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Asset Efficiency, Capital Structure, and Network Ownership as Determinants of Private Hospital Financial Performance: Evidence from Georgia

აქტივების ეფექტურობა, კაპიტალის სტრუქტურა და ქსელის საკუთრება, როგორც კერძო საავადმყოფოების ფინანსური მაჩვენებლების განმსაზღვრელი ფაქტორები: მტკიცებულებები საქართველოდან

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Abstract

Introduction: The financial strength of private hospitals depends not only on the size of their asset base but also on their ability to convert available capacity into operating returns and usable cash. This issue is particularly relevant in Georgia, where hospital provision is predominantly private, infrastructure expansion has been substantial, and diagnosis-related group (DRG)-based reimbursement has increased the financial importance of cost efficiency and asset utilization. **Objective:** To identify the financial determinants of performance among private multiprofile hospitals in Georgia during 2021–2024, focusing on asset utilization, fixed-asset intensity, leverage, liquidity, operating cash flow, and network ownership. **Methods:** A quantitative panel-data study was conducted using the audited financial statements of 33 first- and second-category private hospitals. The balanced panel comprised 132 hospital-year observations. Five hypotheses were tested using fixed-effects and Mundlak-corrected random-effects regression models with hospital-clustered robust standard errors. Return on assets (ROA) was the principal performance measure, supplemented by EBITDA margin, operating profit margin, and net profit margin to capture specific financial mechanisms. **Results:** Hospital size and asset turnover were the most consistent positive determinants of financial performance. Asset turnover showed a particularly strong positive association with EBITDA margin. Higher leverage was negatively associated with ROA and net profit margin, indicating pressure on final profitability. Fixed-asset intensity had no independent significant effect on performance; however, its interaction with asset turnover was negative and significant, suggesting that the benefits of asset utilization diminish in hospitals with more fixed-asset-intensive structures. Operating cash flow relative to total assets was more informative than the current ratio as a predictor of performance. The performance gap between network-owned and independent hospitals widened during the later years of the study period. **Conclusion:** The financial performance of Georgian private hospitals is determined more by the effective utilization of assets and the generation of operating cash flow than by the size of the asset base or conventional liquidity measures alone. Asset turnover and fixed-asset intensity should therefore be interpreted jointly. The findings also indicate that leverage and ownership structure have increasingly important implications for hospital profitability.

Keywords: hospital financial performance; asset utilization; fixed-asset intensity; capital structure; operating cash flow; network ownership; emerging markets.

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აბსტრაქტი

შესავალი: კერძო საავადმყოფოების ფინანსური მდგრადობა დამოკიდებულია არა მხოლოდ მათი აქტივების მოცულობაზე, არამედ არსებული სიმძლავრეების საოპერაციო შემოსავლად და რეალურ ფულად ნაკადებად გარდაქმნის უნარზე. აღნიშნული საკითხი განსაკუთრებით მნიშვნელოვანია საქართველოში, სადაც ჰოსპიტალური მომსახურების მიმწოდებელთა უმრავლესობა კერძოა, მნიშვნელოვნად გაფართოვდა ინფრასტრუქტურა, ხოლო დიაგნოზთან შეჭიდული ჯგუფებით (DRG) დაფინანსების დანერგვამ ხარჯების ეფექტიანობასა და აქტივების გამოყენებას უფრო დიდი ფინანსური მნიშვნელობა შესძინა. კვლევის მიზანი იყო 2021–2024 წლებში საქართველოში მოქმედი კერძო მრავალპროფილური საავადმყოფოების ფინანსური საქმიანობის განმსაზღვრელი ფაქტორების შესწავლა, აქტივების გამოყენების, ძირითადი საშუალებების ინტენსივობის, ფინანსური ბერკეტის, ლიკვიდობის, საოპერაციო ფულადი ნაკადებისა და ჰოსპიტალურ ქსელში კუთვნილების გათვალისწინებით. **მეთოდები:** ჩატარდა რაოდენობრივი პანელური კვლევა 33 პირველი და მეორე კატეგორიის კერძო საავადმყოფოს აუდიტირებული ფინანსური ანგარიშგებების საფუძველზე. დაბალანსებული პანელი მოიცავდა 132 საავადმყოფო-წლის დაკვირვებას. ხუთი ჰიპოთეზა შემოწმდა ფიქსირებული ეფექტებისა და Mundlak-ის კორექციით შემთხვევითი ეფექტების რეგრესიული მოდელების გამოყენებით. გამოყენებული იყო საავადმყოფოების დონეზე კლასტერიზებული მდგრადი სტანდარტული შეცდომები. ფინანსური შედეგიანობის ძირითად მაჩვენებელს წარმოადგენდა აქტივების რენტაბელობა (ROA), ხოლო ცალკეული ფინანსური მექანიზმების შესაფასებლად დამატებით გამოყენებული იყო EBITDA-ს მარჟა, საოპერაციო მოგების მარჟა და წმინდა მოგების მარჟა. **შედეგები:** საავადმყოფოს ზომა და აქტივების ბრუნვადობა ფინანსური შედეგიანობის ყველაზე თანმიმდევრულ დადებით განმსაზღვრელ ფაქტორებად გამოვლინდა. აქტივების ბრუნვადობა განსაკუთრებით მჭიდროდ იყო დაკავშირებული EBITDA-ს მარჟასთან. ფინანსური ბერკეტის მაღალი დონე უარყოფითად უკავშირდებოდა აქტივების რენტაბელობასა და წმინდა მოგების მარჟას, რაც საბოლოო მომგებიანობაზე ვალის ზეწოლაზე მიუთითებს. ძირითადი საშუალებების ინტენსივობას დამოუკიდებელი მნიშვნელოვანი გავლენა არ გამოუვლენია, თუმცა მისი ურთიერთქმედება აქტივების ბრუნვადობასთან უარყოფითი და სტატისტიკურად მნიშვნელოვანი იყო. ეს მიუთითებს, რომ აქტივების ეფექტიანი გამოყენების სარგებელი მცირდება ძირითადი საშუალებებით უფრო მეტად დატვირთულ საავადმყოფოებში. მთლიან აქტივებთან შეფარდებული საოპერაციო ფულადი ნაკადი ფინანსური შედეგიანობის უფრო ინფორმაციული მაჩვენებელი აღმოჩნდა, ვიდრე მიმდინარე ლიკვიდობის კოეფიციენტი. კვლევის ბოლო წლებში ასევე გაიზარდა ფინანსური შედეგიანობის განსხვავება ჰოსპიტალურ ქსელებში გაერთიანებულ და დამოუკიდებელ საავადმყოფოებს შორის. **დასკვნა:** საქართველოს კერძო საავადმყოფოების ფინანსურ შედეგიანობას აქტივების ეფექტიანი გამოყენება და საოპერაციო ფულადი ნაკადების გენერირება უფრო მეტად განსაზღვრავს, ვიდრე მხოლოდ აქტივების მოცულობა ან ლიკვიდობის ტრადიციული მაჩვენებლები. შესაბამისად, აქტივების ბრუნვადობა და ძირითადი საშუალებების ინტენსივობა ერთობლივად უნდა შეფასდეს. შედეგები ასევე აჩვენებს, რომ ფინანსური ბერკეტი და საკუთრების ორგანიზაციული ფორმა საავადმყოფოების მომგებიანობისთვის სულ უფრო მნიშვნელოვან ფაქტორებად ყალიბდება.

საკვანძო სიტყვები: საავადმყოფოს ფინანსური შედეგიანობა; აქტივების გამოყენება; ძირითადი საშუალებების ინტენსივობა; კაპიტალის სტრუქტურა; საოპერაციო ფულადი ნაკადი; ჰოსპიტალურ ქსელში კუთვნილება; განვითარებადი ბაზრები.

რეკომენდირებული ციტირება: ნუცა გრძელიშვილი, ვახტანგ ბერიშვილი. აქტივების ეფექტურობა, კაპიტალის სტრუქტურა და ქსელის საკუთრება, როგორც კერძო საავადმყოფოების ფინანსური მაჩვენებლების განმსაზღვრელი ფაქტორები:

მტკიცებულებები საქართველოდან. *ჯანდაცვის პოლიტიკა, ეკონომიკა და სოციოლოგია,* 10 (2). DOI: https://doi.org/10.52340/healthecosoc.2026.10.02.11

Introduction

Background and Research Context

Hospitals are financially complex organizations, since unlike many other institutions a large part of their resources is a necessity and committed before revenue is generated. Physical infrastructure, medical equipment and staffing create service capacity, but capacity alone does not ensure the financial performance. A hospital with a large asset base may appear financially strong, but the same asset base can also become a financial burden. Especially, when patient volume, service mix, reimbursement levels or internal efficiency are insufficient (Bhat & Jain, 2026; Oner et al., 2016). The main challenge for the hospitals nowadays is whether existing or even future investments in the resources are or will be used productively enough to support profitability, cash generation and long-term financial resilience. For this reason, hospital financial performance is considered a multidimensional concept that includes metrics like returns, liquidity, capital structure, activity and utilization (Oner et al., 2016; G. Pink et al., 2007).

The interaction among these dimensions is particularly relevant for private hospitals, where unused capacity and weak cash conversion are less easily absorbed through public subsidy or budgetary support (Bhat & Jain, 2026; Uy et al., 2021). This issue is especially important in Georgia, where the hospital sector is largely privately provisioned and has been affected in the recent year by infrastructure expansion followed by low utilization challenges and even changes in reimbursement rules (Bochorishvili & Kurashvili, 2023; Deisadze et al., 2025; Richardson et al., 2025). Unlike healthcare systems where public hospitals dominate the hospital sector and inpatient care, Georgian hospitals operate as private providers. Therefore, they are exposed to market pressure, investment requirements and financing structure changes. The introduction of DRG-based hospital financing in 2022 made financial management for the hospitals complex. Current financing System links reimbursement to diagnosis-based treatment standards (Richardson et al., 2025; Verulava & Jorbenadze, 2023). Accroding to these factors, asset turnover and fixed-asset intensity have even more importance and show whether hospital capacity is financially productive.

Research Problem

This research study states profitability, liquidity, advantage, ownership and operational efficiency as important determinants of performance. Financially these factors are often examined separately. This separation is useful for measurement but it does not provide full overall performance. In practice, the hospital's asset base is financed, depreciated, maintained and converted into cash at the same time. What gets less attention in the literature is how asset utilization interacts with fixed-asset intensity. A higher fixed-asset share can support advanced services and patient volume, but it also brings other obligations. Therefore, In capital intensive hospitals the same additional revenue may produce different financial outcomes depending on the cost structure behind the asset base. the central research problem is according to this is whether Georgian private hospitals differ not just in size, liquidity or leverage, but in how well they align capacity, utilization, financing and cash conversion

Research Aim and Objectives

The aim of this study is to examine how asset utilization, fixed-asset intensity, leverage, liquidity, operating cash flow and ownership structure are associated with the financial performance of private multiprofile hospitals in Georgia during 2021-2024. Five related objectives follow from this aim. The first asks whether asset-related financial characteristics explain differences in hospital profitability. The second tests whether asset utilization is positively associated with EBITDA margin. The third examines whether fixed-asset intensity moderates the relationship between asset utilization and ROA. The fourth compares operating cash flow with the current ratio as an explanation of performance. The fifth asks whether the performance gap between network-owned and independent hospitals changed over 2021-2024. Together

these objectives reflect a broader concern: financial performance in private hospitals depends on how well capacity, utilization, financing and cash generation are aligned together.

Research Questions

The study is guided by the following research questions:

1. Which asset-related financial characteristics are associated with hospital financial performance in Georgian private multiprofile hospitals?
2. Is asset utilization positively associated with hospital operational profitability?
3. Does fixed-asset intensity change the strength of the relationship between asset utilization and financial performance?
4. Is operating cash-flow strength a more meaningful determinant of performance than traditional liquidity measured by the current ratio?
5. Did the financial performance gap between network-owned and independent hospitals change during 2021-2024?

Scope, limitations and methodological Approach

This study focuses on private first- and second-category multiprofile hospitals in Georgia during 2021–2024. The sample is limited to hospitals that provide both inpatient and outpatient services and participate in the DRG-based financing system, which improves comparability in terms of service scope, operational complexity and reimbursement logic. The analysis is based on audited financial-statement data. This allows consistent measurement of profitability, assets, leverage, liquidity and cash flow, but it does not capture operational details such as bed occupancy, patient volume, case mix, service-line profitability, equipment use or quality of care. The four-year panel which was used to capture post-covid pandemic environment, also limits the ability to assess long-term investment cycles or the full effect of DRG financing over time. The findings should therefore be interpreted as financial associations within the selected group of Georgian private multiprofile hospitals, rather than as causal conclusions for the entire healthcare sector.

Literature Review

Hospital financial performance as a multidimensional concept

Hospital financial performance is a complex concept to measure. The same organization can look financially sound under one measure and weak under another. Positive net income does not remove the possibility of liquidity pressure and a large asset base does not guarantee that assets are being converted into operating returns. This is why the literature does not usually treat hospital financial performance as one narrow accounting result. For this reason, the hospital finance literature generally financial performance as a multidimensional concept rather than as a narrow accounting outcome (Oner et al., 2016; G. Pink et al., 2007). This multidimensional view is most visible in measurement-oriented studies. Pink et al. (2007) uses a literature, expert panel and survey-based approach to classify key indicators into financial viability, liquidity, capital, efficiency and human resource related dimensions. Oner et al. (2016) also identify profitability, liquidity, capital structure, activity, cost, revenue and utilization as important dimensions in empirical hospital finance research. Indicator choice therefore shapes the argument a researcher is able to make. Rosko et al. (2018) analyze operating margin and total margin because the two measures capture different layers of profitability: one is tied to core hospital activity, while the other includes non-operating items. Perger and Hecker (2023) construct a multidimensional measure of financial performance for Italian public health enterprises by combining profitability, liquidity and capital structure. Based on the literature in order to measure hospital financial performance structure of margins, returns, liquidity and capital use has to be interpreted together.

Asset utilization and operational profitability

One of important financial metrics, which is Asset utilization focuses on hospital operations. Hospitals carry costs before patients arrive: beds, equipment, buildings, departments and specialized staff are already in place. The financial question is whether this capacity is used intensively enough to produce revenue. Oner et al. (2016) show that operational and structural variables, including utilization-related measures, frequently appear as predictors of hospital financial outcomes. Rosko et al. (2018) find that profitability is

positively associated with hospital size, market power, high-technology services and occupancy rate. Therefore they point out the importance of revenue-generating use of capacity. Bhat and Jain (2026) researched private hospitals in India. Their financial statement analysis identifies fixed-assets age, current-assets efficiency, operating efficiency, financial structure and profitability relative to operating cost as key dimensions of performance. The study important since assets are not treated only as balance-sheet items. Their condition, use and renewal become part of the financial results. A hospital with expensive infrastructure but weak operating efficiency may appear strong in scale and weak in financial discipline at the same time. The same issue becomes sharper when cash conversion is considered. Uy et al. (2021) find that selected private hospitals in the Philippines generated relatively stable operating margins and were efficient in generating revenues from assets, but they also stress the vulnerability created by disrupted cash flows, particularly delays in insurance receivables. Asset productivity may improve profitability but the delayed cash inflows can still create challenges. This topic is particularly relevant in Georgia's hospital sector since private ownership development and infrastructure expansion have increased the importance of physical and technological capacity. DRG-based reimbursement system also puts pressure on hospitals to control costs. According to these circumstances it's important to research whether the asset base already in place produces sufficient operating returns.

Fixed-asset intensity and capital efficiency

Hospital assets are necessary for service delivery, but an only a larger fixed-asset base does not mean improved financial performance. Fixed-asset intensity supports advanced services and helps manage the patient volume, but it is also quite costly. In hospitals, capital investment becomes beneficial only when the organization can use and finance it effectively. Pink et al. (2009) treat capital-related indicators as an important part of assessing hospitals' financial condition. Also, Bhat and Jain (2026) identify fixed-asset age as the main dimension of private hospital performance. Both studies are pointing at the same problem, that assets do not stop demanding resources once they have been acquired. Uy et al. (2021) separate capital expansion, asset aging and productivity. Growth and renewal are not the same process, and mixing them together makes it harder to identify where financial pressure is actually coming from. In their sample, public hospitals expanded due to the government investment programs and at the same time private hospitals relied more on debt and patient-generated profits. They also showed aging fixed assets. According to these observations, for private hospitals the problem is not only how assets are acquired. It is also how they are renewed when reinvestment depends mainly on internally generated resources or borrowing. Dubas-Jakóbczyk et al. (2020) examined polish public hospitals and found financial losses and overdue liabilities also with some ownership and organizational forms in especially difficult positions. Bem et al. (2019) show that hospital financial condition cannot be read off from location alone, Organizational form and operating context often shape outcomes more clearly than the geographical context. Perger and Hecker (2023) also reach a similar conclusion in the Italian public health hospitals. They found out that financial performance is determined by structural and operational characteristics, such as size and also a degree of specialization. According to these findings scale and capital intensity matter most when considered together. If demand and management capacity for that demands are adequate, they reinforce financial performance. But when they are not, the same assets become a burden.

Leverage, capital structure and financial risk

Debt is also where the picture gets complicated, because borrowing can indicate either strategic investment or financial distress depending on context. Borrowing can finance expansion, modern equipment and infrastructure renewal. It can also lock hospitals into repayment obligations that are difficult to sustain when reimbursement changes or margins decline. In a sector where revenue depends on payer behavior, regulation, patient flows and public financing rules, leverage is associate with risks. Zhang and Laporte (2025), examining hospital capital structure in China, show that borrowing decisions are influenced by ownership, hospital type, revenue diversification and profitability. Their study links hospital leverage to corporate finance theory: under pecking order theory, hospitals prefer internal funds before external borrowing, while under trade-off theory they balance the benefits and costs of debt. Debt-to-assets is therefore useful because it reflects both how hospitals finance their asset base and how vulnerable they may become if

those assets do not generate sufficient returns. The consequences of poorly managed leverage are most visible when hospitals approach distress. Beauvais et al. (2023) note that bankruptcy in this sector damages community access and care quality, not just the institution itself. Bai et al. (2021) make a related point through the Covid-19 experience, where U.S. for-profit hospitals proved especially fragile despite looking profitable in ordinary conditions. Ownership structure, in other words, shapes how exposed a hospital is when circumstances turn. For Georgian private hospitals, leverage has to be read alongside asset utilization and DRG reimbursement. Debt-financed expansion is less problematic when it creates productive capacity that is actually used. It becomes harmful when new or existing assets do not produce enough operating return to cover financing pressure. The expected negative relationship between leverage and ROA or net profitability is therefore not a statement that all borrowing is damaging. It is a test of whether debt obligations absorb resources that could otherwise support operations, renewal and financial flexibility.

Liquidity, operating cash flow and financial resilience

Profitable hospitals do not always have short-term financial security. They often still face pressure of payment obligations to suppliers, employees or creditors. This problem becomes especially challenging when receivables are collected late, because in this case reported income does not mean that cash is available at the right moment. According to this observation the liquidity cannot be assessed only through accounting ratios. Uy et al. (2021) highlight this issue in the case of Philippine hospitals. Study observed that the private providers were not financially resilient when insurance receivables were delayed and operating cash flows were interrupted. This means that reported profitability does not always reflect the cash a hospital has available. Capital structure theory also provides a similar perspective. According to the theory the way an organization is financed finally affects its financial flexibility and its exposure to liquidity pressure. Zhang and Laporte (2025) discuss the preference for internal funds under a different pecking order theory. According to this theory hospitals with stronger internally generated cash may rely less on short-term borrowing and also may be better positioned to finance its operations. The current ratio and operating cash flow to total assets according got the literature show different aspects of financial resilience. The current ratio shows liquidity at a specific point in time and operating cash flow to total assets indicates whether the hospital's asset base can generate internal funds through its core activities.

Ownership context in hospital financial performance

Ownership context is important in terms of financial metrics. Private hospitals generally have stronger better control of the costs and use resources efficiently, but this does not mean better results. Financial results depend on other conditions as well like payment systems, regulatory requirements, competitive pressure, governance quality and service obligations. Rosko et al. (2018) found that for-profit ownership is positively associated with hospital profitability. Bai et al. (2021) show that for-profit hospitals were more financially challenged during the covid-19 pandemic. According to this, hospitals can be more profitable in ordinary periods and under the financial risks during nonstable environments. This happens when its revenue model depends heavily on profitable services, elective procedures or specific patient flows. Examining these relations in Georgian context is especially important, since the sector is already highly privatized. Verulava et al. (2019) observe that private for-profit organizations dominate the Georgian medical market and nonprofit medical institutions are quite rare. Transparency International Georgia (2012) also states in their report that hospital reforms to large-scale privatization, vertical and focus on concerns about competition and regulation. More recent WHO analysis also emphasizes that Georgia's large private sector makes observations really important for managing public policy objectives (World Health Organization, 2025). Al Rahhaleh et al. (2023) study shows that internal control and financial accountability are also important for financial performance. The study was conducted in Saudi private hospitals and focused on governance quality in private hospitals. Based on their findings Network ownership brings more managerial discipline, shared resources that are useful and stronger bargaining capacity.

The Georgian healthcare sector review

Georgian hospital sector is heavily privatized and DRG-reimbursed, which makes the research especially important. Bochorishvili and Kurashvili (2023) report that there are efficiency problems like

oversupply of beds and occupancy rates that, which leaves a significant share of capacity in hospitals unused. This creates an operational problem in Georgian hospitals. There are high costs in assets. Richardson et al. (2025) also describes a same model, where private provision and low bed occupancy create financial pressure. Study also notes that the purchase of medical equipment is not well constrained by statutory controls and this contributes to the current problem. All of these observations show that when investment decisions are decentralized and mostly market-driven, hospitals may accumulate fixed assets faster than they can use them efficiently. Verulava and Jorbenadze (2023) explain that Georgia began implementing DRG-based hospital financing in 2022. Clinics previously had their own tariffs and patients could face additional payments beyond official copayments. Right now, under DRG payment is linked to diagnosis-based and pre-assessed treatment standards. The reform helps control costs, reduce unnecessary length of stay and improve transparency. On the other hand, standardized reimbursement is a challenge for high-cost cases and many multiprofile hospitals hold these high fixed costs. Also, a problem is institutions with inefficient asset use and service structures that are not well matched to tariffs. International studies also support this idea. For example, price effects, cost-structure changes and reform-related pressures can drive Kou et al. (2024) show that public hospital operating costs. Rorimpandey et al. (2025) show that profitability, liquidity and advantage can shift substantially across shock periods when government payment policies change. Although these studies are from Japan and Indonesia, they support the broader interpretation that reimbursement rules, cost structure and operational adaptation have to be considered together. In Georgia, asset turnover and fixed-asset intensity are therefore more than accounting ratios; they indicate how hospitals adapt to a payment system that is becoming less tolerant of unused capacity.

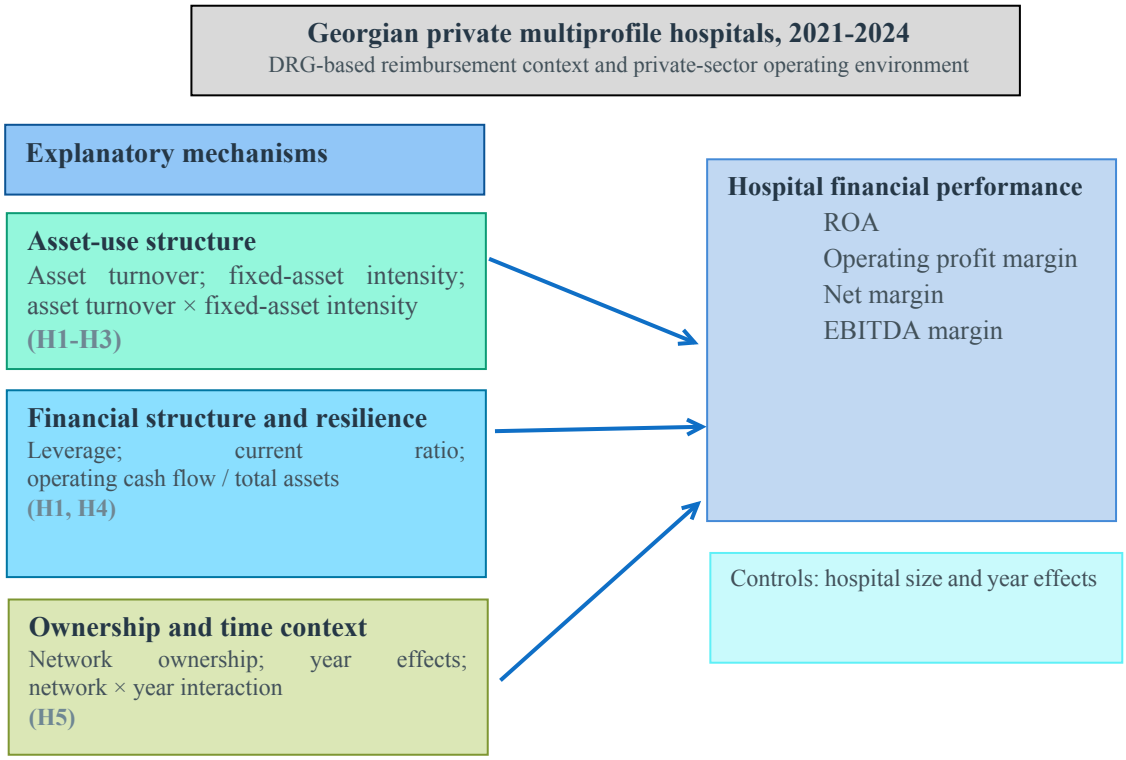
Research gap and conceptual positioning of the present study

The reviewed literature suggests that hospital financial performance cannot be explained by profitability alone. Prior studies emphasize profitability, liquidity, capital structure, activity, efficiency and ownership as important dimensions of hospital financial condition. However, these dimensions are often examined separately, while in hospitals they operate together. This is especially important in capital-intensive institutions and in the Georgian context. Existing research discusses topical like asset age, it's utilization, capital investments and leverage. However, the relationship between asset utilization and fixed-asset intensity in hospitals still is insufficiently tested. This study therefore researches hospital financial performance as the outcome of interaction between operational efficiency and asset structure. Asset turnover is expected to reflect the hospital's ability to generate revenue from its asset base and fixed-asset intensity should capture the capital burden of the selected Georgian hospitals. Study includes advantage and operating cash flow because they show how the asset base is financed and clearly show how operations generate internal resources. Ownership context is also important Georgian context and not thoroughly financially studied. In order to fill these gaps, the study examines asset utilization, fixed-asset intensity, liquidity, operating cash flow and ownership structure link to the hospital profitability in Georgia during 2021–2024.

Conceptual Framework

According to the literature, the conceptual framework of this study positions hospital financial performance as the outcome of three linked mechanisms: asset-use structure, financial structure, resilience and ownership-time context. Asset turnover and fixed-asset intensity capture how the hospital asset base is used; leverage, liquidity and operating cash flow show how financial pressure is managed; and network ownership with year effects reflects organizational differences during 2021-2024. This provides the conceptual bridge between the literature review and the empirical methodology.

Figure 1 Conceptual framework of hospital financial performance in Georgian private hospitals.



(Source: Author's own work)

Methodology and Data

Research Design, Sample and Data Acquisition

This study applies a quantitative panel-data research design to examine the financial determinants of performance among private healthcare clinics in Georgia. The presented design is appropriate because the research hypotheses are tested through numerical financial indicators and observations of the same clinics over time. Panel data allow the analysis to use both cross-sectional variation between clinics and longitudinal variation within clinics, while controlling for unobserved clinic-specific characteristics that may otherwise bias the results.

The dataset consists of 33 private clinics observed annually from 2021 to 2024. According to this analysis uses a balanced panel of 132 clinic-year observations. The year 2020 is excluded because the Covid-19 pandemic generated exceptional financial and operational conditions that would weaken comparability with the post-pandemic period. The sample was deliberately limited to first and second category hospitals, as they represent a more comparable segment of the Georgian hospital sector in terms of service scope, operational complexity and financial structure. In addition, the selected hospitals provide both outpatient and inpatient services, which ensures that their financial performance reflects a broader range of hospital activities rather than a single service line. All hospitals included in the sample also participate in the Diagnostic Related Grouping (DRG based financing system, therefore they all have a similar reimbursement logic, which is important for comparing the financial data of these hospitals. This selection allowed the study to be focused

and fit for financial analysis. The final panel has 33 hospitals across 4 years (N = 33, T = 4). The sample includes 8 network-owned clinics and 25 independent clinics. 19 clinics are located in Tbilisi and 14 operate in regional areas. These are also important because ownership structure and location may influence performance.

Table 1. Sample structure (Source: Authors' own work)

Characteristic	Description
Country context	Georgia
Sector	Private healthcare clinics
Observation period	2021-2024
Number of clinics	33
Clinic-year observations	132
Panel structure	Balanced short panel
Ownership categories	8 network-owned; 25 independents
Unit of analysis	Clinic-year observation

Data Sources and Variable Construction

The empirical analysis is based on secondary data, which was extracted from audited financial statements: balance sheets, income statements and cash-flow statements (Service for Accounting, Reporting and Auditing Supervision [SARAS]) (*Georgian Reporting Portal*, n.d.). The extracted data items were standardized before ratio calculations, which ensured comparability. Return on Assets (ROA) is the main dependent variable. ROA in the analysis is used instead of Return on Equity because equity-based profitability may be strongly affected by advantage and it becomes difficult to interpret when clinics report negative equity and EBITDA margin is used only for the operational profitability hypothesis. For the analysis year dummy variables for 2022, 2023 and 2024 were used with 2021 as the base year. These year effects included macroeconomic and sector-wide conditions for all the hospitals. Year dummies was chosen since they absorb all variations in Georgia like inflation spike, GDP growth and also considerable exchange rate movements.

Table 2. Variable definition. (Source: Authors' own findings)

Variable	Symbol	Measurement	Model role	Purpose
Return on Assets	ROA	Net income / Total assets	Main dependent variable	Financial performance relative to asset base
EBITDA margin	EBITDA_M	EBITDA / Total revenue	Dependent variable for H2	Operational profitability before financing effects
Clinic size	ln_TA	Natural log of total assets	Independent/control variable	Controls for scale and asset-size differences
Leverage	D_A	Total debt / Total assets	Independent/control variable	Measures debt dependence and financial risk
Asset turnover	TA_to	Total revenue / Total assets	Independent variable	Measures revenue generated per unit of assets
Fixed-asset intensity	FA_TA	Fixed assets / Total assets	Independent/moderating variable	Captures capital intensity
Current ratio	CR	Current assets / Current liabilities	Liquidity variable	Measures short-term balance-sheet liquidity
Operating cash-flow intensity	OCF_TA	Operating cash flow / Total assets	Independent variable for H4	Measures cash-generating strength relative to assets
Network ownership	NETWORK	1 = network-owned; 0 = independent	Ownership variable	Tests ownership-related performance differences
Location	LOCATION	1 = Tbilisi; 0 = regional	Control variable	Controls for geographic differences
Year effects	D2022, D2023, D2024	Binary annual indicators	Time control dummy variables	Capture common year-specific including country specific macro variables

Econometric Approach

The empirical analysis uses panel regression methods because clinic performance may be influenced by unobserved factors that persist over time, such as management quality, patient mix, service specialization, local market position and historical investment decisions. If these clinic-specific factors are correlated with the explanatory variables, simple pooled estimation may produce biased coefficients. Pooled Ordinary Least Squares is therefore not used as the primary estimator. The Breusch-Pagan Lagrange Multiplier test is used to assess whether clinic-specific variance is statistically relevant. Rejection of the null supports the use of panel estimators rather than pooled estimation. Fixed Effects estimation is applied where the research question focuses on time-varying financial variables and where the Hausman test rejects the consistency of standard Random Effects. Fixed Effects controls for all time-invariant clinic characteristics by allowing each clinic to have its own intercept. This makes it suitable for H1, where the focal variables vary over time and ownership or location effects are not the main object of estimation. Random Effects estimation is considered where between-clinic variation and time-invariant variables are analytically important. However, standard Random Effects requires the assumption that unobserved clinic-specific effects are uncorrelated with the regressors. When this assumption is not credible, the Mundlak correction is used (Mundlak, 1978).

The Mundlak-corrected Random Effects model adds clinic-level means of time-varying regressors to the random effects specification. This approach addresses correlation between unobserved clinic effects and the regressors while allowing time-invariant variables, such as network, to remain in the model. It is therefore used for H2, H3, H4, and H5.

$$y_{\mathrm{it}} = \alpha + \beta x_{\mathrm{it}} + \gamma\, \overline{x}_i + \delta z_i + \varphi(x_{\mathrm{it}} \times z_i) + \lambda_t + u_i + \varepsilon_{\mathrm{it}}$$

In this expression, x_{it} denotes time – varying financial variables, $\overline{x}_i$ denotes their clinic - level means, z_i represents time – invariant variables, λ_t captures year effects, u_i is the clinic – specific random effect, and $\varepsilon_{\mathrm{it}}$ is the idiosyncratic error term.

Robust Standard Errors and Diagnostic Tests

All primary panel regressions use Arellano heteroscedasticity and autocorrelation-consistent standard errors clustered at the clinic level (Arellano, 1987; Cameron & Miller, 2015). This correction is appropriate because the dataset has repeated annual observations for each clinic and financial ratios may display both heteroscedasticity and within-clinic serial correlation. The short-panel structure of the data also makes clinic-clustered robust inference more suitable than methods designed for panels with long time dimensions. Estimator selection is guided by formal diagnostic tests. The Breusch-Pagan Lagrange Multiplier test evaluates whether panel estimation is preferred to Pooled OLS (Breusch & Pagan, 1980). The Hausman test compares Fixed Effects and Random Effects and indicates whether standard Random Effects is consistent (Hausman, 1978). In Mundlak specifications, joint significance of the added clinic-level means is used to assess whether the correction is necessary.

Model Specifications by Hypothesis

The model specification differs by hypothesis because each hypothesis tests a distinct financial mechanism. The dependent variable, estimator and focal coefficients are therefore selected according to the theoretical content of each hypothesis.

H1: Asset-related financial characteristics and ROA

H1 is estimated using Fixed Effects with Arellano clustered standard errors. ROA is the dependent variable, and the model tests whether changes in size, leverage, asset turnover, fixed-asset intensity and liquidity are associated with changes in clinic profitability.

$$ROA_{\mathrm{it}} = \alpha_i + \beta_1 ln\ TA_{\mathrm{it}} + \beta_2 DA_{\mathrm{it}} + \beta_3 TAto_{\mathrm{it}} + \beta_4 FATA_{\mathrm{it}} + \beta_5 CR_{\mathrm{it}} + \lambda_t + \varepsilon_{\mathrm{it}}$$

H2: Asset utilization and operational profitability

H2 is estimated using Mundlak-corrected Random Effects with Arellano clustered standard errors. EBITDA margin is used as the dependent variable because the hypothesis concerns operational profitability rather than net-income performance after financing effects.

$$EBITDA\_margin_{it} = \alpha + \beta_1 TAto_{it} + \beta_2 lnTA_{it} + \beta_3 DA_{it} + \beta_4 FATA_{it} + \beta_5 CR_{it} + \\ + \gamma_1 \overline{TAto}_i + \gamma_2 \overline{lnTA}_i + \gamma_3 \overline{DA}_i + \gamma_4 \overline{FATA}_i + \gamma_5 \overline{CR}_i + \lambda_t + u_i + \varepsilon_{it}$$

H3: Fixed-asset intensity as a moderator

H3 tests whether fixed-asset intensity changes the relationship between asset turnover and ROA. The specification includes the main effects of asset turnover and fixed-asset intensity together with their interaction term.

$$ROA_{it} \\ = \alpha + \beta_1 TAto_{it} + \beta_2 FATA_{it} + \beta_3 (TAto \times FATA)_{it} + \beta_4 lnTA_{it} + \beta_5 DA_{it} + \gamma_1 \overline{TAto}_i + \gamma_2 \overline{FATA}_i \\ + \gamma_3 \overline{lnTA}_i + \gamma_4 \overline{DA}_i + \lambda_t + u_i + \varepsilon_{it}$$

The coefficient on the interaction term shows whether the profitability effect of asset turnover depends on the clinic's level of fixed-asset intensity. Marginal effects are interpreted at low, average, and high levels of FA_TA where necessary.

H4: Operating cash-flow strength and ROA

H4 is estimated using Mundlak-corrected Random Effects with Arellano clustered standard errors. The main explanatory variable is operating cash flow divided by total assets. Current ratio is retained in this model because the hypothesis distinguishes cash-flow strength from static balance-sheet liquidity.

$$ROA_{it} = \alpha + \beta_1 OCFTA_{it} + \beta_2 CR_{it} + \beta_3 lnTA_{it} + \beta_4 DA_{it} + \beta_5 TAto_{it} + \beta_6 FATA_{it} + \gamma_1 \overline{OCFTA}_i + \\ + \gamma_2 \overline{CR}_i + \gamma_3 \overline{lnTA}_i + \gamma_4 \overline{DA}_i + \gamma_5 \overline{TAto}_i + \gamma_6 \overline{FATA}_i + \lambda_t + u_i + \varepsilon_{it}$$

A Pooled OLS model with clinic-clustered standard errors is also estimated as a robustness check for H4, because the panel effect is weaker in this specification than in the main performance models.

H5: Network ownership and performance-gap evolution

H5 is estimated using Mundlak-corrected Random Effects because NETWORK is time-invariant and would be removed under Fixed Effects. The model includes NETWORK and its interactions with the year dummies to test whether the performance gap between network-owned and independent clinics changed over time.

$$ROA_{it} \\ = \alpha + \beta_1 NETWORK_i + \beta_2 (NETWORK \times D2022)_{it} + \beta_3 (NETWORK \times D2023)_{it} \\ + \beta_4 (NETWORK \times D2024)_{it} + \beta_5 lnTA_{it} + \beta_6 DA_{it} + \beta_7 TAto_{it} + \beta_8 FATA_{it} + \gamma_1 \overline{lnTA}_i + \gamma_2 \overline{DA}_i \\ + \gamma_3 \overline{TAto}_i + \gamma_4 \overline{FATA}_i + \lambda_t + u_i + \varepsilon_{it}$$

The interaction coefficients measure the additional ROA difference between network-owned and independent clinics in each year relative to 2021. Increasingly positive and statistically meaningful interaction coefficients over time clearly show the evidence of a widening gap.

Table 3 Estimator choice by hypothesis. (Source: Authors' own methodological specification)

Hypothesis	Dependent Variable	Estimator	Reason for selection
H1	ROA	Fixed Effects with Arellano SE	Hausman test supports FE; focal variables are time-varying
H2	EBITDA Margin	Mundlak RE with Arellano SE	Operational profitability model; correction addresses correlated clinic effects
H3	ROA	Mundlak RE with Arellano SE	Interaction model retains between-clinic structure while correcting RE bias
H4	ROA	Mundlak RE with Arellano SE; Pooled OLS robustness	Tests cash-flow effect and checks sensitivity to weaker panel effects
H5	ROA	Mundlak RE with Arellano SE	NETWORK is time-invariant and cannot be estimated under FE

Robustness Checks and Scope of the Methodology

Robustness checks are used to assess whether the main findings are sensitive to estimator choice or model specification. First, alternative profitability indicators are reviewed where relevant to examine whether the direction of the results is consistent across performance measures. Second, H4 is re-estimated using Pooled OLS with clinic-clustered standard errors. Third, parsimonious specifications are compared with the full models when variables are not theoretically central to the hypothesis. Fourth, ownership-related findings are interpreted cautiously because the number of network-owned clinics is smaller than the number of independent clinics.

Table 4. Diagnostic and robustness procedures

Hypothesis	Dependent Variable	Estimator	Reason for Selection
H1	ROA	Fixed Effects with Arellano SE	Hausman test supports FE; focal variables are time-varying
H2	EBITDA margin	Mundlak RE with Arellano SE	Operational profitability model; correction addresses correlated clinic effects
H3	ROA	Mundlak RE with Arellano SE	Interaction model retains between-clinic structure while correcting RE bias
H4	ROA	Mundlak RE with Arellano SE; Pooled OLS robustness	Tests cash-flow effect and checks sensitivity to weaker panel effects
H5	ROA	Mundlak RE with Arellano SE	NETWORK is time-invariant and cannot be estimated under FE

Source: Authors' own summary based on Breusch and Pagan (1980), Hausman (1978), Mundlak (1978), Arellano (1987), and Cameron and Miller (2015).

Quantitative Analysis and Hypothesis Testing

Hypothesis N1: Asset-Related Financial Characteristics and hospital financial performance

The conducted quantitative analysis of the hypothesis is based on panel data from Georgian multi-profile hospitals over the period 2021-2024, which was conducted with fixed-effects and random-effects with Mundlak approach panel regression models and clustered standard errors.

First Hypothesis presents the idea that assets-related financial characteristics are associated with hospital financial performance. Therefore, it tests whether hospital-level financial characteristics explain differences in financial performance. More specifically, the model examines whether leverage, size, asset turnover, fixed asset intensity and liquidity are associated with profitability after controlling for hospital-specific characteristics and year effects. The hypothesis was tested using fixed effects panel regression with clustered standard errors. The fixed-effects specification focuses mainly on changes within the same hospital over time, rather than simple differences between hospitals. The model tests whether a hospital's financial performance changes when its own financial structure, scale, efficiency or liquidity position changes. Return on assets (ROA) was used as the main dependent variable, while operating profit margin, net margin and EBITDA margin were estimated as additional performance indicators the results are partially supporting the hypothesis. At the model level, the financial variables are statistically meaningful.

Table 5. H1: Key fixed-effects results for ROA (Source: Authors' own findings)

Key variable	Coefficient	p-value	Interpretation
Hospital size (ln_TA)	0.286***	0.005	Positive significant effect on ROA
Leverage (D_A)	-0.330***	0.002	Negative significant effect on ROA
Asset turnover (TA_to)	0.221*	0.063	Marginal positive effect on ROA
Fixed-asset intensity (FA_TA)	0.163	0.377	No significant independent effect
Current ratio (CR)	0.006	0.116	No significant effect on ROA
Year 2022 (D2022)	-0.104***	0.002	ROA is significantly lower than in 2021
Year 2023 (D2023)	-0.192***	<0.0001	ROA is significantly lower than in 2021
Year 2024 (D2024)	-0.200***	<0.0001	ROA is significantly lower than in 2021

*Note. Fixed-effects panel regression with clustered standard errors. Base year is 2021; therefore, D2022, D2023 and D2024 show the difference from 2021. Significance levels: *** p < 0.01, ** p < 0.05, * p < 0.10. H1 is partially supported because several key variables are significant, while fixed-asset intensity and current ratio are not statistically significant in the ROA specification.*

Within the ROA specification joint test on the regressors came back significant, meaning the explanatory variables collectively help explain variation in hospital financial performance. A within R-squared of around 0.61 indicates that the model explains a substantial portion of the within-hospital variation in ROA over the four year period. The strongest and most consistent result is related to hospital size model. The coefficient of ln_TA is positive and statistically significant in all four models. In the ROA model, ln_TA has a coefficient of 0.286 and a p-value of 0.005. It is also positive and significant in the operating profit margin, net margin and EBITDA margin models. This means that larger hospitals tend to show stronger financial performance, even after controlling for leverage, asset turnover, fixed asset intensity, liquidity and year effects. The result suggests that scale is an important financial factor in the hospital sector. Leverage shows a negative effect, but also its significance depends on the performance measure. In the ROA model, the debt-to-assets ratio has a coefficient of -0.330 and is statistically significant at the 1% level. The same variable is also negative and significant in the net margin model. Which means that higher lever age is associated with weaker return on assets and lower net profitability. However, leverage is not statistically significant in the operating profit margin and EBITDA margin models. According to this debt affects

profitability most when measured at the net level rather than the operating level. Asset turnover is another important determinant. Its coefficient is positive across all of the models. It is statistically significant in the operating profit margin, net margin and EBITDA margin models, while in the ROA model it is positive but only marginally significant. Therefore, hospitals generating more revenue from their asset base tend to perform better financially. The finding is especially relevant and important in a hospital context, where expensive facilities, medical equipment and infrastructure create a need for efficient asset use. Fixed asset intensity does not show a statistically significant effect in the models. The ratio of fixed assets to total assets is insignificant. According to these results, there is not enough evidence to conclude that a higher fixed-asset share independently improves or worsens hospital performance. The current ratio also does not show a stable effect. It is insignificant in the ROA, operating profit margin and net margin models, while it is negative and significant only in the EBITDA margin model. Since this effect is not consistent across the models, liquidity should not be treated as a strong determinant of financial performance in this sample. This analysis is important since based on the model's year effects show a clear negative pattern. In the model 2021 is the base year, which is followed by the negative and mostly significant coefficients for 2022, 2023 and 2024. This trend clearly points out that hospital financial performance declined in later years relative to 2021. This pattern appears across several performance specifications. Therefore, the result points to broader sector-level pressure during the observed period.

Hypothesis 2: Asset Utilization and Operational Profitability

Second Hypothesis proposes that asset utilization is positively associated with hospital operational profitability. It tested whether asset utilization moderates the relationship between fixed-asset intensity and financial performance. The dependent variable in this test was ROA and the key variable was the interaction between fixed assets to total assets and asset turnover. This model does not only test whether fixed-asset intensity or asset turnover matters separately. It tests whether the effect of one variable depends on the level of the other. The interaction term between fixed-asset intensity and asset turnover is negative and statistically significant.so the hypothesis is supported. The positive effect of asset utilization on ROA becomes weaker as fixed-asset intensity increases. Put differently, hospitals with heavier fixed-asset structures do not benefit from asset turnover improvements as strongly as hospitals with lower fixed-asset intensity. According to this finding, The main effect of asset turnover is positive and statistically significant, showing that higher asset utilization is generally associated with stronger ROA. However, because the interaction term is significant, the asset turnover coefficient cannot be interpreted alone. Its effect depends on the level of fixed-asset intensity. The main effect of fixed-asset intensity itself is not statistically significant.

Table 6. H2: Asset utilization and EBITDA margin performance (Source: Authors' own findings)

Key variable	Coefficient	p-value	Interpretation
Hospital size (ln_TA)	0.268***	<0.0001	Positive significant effect on EBITDA margin
Leverage (D_A)	-0.141	0.210	No significant effect on EBITDA margin
Asset turnover (TA_to)	0.319***	<0.0001	Strong positive significant effect; main evidence supporting H2
Fixed-asset intensity (FA_TA)	-0.191	0.124	No significant independent effect
Current ratio (CR)	-0.012***	0.003	Negative significant effect
Network ownership	0.016	0.729	No significant baseline ownership effect
Year 2022 (D2022)	-0.041*	0.054	Marginally lower EBITDA margin than in 2021
Year 2023 (D2023)	-0.123***	<0.0001	Significantly lower EBITDA margin than in 2021
Year 2024 (D2024)	-0.128***	<0.0001	Significantly lower EBITDA margin than in 2021

Note. Mundlak random-effects panel regression with clustered standard errors. Base year is 2021. The hypothesis is supported because asset turnover is positive and highly statistically significant for EBITDA margin.

According to this finding, the fixed assets do not independently explain ROA unless their relationship with asset utilization is also considered. The findings clearly state that fixed assets need to be supported by sufficient revenue generation. When capital intensity is high the utilization rate must be also efficient. The control variables are consistent with the broader findings of the study. Hospital size remains positive and significant, while leverage remains negative and significant. The year effects are also negative and significant, again showing weaker performance after 2021.

Hypothesis 3: Fixed-Asset Intensity and the Asset Utilization-Performance Relationship

Third hypothesis is that fixed-asset intensity moderates the relationship between asset utilization and hospital financial performance. It tests whether liquidity and operating cash-flow strength are significant determinants of hospital financial performance. The dependent variable in this model was ROA. The main variables were operating cash flow to total assets and current ratio, while the model also included and controlled for size, leverage, asset turnover, fixed asset intensity, ownership, year effects and Mundlak mean variables. The model is jointly significant, which means that the included regressors collectively explain variation in ROA. However, the two liquidity-related variables do not behave in the same way. Operating cash flow to total assets has a positive and statistically significant coefficient. According to these tests, hospitals with stronger operating cash generation relative to their asset base tend to achieve higher return on assets. By contrast, the current ratio is not statistically significant. So the traditional short-term liquidity, measured through current assets relative to current liabilities, does not independently explain ROA in this model.

Table 7. H3: Moderating effect of fixed-asset intensity on the asset utilization-ROA relationship (Source: Authors' own findings)

Key variable	Coefficient	p-value	Interpretation
Hospital size (ln_TA)	0.266***	0.0003	Positive significant control effect
Leverage (D_A)	-0.315***	0.0007	Negative significant control effect
Asset turnover (TA_to)	0.517**	0.015	Positive effect before accounting for interaction
Fixed-asset intensity (FA_TA)	0.372	0.149	No significant direct effect
FA_TA x TA_to interaction	-0.557**	0.040	Significant negative moderation effect; main evidence supporting H3
Network ownership	0.015	0.650	No significant baseline ownership effect
Year 2022 (D2022)	-0.088***	0.0002	ROA is significantly lower than in 2021
Year 2023 (D2023)	-0.175***	<0.0001	ROA is significantly lower than in 2021
Year 2024 (D2024)	-0.183***	<0.0001	ROA is significantly lower than in 2021

Note. Mundlak random-effects panel regression with clustered standard errors. The interaction term FA_TA x TA_to is the key coefficient for this hypothesis. The negative and significant interaction shows that the positive effect of asset turnover on ROA weakens as fixed-asset intensity increases.

Therefore, the hypothesis is not fully supported. The evidence also suggests that cash-generation capacity matters more for hospital performance than the static liquidity position shown by the current ratio. The control variables are consistent with the earlier profitability models. Hospital size remains positive and statistically significant, while leverage has a negative and statistically significant effect on ROA. The year effects are also negative and significant for 2022, 2023 and 2024. This hypothesis also confirms that hospital performance declined relative to the base year of 2021.

Hypothesis 4: Operating Cash-Flow Strength and Liquidity

The fourth hypothesis focuses on the role of cash-generation capacity in hospital financial performance. This hypothesis has an emphesis on operational profitability rather than overall profitability. EBITDA margin is useful in this context because it excludes interest, taxes, depreciation and amortization, allowing the analysis to focus more directly on operating performance. According to the analysis, Asset turnover has a positive and highly statistically significant coefficient. This proves that the hospitals generating more revenue per unit of assets tend to achieve higher EBITDA margins. Asset utilization is one of the strongest operational performance drivers in the analysis. Hospital size is also positive and statistically significant, showing that larger hospitals tend to have stronger EBITDA margins. This is consistent with the wider finding that scale is an important determinant of hospital financial performance. Current ratio, however, is negative and statistically significant in this model. Tehrefore the higher short-term liquidity may be associated with weaker operational profitability. One possible interpretation is that excessive current assets may represent idle resources that are not being used productively. This interpretation should be stated cautiously, but the result shows that liquidity does not always have a positive relationship with performance. Leverage is not statistically significant in the EBITDA margin model. This result is logical because EBITDA is calculated before interest expense. Therefore, debt burden may reduce ROA or net margin through financing costs, but it should not necessarily affect EBITDA margin directly. This difference strengthens the analysis because it shows that different profitability indicators capture different financial mechanisms. The year effects show that EBITDA margin was significantly lower in 2023 and 2024 relative to 2021, while the 2022 effect is only marginally significant. Operational profitability pressure appeared to intensify in the later years of the study period.

Table 8. H4: Operating cash-flow strength and liquidity as determinants of ROA (Source: Authors' own findings)

Key variable	Coefficient	p-value	Interpretation
Hospital size (ln_TA)	0.246***	0.005	Positive significant control effect
Leverage (D_A)	-0.341***	0.004	Negative significant control effect
Asset turnover (TA_to)	0.152	0.177	No significant effect in this specification
Fixed-asset intensity (FA_TA)	0.061	0.728	No significant effect
Current ratio (CR)	0.004	0.255	Traditional liquidity is not significant
Operating cash flow to assets (OCF_TA)	0.325**	0.018	Positive significant effect on ROA; main evidence supporting H4
Network ownership	0.011	0.595	No significant baseline ownership effect
Year 2022 (D2022)	-0.091***	0.001	ROA is significantly lower than in 2021
Year 2023 (D2023)	-0.160***	<0.0001	ROA is significantly lower than in 2021
Year 2024 (D2024)	-0.174***	<0.0001	ROA is significantly lower than in 2021

Note. Mundlak random-effects panel regression with clustered standard errors. H4 is partially supported because OCF_TA is positive and significant, while current ratio is not statistically significant.

Hypothesis 5: Network Ownership and Time-Varying Performance Gap

The last hypothesis tested whether the financial performance gap between network-owned and independent hospitals widened after the base 2021 year. This hypothesis was not designed to test only whether network-owned hospitals had higher performance on average. Instead, it tested whether the relative difference between the two ownership groups changed over time. The key variables in the model are the interaction

terms between network ownership and the years for 2022, 2023 and 2024. The Mundlak random-effects model included the same financial control variables as the first hypothesis but together with the ownership variable and year effects. In this case network ownership coefficient shows whether network-owned hospitals differed from independent hospitals in the base period. Model uses The interaction terms as well which show whether that ownership difference became larger or smaller in later years compared with 2021. Final model results show that the standalone network ownership coefficient is not statistically significant in the models. According to these results there is not a clear performance advantage for network-owned hospitals in the base year. However, the ownership-year interaction terms become positive and statistically significant in later years, especially in 2023 and 2024. This matters because the financial position of network-owned hospitals strengthened over time compared to the independent ones. The same results between network ownership and 2022 in the first ROA model is positive but is not statistically significant. In 2023, the interaction becomes positive and statistically significant, with a coefficient of 0.121 and a p-value of 0.016. In 2024, the coefficient increases to 0.150 and remains statistically significant, with a p-value of 0.002. This provides clear evidence that the ROA gap between network-owned and independent hospitals widened after 2022. The operating profit margin results also support the hypothesis. The 2022 ownership interaction is not significant, but the 2023 and 2024 interaction terms are positive and significant. Based on this information performance gap which widened over time was not visible only in net income-based measures, but also in operating profitability. The EBITDA margin model is slightly weaker. The 2023 ownership interaction is positive and statistically significant, while the 2024 interaction is positive but only marginally significant. Therefore, EBITDA margin provides directionally consistent evidence, but it is less strong than the ROA, net margin and operating profit margin results.

Table 9. H5: Ownership-year interactions for ROA and operating profit margin (Source: Authors' own findings)

Performance measure	Term	Coefficient	p-value	Interpretation
ROA	Network ownership	-0.073	0.123	No significant base-year difference
ROA	Network x 2022	0.057	0.171	No significant difference from 2021
ROA	Network x 2023	0.121**	0.016	Positive significant widening of ROA gap
ROA	Network x 2024	0.150***	0.002	Positive significant widening of ROA gap
Operating profit margin	Network ownership	-0.034	0.527	No significant base-year difference
Operating profit margin	Network x 2022	0.016	0.634	No significant difference from 2021
Operating profit margin	Network x 2023	0.098**	0.026	Positive significant widening of operating margin gap
Operating profit margin	Network x 2024	0.088**	0.040	Positive significant widening of operating margin gap

Note. Mundlak random-effects panel regressions with clustered standard errors. Network ownership alone measures the base-year ownership difference. Network x year terms measure whether the gap changed relative to 2021.

Taken together, the quantitative analysis provides empirical support for the central argument of this study: asset-based financial characteristics are meaningful determinants of hospital financial performance, though their effects are not uniform across variables or performance measures. Findings show that the hospital size and asset utilization are the most important drivers of profitability and leverage affects mostly the return-based measures. Based on the panel data cash-flow strength proved to be more relevant than traditional liquidity. Researched context of ownership structure becomes significant factor after 2021.

Summary of Hypothesis Testing Results

The quantitative analysis based on the observed five hypothesis supports the main argument of the study and shows that asset-based financial metrics affect hospital financial performance. Hospital size and asset utilization are the most important for hospital profitability. Leverage has negative effect on return-based measures and it is visible that fixed-asset intensity only matters with asset utilization. Cash flow turns out to be a better indicator than standard liquidity ratios. Ownership starts out as a weak predictor but gains importance later, since the gap between hospitals becomes wider. Alongside these firm-level findings, the consistent pattern of declining year effects across all models points to broader sector-level pressures during the 2021–2024 period, which provides important context for interpreting the cross-sectional variation in hospital performance.

Table 10: Hypothesis outcomes and interpretation (Source: Authors' own findings)

Hypothesis	Main result	Outcome	Interpretation
H1	Hospital size and asset turnover show the most consistent positive relationship with financial performance. Leverage is negative mainly for ROA and net margin, while fixed-asset intensity and current ratio are not stable determinants.	Partially supported	Hospital financial performance is explained by selected firm-level financial characteristics, but not all indicators have equal explanatory power.
H2	Asset turnover has a positive and statistically significant relationship with EBITDA margin.	Supported	Hospitals that generate more revenue from their asset base tend to achieve stronger operational profitability.
H3	The interaction between fixed-asset intensity and asset turnover is negative and statistically significant.	Supported	The positive effect of asset utilization on ROA becomes weaker when hospitals have heavier fixed-asset structures.
H4	Operating cash flow to total assets is positive and statistically significant, while current ratio is not significant.	Partially supported	Cash-generation capacity is more relevant for hospital performance than traditional balance-sheet liquidity.
H5	Network ownership alone is not significant in the base year, but network ownership x year interactions become positive and significant in later years, especially 2023 and 2024.	Partially supported	Network-owned hospitals appear to become relatively more financially resilient over time, but this should not be interpreted as a permanent ownership advantage.

Discussion & Conclusions

Discussion of Empirical Findings

The research results show that financial performance of Georgian private multiprofile hospitals is explained unevenly by the tested financial characteristics. The results support the general proposition that asset-related characteristics are associated with hospital performance, but they do not support all variables with the same strength. Hospital size and asset turnover show the clearest positive relationship with profitability, while leverage is negatively associated with ROA and net margin. In contrast, fixed-asset intensity and the current ratio do not appear as stable independent determinants. Therefore, based on the results financial performance differences observed in the sample are not explained by the possession of assets alone, but by the extent to which hospitals use, finance and convert those assets into returns.

The hypothesis that asset-related financial characteristics are associated with hospital financial performance is only partially supported. The positive and significant size effect shows that larger hospitals in the sample were generally better positioned financially. However, the same model shows that fixed-asset intensity is not statistically significant which means that the results support the importance of scale, but not the idea that a larger fixed-asset share automatically strengthens profitability. This finding is important because it shows that the financial benefit appears to come from productive scale rather than from capital intensity by itself. Asset turnover is also positive across the performance models and is especially strong in the EBITDA margin specification. Since EBITDA margin measures operating profitability before financing and depreciation effects, the result points out that hospitals generating more revenue from their asset base tend to achieve stronger operating performance. This supports the previously proposed hypothesis that asset

utilization is positively associated with hospital operational profitability. The results for fixed-asset intensity alone is not significant, but its interaction with asset turnover is negative and statistically significant. According to this the fixed-asset intensity moderates the relationship between asset utilization and financial performance. The positive effect of asset turnover on ROA becomes weaker when hospitals have a heavier fixed-asset structure. Asset utilization improves performance, but the strength of that improvement depends on the capital structure behind the asset base. In practice, the result indicates that high fixed-asset intensity may absorb part of the benefit created by higher revenue generation from assets. Leverage also explains why operating improvement does not always mean stronger final profitability. Debt-to-assets is negative and significant for ROA and net margin, but it is not significant in the EBITDA margin model. This difference is important because EBITDA margin is measured before interest expense, while ROA and net margin are affected by financing costs. Based on this financing structure important for profitability. Study proposed another hypothesis that operating cash-flow strength is positively associated with hospital financial performance, which is supported but only partially. Operating cash flow to total assets is positive and statistically significant and the current ratio is not significant. Operating cash flow had a positive result and based on that finding hospitals that generate more cash from their asset base tend to perform better financially. Another very interesting dimension is the ownership results, since research showed that network ownership alone is not statistically significant in the base year of 2021. Meaning that the results do not show a permanent advantage for network-owned hospitals. However, the interaction between network ownership and later years becomes positive and significant, especially in 2023 and 2024. This supports the hypothesis that the financial performance gap between network-owned and independent hospitals widened over the 2021–2024 period. Network-owned hospitals appear to have improved their relative position in later years, while independent hospitals did not show the same pattern. The year effects here are also additional context for the interpretation of these findings. Across the models, 2022, 2023 and 2024 are generally associated with weaker performance relative to 2021. Since the models include year dummy variables, these results indicate that common annual pressures affected the hospital sector during the observed period. This makes the ownership result more interesting, since the widening network-independent gap occurred during years when overall performance was weaker than in the base year. Therefore, the results suggest that differences in financial structure, asset use, cash generation and organizational form became more visible under less favorable sector conditions.

The findings show that the central issue is not whether hospitals have assets, debt, and liquidity or ownership advantages separately. The main conclusion is that hospital financial performance in the sample depends on the fit between asset utilization, fixed-asset intensity, leverage and cash flow generation. Asset turnover improves performance, but its effect weakens when the fixed-asset burden is high. Leverage reduces final profitability when financing costs absorb operating gains. Operating cash flow explains performance better than the current ratio. Network ownership becomes relevant over time rather than as an immediate baseline advantage. All of these findings support the study argument that capital efficiency is central to understanding financial performance among Georgian private multiprofile hospitals.

Table 11. Sample results (Source: Authors' own findings)

Mechanism	Empirical Data	Meaning for hospital performance
Capacity	Hospital size is consistently positive; fixed-asset intensity alone is not significant.	Scale can support performance, but just physical capacity does not create profitability.
Assets	Asset turnover is positive, especially for EBITDA margin.	Assets improve operating profitability when they are actively converted into revenue.
Capital	TA_to x FA_TA interaction is negative and significant.	High fixed-asset intensity reduces the profitability gain from utilization because more cost is attached to the asset base.
Financing	Leverage is negative for ROA and net margin but not for EBITDA margin.	Debt weakens final profitability through financing costs rather than operating performance itself.
Cash conversion	OCF_TA is positive and significant; current ratio is not.	Financial resilience depends more on internally generated cash than on static balance-sheet liquidity.
Ownership	Network-year interactions become positive and significant after 2022.	Network structures may create advantages under sector-wide pressure through governance, coordination and financial control.

Concluding Synthesis

The empirical findings lead to the conclusion that the financial performance of Georgian private multiprofile hospitals depends on the alignment between capacity, utilization, and financing and cash generation. The study shows that a larger fixed-asset base does not mean better performance. Size and asset turnover are beneficial for profitability but only under certain conditions. Leverage and high fixed-asset intensity can get in the way and limiting how much of the operating activity actually show in the final profitability. The strongest asset-based evidence comes from the asset turnover result in the EBITDA margin model and from the negative interaction between asset turnover and fixed-asset intensity in the ROA model. All these results show that utilization matters, but its financial effect is weaker where the hospital has a heavier fixed-asset structure. This is the main contribution of the study because it focuses to only about the ownership of the assets, which is usually a really good sign for financial stability, to whether those assets are productive enough relative to the capital burden they create for the hospital. Operating cash flow to total assets is also significant while the current ratio is not; showing that financial resilience in the sample is more closely connected to cash generated from operations than to static liquidity. Network ownership context, which is quite important in the Georgian environment, becomes significant through later-year interactions, showing that ownership differences became more visible over time and after the covid-19 rather than existing as a fixed base-year advantage.

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