., at home or in public areas), which decline by 1.18 per 10,000 inhabitants or 6.6% of the baseline (Panel B). In contrast, the estimated effect on deaths occurring at health facilities is smaller (−0.6 or about 1%) and not statistically significant (Panel C). This pattern suggests that OSS hospitals improve outcomes for individuals who might otherwise die without accessing care, consistent with the interpretation that OSS addresses previously unmet demand.

To further evaluate this conjecture, Figure VII, Panel D explores heterogeneity in mortality effects according to the baseline supply of beds per capita at the local level. In municipalities with initially low bed availability, OSS reduces mortality by 4 deaths per 10,000 people (6.4% of baseline), whereas in areas with high initial supply, the reduction is smaller and statistically insignificant (0.5 or less than 1%). These results reinforce our earlier conclusion that OSS improves access most in underserved areas and reinforce the view that these improvements in access translate into meaningful health gains.

With these estimates, we can conduct a back-of-the-envelope calculation of the marginal health benefit generated by the additional admissions. Measuring effects per 10,000 people, municipal admissions increase on average by 130 while deaths fall by 1.7. Attributing the mortality decline to the additional admissions implies 0.013 fewer deaths per marginal admission. Studies on hospital closures for acute myocardial infarction in the United States (Shen and Hsia 2016), Sweden (Avdic 2016), and Italy (Ghislandi, Renner, and Varghese 2025) report effects reaching roughly 0.06–



(A) Population mortality

(B) Population mortality at home or in public spaces

(C) Population mortality at health facilities

(D) Heterogeneity by bed supply per capita

FIGURE VII

OSS Effects on Population Mortality

This figure plots 95% confidence bands computed with a municipal-level clustered bootstrap and DiD estimates for the effects of the OSS model on municipal-level deaths per 10,000 people (Panel A), municipal-level deaths at home or in public spaces per 10,000 people (Panel B), and municipal-level deaths in health facilities per 10,000 people (Panel C). The average treatment effect is computed as the average of the DiD estimates for event times 1–5. Standard errors in parentheses are computed using a municipal-level clustered bootstrap. The figure also reports the p-value from an F-test of the joint significance of the pretreatment coefficients. The baseline corresponds to the sample mean for treated municipalities in the five years before OSS adoption. Panel D reports the average treatment effects on municipal-level deaths per 10,000 people and respective 95% confidence bands separately for municipalities with high and low number of hospital beds per capita at baseline, where high and low groups are defined based on a median split of baseline beds per capita.

0.08 deaths per affected patient. More comparable to our estimate, Chandra, Dalton, and Staiger (2023) show that the closure of high-quality hospitals in the United States raises mortality for affected patients by 1 percentage point. We view our estimate as expectedly smaller than the acute care benchmarks and in line with what one would anticipate given our case mix, especially because the marginal admissions in our setting are not concentrated in acute conditions.

Taken together, our findings indicate that the performance of public hospitals improved following the transition to OSS management. Not only did productivity increase without any deterioration in quality or equity, but the rise in output created value for patients, particularly those who previously faced supply-side barriers to hospital care, as reflected in improved survival. These results further mitigate concerns that the observed gains reflect moral hazard incentives leading to inefficient increases in production.

V.E. Robustness Checks

1. Hospital-Level Results. We assess the robustness of the hospital-level results to alternative modeling assumptions and identification concerns. Table IV summarizes the corresponding estimates for our main outcomes: hospitalizations, bed turnover, length of stay, predicted mortality, inpatient mortality, and inpatient mortality among at-risk patients. Column (1) repeats the results for our baseline model for ease of comparison. The results shown in the following columns are reassuring, as the coefficients remain relatively similar to the baseline estimates of column (1) in all checks. We discuss these and additional robustness exercises below.

i. Matching and Covariate-Specific Trends. Our main results are estimated using a matched sample in which treated hospitals are paired with control hospitals based on baseline scale and macro-region indicators. This design ensures that our estimates are fully robust to unobserved time trends that are specific to these observable characteristics. We assess the robustness of the results to alternative specifications. Table IV, column (2) reports estimates from a specification that uses the full set of state-managed hospitals as the control group, rather than the matched sample. Column (3) also uses the full control group but controls for baseline covariates using the doubly robust estimator of Sant'Anna and Zhao (2020), which combines inverse probability weighting with standard regression covariate adjustment. The estimated average effects are highly stable across columns (1)–(3), indicating that our findings are not an artifact of the match-

TABLE IV
ROBUSTNESS CHECKS

	Main specification (1)	All control hospitals (2)	All control hospitals + covariates (3)	Main + unadjusted patient outcomes (4)	Main + balanced panel (5)	Main + excluding COVID-19 data (6)	TWFE (7)
Hospital admissions	1,577.668	1,633.690	1,395.477		1,869.411	1,762.094	1,391.693
	(357.877)	(285.964)	(297.889)		(434.086)	(433.934)	(310.017)
Bed turnover rate	8.036	8.704	8.712		8.141	9.024	8.306
	(2.238)	(1.712)	(1.783)		(2.769)	(2.609)	(1.967)
Length of stay	−0.524	−0.604	−0.635	−0.566	−0.623	−0.479	−0.439
	(0.174)	(0.181)	(0.195)	(0.201)	(0.228)	(0.207)	(0.165)
Predicted inpatient mortality	0.001	−0.001	0.000		−0.000	−0.002	0.002
	(0.003)	(0.002)	(0.002)		(0.003)	(0.003)	(0.003)
Inpatient mortality rate	−0.000	−0.002	−0.001	0.001	−0.001	−0.002	0.003
	(0.004)	(0.003)	(0.004)	(0.004)	(0.005)	(0.004)	(0.003)
Among at-risk patients	−0.003	−0.012	−0.010	0.006	−0.006	−0.007	0.001
	(0.009)	(0.008)	(0.009)	(0.008)	(0.012)	(0.010)	(0.008)

Notes. This table reports the average effects of the OSS model on primary outcomes across different specifications. Each column reports the average of the DiD estimates for OSS effects over event times 1–5. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. Length of stay, inpatient mortality rate, and inpatient mortality rate among at-risk patients are risk-adjusted using the procedure described in Section III. At-risk patients are those in the top quartile of the predicted inpatient mortality distribution. Column (1) reports the results from our baseline specification, which uses matching. Column (2) uses the full set of state-managed hospitals as the control group, rather than the matched sample. Column (3) also uses the full control group but adjusts for baseline covariates using the doubly robust estimator of Sant'Anna and Zhao (2020). Column (4) reestimates the baseline specification but uses unadjusted patient outcomes. Column (5) considers a fully balanced panel over the event times and follows the main specification. Column (6) excludes data from 2020 onward and follows the main specification. Column (7) reports estimates from a two-way fixed effects model, using the same sample as the main specification.

ing procedure and are unlikely to be driven by differential trends between treated and control hospitals. Online Appendix Figure A6 presents the complete event-study coefficients for all main outcomes under these three specifications. Both pre- and posttreatment estimates display very similar patterns across specifications.

ii. Risk Adjustment. Our main specification relies on risk-adjusted measures when investigating patient outcomes to safeguard our estimates against potential changes in patient composition following OSS management. However, we observe that OSS adoption does not lead to meaningful changes in patient selection or case-mix severity, indicating that the risk-adjustment procedure should not be first-order in practice. Table IV, column (4) confirms this by reestimating the models using unadjusted outcomes and reporting very similar results. The effects on inpatient mortality (total and among at-risk patients) remain small and statistically insignificant, and the effect on length of stay remains significant and close to our baseline estimate. Online Appendix Figure A5 presents these results in event-study format and likewise shows that our estimates are stable across adjusted and unadjusted specifications. These patterns support the view that our findings are not driven by compositional changes in the patient population.

iii. Additional Checks. Another potential concern is that our estimates may stem not only from dynamic effects but also from compositional changes due to late hospital switchers having missing post-OSS years. To address this, Table IV, column (5) considers a fully balanced panel over the event times. Results remain very similar, indicating that compositional changes do not impact our results. In column (6), we exclude data from 2020 onward. Since many public hospitals were already treated in the second half of our panel, there may be concerns that our estimates are influenced by differential changes in hospital behavior in response to the COVID-19 pandemic. Results are again very similar. Finally, to further assess whether the interpretation of our estimates is affected by normalization or treatment-effect heterogeneity, Online Appendix Figure A7 presents the full event-study estimates from two versions of the Callaway and Sant'Anna estimator alongside a conventional TWFE specification.[31] The first version uses their standard estimator of pretreatment effects, while the second, in analogy to TWFE, uses a fixed baseline period and normalizes all coefficients relative to event time −1. Across all specifications, pretreatment estimates are jointly indistinguishable from zero, and treatment effects are very similar.

2. Population Mortality. We test the robustness of the estimated impact of OSS on population mortality to a range of potential confounders. During the 2000s, Brazil underwent demographic changes. If these changes varied systematically across municipalities and coincided with the timing of OSS adoption, they could bias our estimates through their relationship with mortality. We test the stability of our results to controlling for time-varying demographic composition, using variables that capture the share of the municipal population within each nine-year-by-gender-age bin. We also consider the possibility that treated and control municipalities may exhibit differential trends due to preexisting differences in socioeconomic conditions or public spending patterns. To address this, we test for the inclusion of trends specific to a broad set of municipal-level baseline covariates—GDP per capita, Theil index, poverty rate, illiteracy rate, share of rural population, total population, and per capita social and health expenditures.

In addition, we investigate whether our results are robust to the timing of other health initiatives implemented at the municipal level. One important program is the Family Health Program (Programa Saúde da Família, PSF), which expanded access to pri-

31. We use the following equation to estimate these effects:

$$y_{it} = \alpha + \sum_{\tau \neq -1} \beta_\tau \,\mathrm{OSS}_i \times \mathbb{1}[\text{years since OSS} = \tau] + \mu_i + \lambda_{tg} + \eta_{it},$$

where y_{it} is the outcome of interest for hospital i in year t. OSS_i is an indicator equal to one for public hospitals that transitioned to OSS management and zero for those that remained under state management. μ_i denotes hospital fixed effects, while λ_{tg} denotes year-by-cohort fixed effects, where g indexes the treatment cohort of OSS hospitals and their matched controls. The coefficients of interest are $\{\beta_\tau\}$, which trace the effects of OSS management around the transition. To estimate average effects, we use an analogous specification that replaces the separate interactions for event times 1–5 with a single interaction equal to one over that window, while retaining the remaining event-time interactions outside that interval. Table IV, column (7) reports the corresponding average effects, which remain close to those estimated in our baseline specification.

mary care throughout Brazil in the late 1990s and early 2000s (Rocha and Soares 2010; Bhalotra, Rocha, and Soares 2019). Even though the program came before the OSS expansion, we control for differential trends according to PSF adoption × year of adoption. We also account for the potential influence of the More Doctors Program (Programa Mais Médicos), which expanded physician supply in underserved areas by recruiting doctors from abroad, especially during 2013–2014, followed by policy interruption in 2019 (Fontes, Conceição, and Jacinto 2018; Carrillo and Feres 2019; Ruiz et al. 2026). Online Appendix Figure A8 shows that our baseline estimates remain highly stable when each of these controls is included individually. These results suggest that our findings are unlikely to be driven by differential trends in demographics, baseline conditions, or concurrent health policies across treated and control municipalities.

3. Longer Pretreatment Window. Throughout the article, we have reported event-study estimates with pretreatment coefficients up to five years before OSS adoption. In all cases, the pretrends consistently hover around zero, and the F-tests for the joint significance of the pre-treatment coefficients fail to reject the null of no pre-trends. We focus on a five-year pre-period in the baseline to avoid losing many hospitals that cannot be followed for longer horizons before OSS adoption. As an additional robustness check, we extend the pretreatment window to eight years before the OSS transition. Online Appendix Figure A9 presents the corresponding event-study estimates for our main hospital-level outcomes, as well as for population mortality. The pretreatment coefficients remain very stable and close to zero over this extended eight-year horizon, reinforcing the validity of our identifying assumption. For ease of comparison with the baseline results, Online Appendix Table A5 reports F-tests for the joint significance of the pretreatment coefficients under the five-year and eight-year specifications. The p-values move even further away from conventional significance thresholds when we consider the extended window.

VI. Mechanisms and the Role of Management

How does the transition into OSS management map into changes in production output and hospital performance? We explore the resource and organizational changes that follow the transition into OSS management and discuss how these changes may have acted as mechanisms driving the effects on hospital performance. For ease of presentation, we consider the simple conceptual framework presented in Section II.B, where hospital output $Y = A(e)\, f(K, L)$ depends on operating capacity, for example, inputs such as physical K and human L capital, and operating efficiency $A(e)$, with which these resources are deployed. We assess three specific channels. First, we examine whether new managers expand the hospital's operating capacity and evaluate whether increases in production output and improvements in hospital performance primarily reflect such changes. Second, we examine the same question but look at drivers of operating efficiency. The previous section showed that transitioning to OSS led to significant gains in operating efficiency. Here, we shed light on two different pathways behind these gains. First, the OSS model allows the use of new management practices and more flexible contracts. Second, irrespective of the former pathway, the OSS model may have attracted more experienced hospital managers. We assess these conjectures with a particular focus on personnel management, employment contracts, and physician productivity, as the available data allows us to provide fine-grained analyses on these margins.

VI.A. Operating Capacity

1. Physical Capital. Table V begins by investigating changes in the physical capital of hospitals. We first focus on the number of hospital beds, which typically indicates hospital scale. We find an average increase of 16 hospital beds, which corresponds to 13.9% of the baseline. However, this expansion pales in comparison to the 40% rise in the number of hospital admissions, suggesting that productivity is a relevant driver of the overall growth in hospital production. Consider a simple simulation. Based on the average baseline bed turnover rate of 35, the additional 16 beds would yield roughly 550 extra admissions a year, accounting for only 34.8% of the overall increase in hospitalizations (1,578). The expected production growth driven by the estimated increase in bed turnover (from 35 to 43) is much larger: 920 additional admissions a year, holding fixed the baseline hospital size of 115 beds. Applying the productivity gain to the extra beds would further boost hospitalizations by 128. Hence, a substantial share of the increase in production stems from more efficient utiliza-

TABLE V
OSS EFFECTS ON HOSPITAL INPUTS: PHYSICAL CAPITAL AND HUMAN RESOURCES

	2-year effect (1)	5-year effect (2)	Pre-trends test (3)	Mean at baseline (4)
Beds	10.446	16.172	.90	115.057
	(4.102)	(5.668)		
Essential bed-level equipment	14.821	24.939	.83	53.405
	(5.098)	(5.684)		
High-tech equipment	0.487	0.261	.29	1.267
	(0.394)	(0.349)		
Mid-tech equipment	2.053	2.173	.20	19.752
	(1.166)	(1.294)		
Other equipment	0.145	0.796	.73	9.740
	(0.742)	(0.870)		
Total workers	52.272	78.269	.32	328.865
	(22.828)	(32.447)		
Physicians	9.093	9.177	.48	70.396
	(5.149)	(6.226)		
Nursing staff	25.468	37.377	.53	168.662
	(13.461)	(17.797)		
Other health workers	1.025	−0.100	.73	17.529
	(2.142)	(3.053)		
Other workers	16.686	31.815	.17	72.279
	(10.560)	(15.816)		
Total workers per 100 beds	11.307	13.935	.05	287.110
	(15.494)	(17.473)		
Physicians	2.317	1.229	.47	59.905
	(3.549)	(4.413)		
Nursing staff	1.130	1.803	.29	145.701
	(8.682)	(9.318)		
Other health workers	0.610	−0.250	.87	13.848
	(1.040)	(1.394)		
Other workers	7.250	11.153	.04	67.656
	(7.258)	(8.280)		

Notes. This table reports the average effects of the OSS model on hospital inputs, including beds, medical equipment, workers, and workers per 100 beds. Workers are measured in full-time-equivalent units. Columns (1) and (2) report the average of the DiD estimates for OSS effects over event times 1–2 and 1–5 years after OSS adoption, respectively. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. Column (3) reports the p-value from an F-test of the joint significance of the pretreatment coefficients. Column (4) shows the mean of each variable in the five years before OSS adoption.

tion of hospital beds, not merely from an increase in the number of beds. Also consistent with that, in Table V we examine effects on other physical resources, and document that OSS hospitals do not significantly increase the availability of technologically advanced and costly equipment,[32] investments that could otherwise expand hospital treatment capacity and performance through large capital outlays (Chandra and Skinner 2012). Instead, they exhibit substantial growth in bedside essentials (by 25 pieces or 50% relative to the baseline), including infusion pumps and ECG monitors. This pattern suggests that managers prioritized replenishing basic resources and maintenance services, which may have boosted productivity if beds were previously idle due to a lack of essential tools, rather than pursuing major capital expansions.[33]

2. Human Resources. Table V also presents OSS effects on personnel. Estimates reveal a 23% increase in total staff size, amounting to an addition of 78 FTE workers from a baseline of 330. An important question is whether this increase merely matched the expansion in hospital size or if the hospital disproportionately expanded its workforce relative to the number of beds to strategically change the mix between physical and human resources. To investigate this, we examine the number of FTEs per 100 beds. When adjusted for bed count, the effects become small and statistically insignificant, representing just a 4.8% increase over the baseline.[34] The effect is particularly negligible for key health professionals such as physicians and nurses, whose increases represent only 1% and 2% of the baseline, respectively. Therefore, the results confirm the increase in hospital operating capacity, but indicate that the expansion of the total workforce is aligned with the expansion in hospital beds. In the next sections, we examine changes in the composition of the workforce and its productivity.

32. These include high- and mid-tech specialized diagnostic and treatment equipment: MRI, CTI, X-ray, hemodialysis machine, ECMO, and phototherapy devices.

33. The shortage of such basic equipment may stem from protracted capital procurement processes in Brazilian public institutions. The transition to private administration likely alleviates these constraints, contributing to the rapid increase in bedside essentials.

34. Although previous privatization studies document declines in workforce per bed, possibly as a response to workforce exceeding the optimal level in the public sector (Heimeshoff, Schreyögg, and Tiemann 2014; Duggan et al. 2023), OSS hospitals in our setting face binding volume targets that require higher output, potentially sustaining staffing intensity despite increased efficiency.

VI.B. Efficiency-Oriented Management Practices

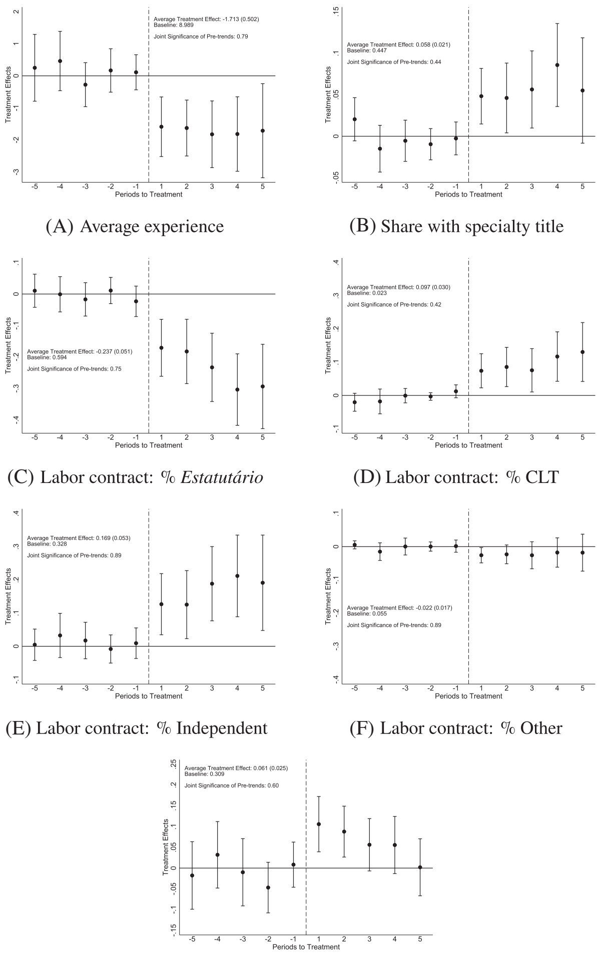
This section analyzes whether OSS management is associated with the implementation of efficiency-driven practices. We focus on personnel practices by examining changes in workforce composition, employment contracts, and hiring and separation patterns. We focus in particular on physicians, for whom we have access to identified microdata.

1. Medical Workforce Composition and Employment Contracts. Figure VIII and Online Appendix Table A6 (Panel A) investigate whether OSS management reshapes the composition of physicians in treated hospitals. Figure VIII, Panels A and B present the effects on the average experience and specialization of physicians, respectively. We define physician experience as the number of years since registration with the Federal Council of Medicine and specialization as holding certification from recognized associations that regulate residency and medical specialization in Brazil. We find that the average experience of physicians decreases by 1.7 years in the post-OSS period, representing a 9% decline relative to the baseline. This result suggests that new managers may prefer younger physicians, who generally represent lower immediate costs and may be more adaptable to organizational changes implemented by the new management (Chong, Guillen, and López-de Silanes 2011).[35] We also observe that the proportion of physicians with a specialty title rises by almost 6 percentage points, or 13% of the baseline. This pattern may reflect a strategic effort to sustain the quality of care. Finally, Online Appendix Table A7 provides additional evidence of a shift in staff composition toward higher qualifications when examining nursing personnel, reinforcing the managerial preference for more skilled professionals.[36]

Figure VIII, Panels C–F explore changes in employment regimes. Our analysis differentiates between two types of for-

35. Existing evidence from Brazil suggests that exogenous variation in physician seniority within public hospitals does not significantly affect the quality of care (Branco et al. 2025).

36. Results reveal a significant reduction of almost 8.7 FTE auxiliary nurses per 100 beds, accompanied by increases of 5 FTEs for nurses and nurse technicians. Hence, while the total number of nursing professionals remains relatively stable, there is a shift toward a more qualified nursing staff. The share of auxiliary nurses in the nursing team decreases by 15% in the short run and 10% in the long run (borderline significant).



(A) Average experience

(B) Share with specialty title

(C) Labor contract: % *Estatutário*

(D) Labor contract: % CLT

(E) Labor contract: % Independent

(F) Labor contract: % Other

(G) Share of newly hired physicians

FIGURE VIII

OSS Effects on Physicians' Composition

This figure plots 95% confidence bands computed with a hospital-level clustered bootstrap and DiD estimates for the effects of the OSS model on the average experience of physicians (Panel A), the share of physicians with a specialty title (Panel B), the distribution of physicians across four employment regimes—*Estatutário* (Panel C), CLT (*Celetista*) (Panel D), independent contractor (Panel E), and other contracts (Panel F)—and the share of newly hired physicians (Panel G). The average treatment effect is computed as the average of the DiD estimates for event times 1–5. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. The baseline corresponds to the sample mean for treated hospitals in the five years before OSS adoption. The figure also reports the p-value from an F-test of the joint significance of the pretreatment coefficients.

mal employment contracts, Estatutário and CLT. As already mentioned, the former emphasizes job stability and is highly rigid, prohibiting managers from arbitrarily modifying salaries, linking pay to performance, and setting flexible schedules. In contrast, the CLT contract, typically used by private companies, offers greater flexibility. We also examine independent contracts, where hospitals contract physicians as firms. This is a highly flexible arrangement where physician remuneration is closely tied to their output. After the OSS implementation, we observe a significant decline in the share of doctors under Estatutário contracts (by 23 percentage points). This decrease is partially offset by a 9 percentage point increase in the share of CLT workers. The remaining reduction is compensated by a substantial rise in the share of independent contractors, up by 17 percentage points (52% from baseline). These changes likely reflect efforts by OSS-managed hospitals to use employment contracts to connect payment with performance and productivity.

Changes in experience, specialization, and employment contracts are likely to be interconnected. Younger physicians are more amenable to flexible labor contracts and less attached to rigid employment arrangements. A managerial focus on expanding the use of flexible contracts can therefore naturally tilt the workforce toward younger doctors. In addition, older physician cohorts in Brazil are less likely to hold formal specialty titles, reflecting the historical expansion of residency and certification programs. Shifts toward younger physicians and shifts toward more specialized physicians can thus go hand in hand. Consistent with this, Online Appendix Table A8 shows that experience is positively correlated with permanent public contracts and negatively correlated with formal specialization. These correlations suggest that part of the observed decline in average experience, the shift toward more flexible contracts, and the rise in specialization may reflect common compositional adjustments rather than independent patterns.

2. Hiring, Separation, and Productivity.

i. Hiring of New Physicians. The autonomy granted to OSS in personnel management may manifest through hiring decisions, a critical element in building a productive workforce. Figure VIII, Panel G reveals a sharp rise in the share of newly hired workers. One year after the transition to OSS, the share of new hires rises by 11 percentage points, equivalent to 30% of the baseline average. In Brazil, the hiring process for public sector workers is typically lengthy and bureaucratic. The transition into OSS likely eased these constraints, enabling the rapid recruitment of new physicians.

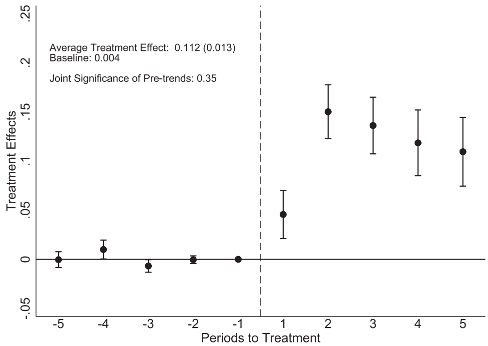
A key question is how managers use this flexibility. Although part of the observed rise may reflect a mechanical effect of capacity expansion and reduced bureaucratic constraints, it is important to understand whether new managers use hiring to strategically reshape the workforce. To explore this, Panel B of Online Appendix Table A6 presents OSS effects on physician composition, focusing solely on new hires. These estimates show how the recruitment of new physicians under OSS differs from baseline. The effect on experience is positive, but small and statistically insignificant. The observed decline in physicians' average experience is therefore not driven by a hiring preference for younger workers. It actually reflects higher separation rates among older incumbent workers, as will be documented below. The transition to OSS significantly changes hiring patterns along other dimensions. OSS hospitals recruit a higher share of doctors with specialty titles and significantly shift the types of labor contracts used for new hires. The share of physicians hired as independent contractors increases by almost 65%. OSS hospitals also increase their use of CLT contracts while relying less on Estatutário contracts. All these changes align with the broader shifts in physician composition described earlier.

ii. Separation of Incumbent Physicians. Recent literature documents that incumbent workers face higher separation rates following privatization (Arnold 2022; Olsson and Tåg 2025). This reflects restructuring strategies by private firms to pursue a more efficient workforce. To determine whether OSS hospitals adopt similar strategies, we redefine our analysis and implement it at the physician level, closely following previous studies. Using identified data from the CNES, we construct a panel of physicians, restricting the sample to those already employed in the hospitals during the two periods before the transition into OSS (referred to here as incumbents). We adopt the empirical strategy outlined in Section IV. In particular, we estimate the counterfactual evolution of the retention of incumbent physicians in OSS hospitals based on the retention patterns of incumbent physicians in matched control hospitals. Our main outcome is a dummy indicating a doctor's exit from the hospital. Figure IX presents the results. Panel A shows a significant spike in exit rates two years after the transition, with effects gradually declining over time. On average, OSS management increases the likelihood of incumbent separation by 11 percentage points. The magnitude and temporal pattern of our effects closely mirror findings by Arnold (2022) on the privatization of Brazilian firms in the 1990s. Brazil's public labor laws have historically emphasized job stability and imposed numerous barriers to job dismissal. OSS management introduces flexibility that reduces these barriers, allowing hospitals to achieve better matches.[37]

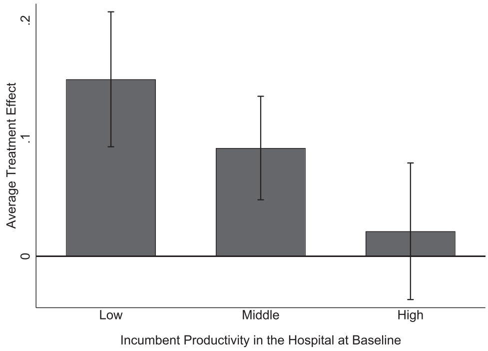
iii. Separation of Low-Productivity Physicians. To further investigate if new managers leverage their autonomy to enhance efficiency, we examine exit rates among physicians of varying productivity levels in the baseline. We gather identified data informing the number of inpatient cases handled by each physician in the two years before treatment and define productivity as the number of cases per work hour. We standardize this measure by the average in each physician's specialization to account for heterogeneity across different specializations.[38] Figure IX, Panel B reveals stark heterogeneity across baseline productivity levels, with effects decreasing monotonically along the distribution. The average exit rate among doctors in the lowest productivity quartile is 15 percentage points, while in the top quartile it is just 3 and not statistically significant. Consistent with these results, Online Appendix Figure A10 shows that the average output per physician increased by 24% in the post-OSS period, reflecting gains in input productivity. The magnitude of this effect mirrors the improvement in bed turnover, reinforcing the positive effects of OSS management on hospital efficiency.

37. We also investigated incumbents' employment trajectories following OSS transition and after separation. We observe that they exit the local hospital market almost entirely. Although some reallocate hours to other health establishments (such as private practices and lower-complexity public facilities), this reallocation of work hours is insufficient to offset the loss of hospital hours, resulting in a persistent decline in total labor supply. Results are available on request.

38. Some specializations focus on more complex cases that might take more time for physicians to treat. Results remain nearly unchanged if we do not make such adjustments (results on request).



(A) Effects for all incumbent physicians



(B) Heterogeneous effects by baseline productivity

FIGURE IX

OSS Effects on the Probability of Job Transition or Layoff Among Incumbent Physicians, Physician-Level Analysis

Panel A reports 95% confidence bands computed with a physician-level clustered bootstrap and DiD estimates for the effects of the OSS model on the probability that an incumbent physician transitions jobs or is laid off. Incumbent physicians are defined as those working at the hospital in the years $g-2$ and $g-1$, where g denotes the treatment year. The analysis sample is restricted to incumbent physicians in treated hospitals and their matched controls. The average treatment effect is computed as the average of the DiD estimates for event times 1–5. Standard errors in parentheses are computed with a physician-level clustered bootstrap. The baseline corresponds to the sample mean for incumbent physicians at treated hospitals in the five years before OSS adoption. The figure also reports the p-value from an F-test of the joint significance of the pretreatment coefficients. Panel B reports the average treatment effect separately for incumbents with low (first quartile), middle (second and third quartiles), and high (last quartile) baseline productivity. Productivity is measured as the number of cases handled by an incumbent physician at baseline relative to hours worked. This measure is standardized by the average within each physician's specialization to account for heterogeneity across different specializations.

iv. Heterogeneity by Other Characteristics. Online Appendix Figure A11 investigates whether the impact of OSS on separation rates varies according to physicians' other characteristics. Panel A shows that the effect is lower for physicians in the lowest quartile of experience, consistent with the decrease in the average experience of the physician pool. However, it is important to note that physician experience is uncorrelated with productivity (Online Appendix Figure A12 and Online Appendix Table A8). We also find that exit rates are similar across employment contracts and specialization (Panels B and C, respectively). Overall, the results reinforce the view that separations were mainly targeted at physicians at the bottom of the baseline distribution of productivity.

VI.C. Management Capacity

Although our results indicate that managerial autonomy facilitates the implementation of efficiency-driven personnel practices, it is not immediately clear that the quality of management itself has changed. It is possible that state managers were equally capable but constrained by rigid public sector regulations that limited their ability to enact similar changes. To examine whether changes in management quality influence the observed outcomes after outsourcing, we test if our results vary with the organizational capabilities of the private firms now managing public hospitals. Our analysis focuses on OSS experience, a key dimension of a firm's productivity (Syverson 2011). This focus is conceptually grounded in the resource-based view of the firm (Wernerfelt 1984; Barney 1991), which emphasizes that experience reflects not only accumulated operational learning, commonly linked to efficiency gains through learning-by-doing (Syverson 2011), but also firm-specific organizational capabilities that enhance adaptability to complex demands (Peteraf 1993; Teece, Pisano, and Shuen 1997). These capabilities, critical in health care management, allow firms to implement personnel and operational adjustments more effectively.[39]

39. Firm experience mechanically accumulates with survival, so a natural concern is that an age effect could partly reflect a confounding selection effect rather than the effect of managerial capacity per se. This is not a competing explanation but one reason experience can be informative about underlying organizational quality. In standard models of learning and industry dynamics, firms differ in persistent productivity, and those with higher underlying efficiency are more

Specifically, we first estimate heterogeneous effects by comparing hospitals managed by newer firms to those managed by older firms, using a median split on the number of years the OSS operates in the market. We then show that the patterns documented using OSS firm experience generalize closely to alternative measures of managerial capacity. The median OSS experience is 24 years; older firms have on average 44 years of experience, and newer ones have 10 years.[40] In our main analyses, we exclude hospitals with extreme production outputs at baseline from our sample, in the bottom 10% and top 10% of the distribution, creating a more balanced sample of hospitals by OSS experience and facilitating the comparison of estimates. We show that our results remain stable with the inclusion of these extreme cases and robust to other strategies for balancing the sample.

1. Hospital Performance. Table VI, Panel A and Online Appendix Figure A13 show that the effects of OSS on production output and bed turnover are driven by more experienced firms. Public hospitals managed by more experienced OSS saw an average increase of 2,016 admissions (54% of the baseline) five years after the transition, compared with a smaller increase of 694 admissions (21%) in hospitals managed by less experienced firms. The differences in productivity across firms are even more pronounced. Bed turnover in hospitals managed by experienced OSS increased by an average of 14.8 (40%), compared with only 1.1 (3%) in hospitals under less experienced firms. These differences in admissions and bed turnover are statistically significant. Although estimated with less precision, average length of stay also decreases more in hospitals managed by more experienced OSS firms. Importantly, we find no evidence of compromised quality, measured by hospital mortality rates, with average effects being practically null and statistically insignificant. We likewise detect

likely to survive and grow. As a result, age and survival emerge as equilibrium outcomes correlated with unobserved quality rather than arbitrary duration (e.g., Jovanovic 1982; Hopenhayn 1992). From this perspective, survival is a channel through which experience becomes a reduced-form proxy for organizational capability, rather than a confounder that mechanically generates performance differences.

40. Firm age is measured from the year the primary holding of the OSS was registered. This information comes from the Brazilian Federal Revenue Service and the Map of Civil Society Organizations, encompassing all third-sector firms in the country engaged in contractual agreements with the state, including OSS.

TABLE VI
HETEROGENEOUS OSS EFFECTS BY OSS FIRM EXPERIENCE

	OSS firm experience				
	High		Low		
	5-year effect (1)	Baseline (2)	5-year effect (3)	Baseline (4)	*p*-value (1) = (3) (5)
Panel A: Final outcomes					
Hospital admissions	2,016.370	3,730.343	694.862	3,383.849	.046
	(531.734)		(379.711)		
Bed turnover rate	14.834	36.189	1.106	34.965	.003
	(3.594)		(2.977)		
Length of stay	−0.760	5.784	−0.375	6.211	.410
	(0.317)		(0.327)		
Predicted mortality	0.004	0.056	0.002	0.047	.813
	(0.005)		(0.005)		
Inpatient mortality rate	−0.001	0.061	0.007	0.042	.427
	(0.006)		(0.008)		
Population mortality	−2.963	65.020	−0.750	61.389	.144
	(0.977)		(1.177)		
Panel B: Inputs					
Beds	12.292	112.373	15.186	102.499	.760
	(5.794)		(8.622)		
Workers	18.232	290.690	14.900	285.211	.923
	(26.021)		(23.574)		
Physicians	2.493	69.680	2.187	54.218	.973
	(7.086)		(5.909)		
Essential bed-level equipment	33.356	57.609	20.901	56.429	.307
	(8.412)		(8.720)		
Panel C: Physician composition					
Experience	−2.108	9.144	−1.739	8.814	.713
	(0.654)		(0.758)		
% Specialist	0.056	0.456	0.071	0.444	.700
	(0.027)		(0.031)		
Contract: % CLT	0.128	0.016	0.077	0.029	.440
	(0.038)		(0.048)		
Contract: % Estatutario	−0.305	0.521	−0.144	0.658	.099
	(0.073)		(0.058)		
Contract: % Independent	0.217	0.391	0.106	0.271	.283
	(0.072)		(0.068)		
Share of new hires	0.134	0.366	0.064	0.269	.219
	(0.039)		(0.042)		

TABLE VI
CONTINUED

	OSS firm experience				
	High		Low		
	5-year effect (1)	Baseline (2)	5-year effect (3)	Baseline (4)	p-value (1) = (3) (5)
Panel D: Separation of incumbents					
All incumbents	0.143	0.044	0.037	0.029	.000
	(0.014)		(0.019)		
High-productivity incumbents	0.044	0.018	−0.009	0.013	.342
	(0.042)		(0.048)		
Low-productivity incumbents	0.174	0.031	0.054	0.010	.071
	(0.038)		(0.063)		

Notes. This table reports the average effects of the OSS model on primary final and mechanism outcomes, separately for hospitals managed by OSS firms with high and low experience. Hospitals are classified as managed by high- or low-experience OSS firms based on a median split in the number of years the OSS firm has operated in the market. Standard errors in parentheses are computed with a hospital-level clustered bootstrap. Length of stay and inpatient mortality are risk-adjusted using the procedure described in Section III. Columns (1) and (3) report the average of the DiD estimates for each event time ranging from 1 to 5 (except for the share of new hires, where we report the average over event times 1 and 2 as the bulk of hiring occurs shortly after the transition). Columns (2) and (4) report baseline means in the five years prior to OSS adoption. Column (5) reports the p-value associated with a t-statistic testing the equality of the average effects for high- and low-experience OSS firms, where the standard error of the difference in estimates is obtained via bootstrap.

no change in case-mix risk, measured by predicted mortality. We observe substantially larger reductions in population mortality in municipalities where the transitioned OSS hospital is managed by a more experienced firm. In these municipalities, mortality declines by 2.9 deaths per 10,000 people, which is equivalent to a 4.5% decline relative to the baseline rate. In contrast, the effect is smaller and not statistically significant where the managing firm is less experienced (−0.7 deaths or 1% of the baseline).[41]

2. Operating Capacity. We examine whether heterogeneity in performance maps on heterogeneity in potential mechanisms. Table VI, Panel B presents the results on hospital inputs. Both types of firms expanded hospital capacity in similar proportion, as measured by the number of beds. If anything, the impact among less experienced OSS firms was higher, 15.2 (14.7%) versus 12.2

41. Municipalities with hospitals managed by more and less experienced OSS firms have, on average, the same supply of hospital beds at baseline (21 beds per 10,000 inhabitants). The heterogeneity by firm experience therefore does not reflect the heterogeneity in effects because of differences in baseline bed availability.

(10.7%). The increased production output among the less experienced OSS firms seems to be almost entirely driven by enhanced operating capacity. Holding the baseline bed turnover constant, the extra beds should produce 530 new admissions, which refers to 77% of the total effect on production. We do not see substantial differences in the overall availability of employees across groups, and the same holds when we focus on physicians only. These results reinforce the view that efficiency gains, more likely to be achieved by experienced firms, are the primary driver of hospital output growth.

3. Management Practices. We find meaningful heterogeneity between more and less experienced OSS in personnel practices. Table VI, Panel C explores heterogeneous effects on physician composition (including employment contracts) and hiring. Although both groups substantially alter the employment contracts of physicians, the shift away from rigid contracts is much less pronounced among the less experienced firms. At baseline, approximately 60% of physicians in both high- and low-experience OSS hospitals are employed under rigid Estatutário contracts, making this the dominant arrangement. After the transition, hospitals managed by high-experience OSS organizations reduce the share of Estatutário contracts by 30 percentage points, roughly half of the baseline share, whereas the corresponding reduction among low-experience OSS organizations is only 14.4 percentage points. This difference is economically substantial and statistically significant at 90%.

The decline in rigid contracts among high-experience OSS firms is mirrored by larger increases in flexible arrangements. The roughly 30 percentage point reduction in Estatutário contracts among high-experience OSS organizations is largely absorbed by an increase of about 20 percentage points in independent contracts and around 10 percentage points in CLT contracts. The corresponding changes among low-experience OSS firms are markedly smaller. For instance, the rise in the share of independent contracts among high-experience OSS firms is more than double relative to baseline levels compared to low-experience firms (21.7 versus 10.6 percentage points). Although some differences between groups are estimated with limited precision due to sample splitting, the joint pattern across contract types is unambiguous and shows that high-experience OSS firms make systematically greater use of flexible arrangements, whereas low-experience firms adjust more modestly despite operating under the same legal framework.

We do not find significant differences between groups in terms of average experience of physicians and the share of specialists, but the more experienced OSS are more likely to expand hiring. The share of new hires increases by 0.134 compared to 0.064, from similar baseline levels of approximately 0.36 and 0.26, respectively. Consistent with these findings, Table VI, Panel D shows that the increase in separation rates among incumbent physicians is nearly four times larger in hospitals managed by more experienced firms (0.140) compared with those managed by less experienced firms (0.037). As before, this effect is driven by separations among lower-productivity physicians.

Overall, the results indicate that while the OSS model expands managerial flexibility, it does not automatically lead to the adoption of efficiency-enhancing management practices. The extent to which organizations capitalize on this flexibility depends on managerial capacity.

4. Robustness. A potential concern for our interpretations is that more experienced OSS firms might select into and win bids for hospitals already better positioned for performance gains. In our setting, hospitals managed by more experienced OSS firms have higher production outputs and bed turnover rates at baseline. Although this might imply that such hospitals are harder to improve, contrary to the initial concern, we examine whether preexisting differences across hospitals drive the observed heterogeneity in our results.

For ease of comparison, columns (1) and (2) of Online Appendix Table A9 replicate the main findings from the previous section, based on a balanced sample of treated hospitals. Columns (3) and (4) reassess the heterogeneity analyses by including all treated hospitals. Although the comparison of baseline means (in brackets) shows that hospitals are not fully balanced across OSS experience levels now, the results are virtually the same in both analyses, indicating that baseline differences across hospitals are unlikely to explain the heterogeneity in outcomes.

To further assess this issue, we implement an alternative specification. We estimate the propensity score for being managed by a high-experience OSS and apply an inverse probability weighting scheme.[42] Columns (5) and (6) of Online Appendix Table A9 present the results. This approach further improves the balance between groups and the observed heterogeneity in outcomes persists. If anything, it becomes more pronounced. For example, the effect on the number of admissions is 2,463 for hospitals with high-experience OSS, compared with 443 for hospitals with low-experience OSS. Similarly, the impact on bed turnover is 16 for hospitals managed by experienced OSS versus 0.01 for those with less experienced OSS. Overall, these findings suggest that the heterogeneity in outcomes reflects the influence of OSS experience rather than preexisting hospital characteristics correlated with OSS experience.

5. Alternative Proxies for Management Capacity. Our baseline heterogeneity analysis shows that the gains in hospital production, productivity, and personnel practices following OSS are concentrated among hospitals managed by more experienced organizations, highlighting the role of managerial capacity in shaping posttransition outcomes. These findings align with the literature on management practices, which consistently documents a strong relationship between firm age, better management practices, and improved organizational performance (Bloom, Sadun, and Van Reenen 2016). We extend the analysis to a broader set of proxies for management capacity to characterize these findings more comprehensively.

We link OSS firm identifiers to the Brazilian employer-employee matched data (RAIS),[43] which allows us to construct a set of proxies for management capacity at the firm and worker level. To select and define these proxies, we follow prior work using similar administrative data, which shows that observable firm and manager characteristics can be strong predictors of management quality as measured in specialized management surveys (Bender et al. 2018; Cornwell, Schmutte, and Scur 2021). At the manager level, we identify workers in managerial occupations in

42. Hospitals managed by high-experience OSS receive weights based on the inverse of the propensity score, and hospitals managed by low-experience OSS receive weights based on the inverse of one minus the propensity score.

43. RAIS is assembled by the Brazilian Ministry of Labor and covers identified administrative data on formal workers and firms over time. Each record captures the details of an employment relationship between a worker and an establishment each year.

each OSS firm and track their labor market histories, including tenure in the health sector before joining the OSS, which serves as a proxy for industry-specific managerial experience.[44] We also estimate managers' permanent wage components from an AKM-type fixed-effects model, capturing persistent earnings capacity commonly interpreted as a proxy for individual productivity or skill.[45] At the firm level, we construct measures of firm size and worker turnover, both widely used indicators of organizational productivity and quality. Finally, we construct a composite index that combines these measures with OSS experience.[46] With these proxies, we replicate the empirical strategy of our baseline heterogeneity analysis by splitting hospitals according to the median of each measure (managers' health-sector tenure, managers' wage fixed effects, firm size, inverse worker turnover, and the composite index) computed from its distribution at the OSS firm level, and estimate effects for the same outcomes studied in the baseline analysis.

Online Appendix Figure A14 reports heterogeneous effects across these alternative dimensions for the same set of outcomes studied in Table VI. For ease of comparison, we also reestimate heterogeneity by OSS firm experience in the same figure. Across the board, the patterns based on the new proxies closely mirror those based on OSS experience. In particular, increases in hospi-

44. We follow very closely Cornwell, Schmutte, and Scur (2021), whose analysis also draws on RAIS, to define these manager-level measures. We use the official occupational classification system in Brazil to observe which workers are managers. To measure their experience in the health industry, we use Brazil's official industry classification system, which standardizes and identifies establishments' economic activities. We count the manager's number of years employed in establishments classified in the health sector before joining the OSS organization.

45. For the AKM model (Abowd, Kramarz, and Margolis 1999), we restrict the data to workers aged 20–60 with positive real wages and nonmissing demographic information. We estimate the model $y_{it} = \alpha + x_{it}\beta + \psi_{J(i,t)} + \theta_i + \varepsilon_{it}$, where y_{it} is the real log wage of worker i in year t, and $\psi_{J(i,t)}$ are fixed effects for the firm J where individual i was employed in period t. Worker fixed effects θ_i capture permanent earnings capacity. Controls in x_{it} include a normalized cubic in age interacted with race and gender along with year effects. The age terms are identified from within-worker variation over time and normalized relative to omitted reference categories. The model is estimated separately by state and restricted to the largest connected set of worker–establishment mobility. We measure the average quality of managers in OSS firms by the average of their $\widehat{\theta_i}$.

46. Using factor analysis, we retain the main factor capturing the shared variation across these measures and use its predicted scores as a composite measure of management capacity.

tal production and productivity are consistently at least twice as large in hospitals managed by high-capacity OSS organizations, and the decline in population mortality is concentrated in this group.[47] By contrast, as in the baseline analysis, we find no heterogeneity in predicted mortality or inpatient mortality. Online Appendix Figure A15 turns to the main mechanisms. The patterns based on the alternative proxies are broadly consistent with those found using firm experience. Point estimates indicate that hospitals managed by higher-capacity OSS organizations exhibit larger increases in hiring and higher separation rates among incumbent physicians. These hospitals also experience a stronger shift away from rigid labor contracts toward more flexible private-sector arrangements. As in the baseline analysis, we find no heterogeneity in capacity expansion (number of beds and total employment), and observe that in general, increases in bedside essential equipment are greater among higher-capacity OSS organizations.[48]

VII. Policy Implications and Scalability

VII.A. Discussion on Policy Implications

The results indicate that the performance gains observed under OSS management reflect differences in managerial capacity, rather than only differences in regulatory constraints. The OSS reform expands the set of feasible managerial choices by relaxing rigid public-sector rules, particularly in personnel management. However, the heterogeneity analyses show that this expanded discretion does not automatically translate into higher productivity or better outcomes. Hospitals managed by lower-capacity OSS organizations often perform closer to those directly administered by the state, despite operating under a more flexible legal framework. This pattern is difficult to reconcile with an explanation based solely on legal rigidity.

47. Note that while point estimates systematically indicate that high-capacity firms generally outperform low-capacity firms across most outcomes, measurement noise in some proxies and limited power imply that not all differences are statistically distinguishable, even when economically meaningful.

48. Online Appendix Figure A16 shows that all these proxies are positively correlated with OSS experience, reinforcing firm age as a meaningful indicator of managerial capacity. Note, however, that the correlations exhibit substantial dispersion, ranging from 0.25 to 0.45 standard deviations, indicating these alternative proxies capture distinct dimensions of managerial capacity rather than mechanically reproducing the experience measure.

At the same time, hospitals managed by higher-capacity OSS organizations achieve substantially larger gains in productivity, personnel efficiency, and population health outcomes, even though they operate under the same public financing rules and surplus-control constraints as both lower-capacity OSS and directly administered hospitals. This contrast isolates the role of managerial capacity and organizational know-how. When discretion is exercised by organizations with the ability to implement effective management practices, performance improves markedly, even in the absence of surplus incentives or market competition.

These findings point to an important complementarity between managerial discretion and managerial capacity. Regulatory flexibility alone does not seem to be sufficient for efficiency-enhancing improvements. The benefits of expanded discretion materialize primarily when it is paired with managers who are capable of translating autonomy into efficient organizational and personnel practices. More broadly, this evidence suggests that reforms aimed at improving public service delivery may consider not only the formal rules under which organizations operate but also who is empowered to operate in those rules. This complementarity is important for understanding the mechanisms through which the OSS model improves hospital performance and for assessing the potential implications of outsourcing complex public services in other contexts.

Although our results most directly apply to the profile of hospitals selected into OSS contracting—medium- and large-sized facilities with complex services and scope for efficiency gains—the baseline institutional conditions in our setting share many features with those observed in other countries. Comparative evidence indicates that Brazil's civil service operates under a professionalized, merit-based, and rules-driven framework that is broadly comparable to public administrations in many OECD and upper-middle-income countries (OECD 2016). Managerial incentives are primarily career-based, and discretion over personnel, wages, and budget reallocation is constrained but not absent. Likewise, whereas baseline occupancy in directly managed public hospitals in Brazil is relatively low, it does not remain far from the range observed in developed countries. OSS hospitals before the management transition exhibit occupancy rates (48%) near the lower end of the OECD distribution (51%) (OECD 2025). After the transition, average occupancy rose to approximately 56.5%, placing OSS hospitals within the OECD range. The governance challenges faced by public hospitals in Brazil are not unique. A broad international policy literature documents that public hospitals in many countries have long struggled with rigid administrative rules, limited managerial autonomy, weak accountability for performance, and centralized decision making. These challenges have motivated hospital governance reforms over the past decades, particularly in Europe, aimed at decentralizing hospital management, introducing contractual arrangements and performance targets, and granting greater operational flexibility while maintaining public ownership and financing (Saltman, Durán, and Dubois 2011). The OSS results are therefore informative beyond the Brazilian context and contribute to ongoing international debates on public sector governance and healthcare reform.

VII.B. Spillover Effects and Policy Scalability

The evidence presented so far shows that OSS management generates improvements in hospital productivity and efficiency, largely through changes in internal organization and personnel practices. An important question is whether these gains are scalable, that is, whether expanding OSS management to a larger number of hospitals can generate aggregate improvements without offsetting effects elsewhere in the health system. A natural concern is that productivity gains in treated hospitals could reflect the reallocation of scarce high-quality personnel from nearby facilities, which would limit net system-wide benefits. In this final empirical section, we assess the scalability of the OSS model by examining whether transitions generate spillover effects on neighboring hospitals, with a particular focus on personnel flows and performance outcomes.

We begin by examining the sources of new hires at OSS hospitals. Online Appendix Figure A17, Panel A shows the composition of new hires after the transition. The first bar reports the overall increase in hiring, and subsequent bars decompose this increase by physicians' employment characteristics in the year before the OSS transition. Roughly half of the hiring response comes from physicians previously working in hospitals outside the local market under flexible, private-sector-type contracts (CLT or independent contractor). Other sources contribute little. In particular, there is virtually no inflow from hospitals located in the same local market.

We examine how newly hired physicians adjust their labor supply. Panels B and C of Online Appendix Figure A17 track their number of concurrent jobs and total weekly hours. In the year of OSS hiring, physicians exhibit a discrete increase in the number of concurrent jobs, from an average of three to four, indicating that the OSS position is typically added on top of existing employment relationships. Weekly hours increase by about 12 hours, roughly corresponding to one hospital shift. Both margins remain elevated up to five years after hiring. Together, these patterns alleviate concerns that OSS expansion crowds out physician labor from other providers.

We assess spillovers on neighboring hospitals directly. Using the same empirical strategy as in the main analysis, we reestimate the models after replacing each treated hospital with its neighboring hospitals, assigning them the same (placebo) treatment date. Neighboring hospitals are defined as all hospitals in the same municipality as the treated hospital at the time of transition. The median number of neighbors is two.

Online Appendix Table A10 reports the results. Panel A focuses on performance outcomes. Effects on admissions are small and statistically insignificant, consistent with earlier evidence that OSS effects at the hospital and municipality levels are nearly identical. We also find no evidence of productivity declines. Effects on bed turnover and bed occupancy are positive but small and statistically insignificant. Risk-adjusted length of stay shows no short-run effect and a small, borderline-significant decline in the long run (roughly 5% of baseline). Quality outcomes are unaffected. Estimates for risk-adjusted inpatient mortality and mortality among at-risk patients are tightly centered around zero. Overall, we find no evidence of performance deterioration at neighboring hospitals. Panel B turns to physician staffing. We find no effect on the overall number of physicians, consistent with the earlier finding that OSS hiring does not draw from nearby hospitals. We also find no effect on the share of new hires, indicating that separated incumbents from OSS hospitals do not relocate to neighboring hospital facilities. Measures of physician composition (experience, specialization, and contract type) also remain unchanged, further supporting the absence of spillovers through personnel reallocation.

The absence of detectable declines in staffing, productivity, or quality at nearby facilities therefore indicates that OSS-driven improvements do not mechanically rely on drawing resources away from other public hospitals. These results suggest that the performance gains associated with OSS management are not offset by adverse spillovers on neighboring hospitals, supporting the scalability of the model in local health systems. This interpretation naturally reflects the scale of adoption observed in our empirical setting and does not speak to potential constraints under much larger expansions.

Relatedly, we documented that on average OSS hospitals achieve larger service volumes and higher productivity even though they operate under budget envelopes that are broadly comparable to those of government-managed hospitals. This pattern is consistent with a growing body of evidence documenting that more effective physicians can deliver similar or better health outcomes with lower resource use, shorter treatment intensity, and fewer diagnostic inputs (Doyle, Ewer, and Wagner 2010; Currie and MacLeod 2017; Chan and Chen 2022; Currie and Zhang 2025). This pattern is also consistent with, rather than contradictory to, evidence indicating that hospitals may undermine care quality when increasing volume to boost revenues under more standard market incentives and cost containment practices (Duggan et al. 2023; Aghamolla et al. 2024). In sum, although a definitive cost–benefit assessment would require more detailed expenditure data than are currently available, the observed aggregate patterns are consistent with the view that OSS management improves operational efficiency rather than increasing costs.[49] Given that these performance gains do not occur alongside adverse spillovers on neighboring hospitals, the results suggest scope for scaling the OSS model under existing fiscal constraints.

VIII. Concluding Remarks

Governments around the world have increasingly outsourced the delivery of public goods and services to the private sector, using a variety of models ranging from public-private partnerships to full privatization. Economic theory suggests that outsourcing

49. Online Appendix B provides further discussion on costing and expenditure based on cross-sectional comparisons of a limited sample of public hospitals in São Paulo. We observe that in this sample, on average OSS-managed hospitals spent annually R$119.31 million per hospital (around US$23 million), with an expenditure per admission of R$15,890, including fixed and variable costs. This is 12% lower than the R$18,140 observed for government-managed hospitals.

can improve efficiency, but it may also incentivize cost-cutting strategies that compromise service quality and equity, particularly when private firms retain surplus rights. Against this backdrop, we study Brazil's OSS model, a distinctive governance approach that transfers hospital management to private nonprofit organizations while retaining public control over surplus rights and enforcing contractible performance targets. To evaluate its effects, we built a new administrative data set from Brazil's health care system and implemented a DiD design exploiting staggered hospital transitions from government to OSS management over time.

Our findings show that the OSS model substantially increases hospital production and productivity without sacrificing quality or equity. These improvements are consistent with OSS contracts introducing verifiable performance targets in a context of initially weak incentives and scope for efficiency gains, allowing hospitals to expand production along observable dimensions such as volume, without compromising non-contractible measures of quality such as inpatient mortality. The increase in production contributes to addressing previously unmet demand, expanding access to hospital care for the local population, particularly in underserved areas, and leading to a reduction in population mortality. These performance gains are only partly explained by increased operational capacity. Although inputs such as bed supply expand following OSS transitions, they account for only a small share of the observed increase in hospital output. We find no evidence of large investments in advanced medical equipment; the sizable productivity gains instead point to more efficient resource allocation. Managerial flexibility, particularly in personnel management, emerges as a key mechanism. OSS hospitals increasingly adopt flexible hiring arrangements, shift workforce composition toward specialized physicians, and exhibit higher exit rates among low-productivity incumbent workers.

Managerial experience also plays an important role. More experienced OSS providers achieve larger gains in output and efficiency, and these gains translate into greater improvements in population health. They are also more likely to implement performance-oriented personnel practices. In contrast, less experienced firms rely more heavily on input expansion and show smaller productivity improvements. This heterogeneity has important policy implications and suggests that the careful selection of OSS providers, with a strong emphasis on experience and demonstrated managerial capabilities, is key for realizing the full potential of service outsourcing. These results underscore that the effects of outsourcing depend critically on governance design, and suggest that well-designed governance arrangements can mitigate the classic efficiency-quality trade-off in delivering complex public services, especially when contracts are incomplete and quality is hard to specify or enforce. This insight is particularly relevant given the substantial variation in outsourcing models observed across and within public administrations worldwide.

Supplementary Material

An Online Appendix for this article can be found at *The Quarterly Journal of Economics* online.

Data Availability

The data and code underlying this article is available in Coube, Fontes, and Rocha (2026), in the Harvard Dataverse, https://doi.org/10.7910/DVN/D7IMCO.

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