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Economic Performance Drivers and Fiscal Resilience in Indian Airports

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Abstract— Indian civil aviation has undergone a structural transformation over the past two decades, moving from a wholly state-managed airport network toward a mixed public-private ecosystem shaped by liberalization, privatization, and regulatory reform. This manuscript examines the economic performance drivers of Indian airports and the fiscal resilience mechanisms that allow these entities to withstand demand shocks, capacity constraints, and regulatory uncertainty. Drawing on verifiable academic literature spanning efficiency measurement, privatization economics, and tariff regulation, the paper develops a conceptual framework linking traffic-driven revenue generation, non-aeronautical diversification, capital expenditure financing, and regulatory design to long-run financial sustainability. The discussion is supported by illustrative tables summarizing performance drivers and resilience indicators. The paper concludes that fiscal resilience in Indian airports depends less on ownership structure alone and more on the interaction between operational efficiency, revenue diversification, and the predictability of the regulatory till mechanism.

Keywords— Indian airports, economic performance, fiscal resilience, airport privatization, non-aeronautical revenue, Airports Economic Regulatory Authority, efficiency

INTRODUCTION

The airport sector occupies a distinctive position in national infrastructure economics. Airports function simultaneously as commercial enterprises, public utilities, and gateways for regional economic activity, which means their performance cannot be assessed through conventional corporate metrics alone. In India, the sector has experienced accelerated growth driven by rising passenger volumes, the entry of low-cost carriers, regional connectivity schemes, and the phased transfer of major hubs to private consortia through concession agreements. This growth has occurred alongside recurring fiscal stress points: high capital intensity, exposure to fuel price and exchange rate volatility, cyclical demand, and the regulatory constraints imposed on tariff-setting.



Fig. 1. Conceptual Framework

Economic performance in this context refers to an airport's capacity to generate revenue and operating surplus relative to its asset base, traffic volume, and cost structure. Fiscal resilience refers to a broader and more dynamic property: the ability of an airport operator, whether the state-owned Airports Authority of India (AAI) or a private concessionaire, to absorb adverse shocks, sustain debt servicing obligations, and continue funding capital expansion without triggering tariff shocks for users or fiscal distress for the operator. These two concepts are related but distinct. An airport may show strong short-run profitability while remaining fiscally fragile if its revenue base is narrow or its capital structure is highly leveraged. Conversely, an airport with modest margins may be fiscally resilient if it benefits from diversified revenue streams and a predictable regulatory framework.

This manuscript synthesizes existing scholarship on Indian airport privatization, efficiency measurement, and economic regulation to identify the principal drivers of economic performance and the structural features that underpin fiscal resilience. The analysis proceeds through a review of relevant literature, articulation of a research gap, a stated set of research objectives, a discussion of research methodology suited to this domain, and a structured discussion supported by illustrative tables.



Fig. 2. Economic Performance Drivers

LITERATURE REVIEW

Scholarship on Indian airport economics has developed along three broad strands: the political economy of privatization, technical and productive efficiency measurement, and the design of aeronautical tariff regulation.

On privatization, Ohri (2009) situates the Indian experience within the broader rationale for airport privatization and international precedent, noting that gaps between Indian and international airports in metrics such as non-aeronautical revenue per passenger and passengers per employee were used to identify areas requiring improvement as the sector modernized. This early discussion paper remains a foundational reference because it frames privatization not as an ownership question alone but as a response to specific operating and financial performance gaps relative to global peers.

More recent empirical work has tested the causal effects of privatization directly. Howell, Kim, and Weisbach's National Bureau of Economic Research working paper examines evidence from airports on the effects of infrastructure privatization, contributing to a growing body of causal evidence on how ownership transitions affect infrastructure performance. This line of inquiry is important for the present analysis because it moves beyond descriptive comparison toward identifying whether observed performance differences between public and private airports reflect genuine efficiency gains or selection effects, since the airports chosen for privatization are often not randomly selected.

A second strand of literature applies frontier efficiency techniques, principally Data Envelopment Analysis (DEA), to benchmark airport performance. Chand, Mohapatra, and Jena (2024) apply DEA to twenty major Indian airports, using average expenditure, airport size, parking bays, and runways as inputs against passenger volume, revenue, aircraft movements, and freight as outputs, finding increasing returns to scale at ten airports, decreasing returns at two, and constant returns at eight, with the Malmquist Productivity Index further decomposed into technical change, efficiency effects, and scale effects. Their analysis identifies Bangalore, Chennai, Cochin, Delhi, and Mumbai as the airports exhibiting the highest operational efficiency scores. This study is methodologically significant because it demonstrates that efficiency in the Indian context is not simply a function of ownership status; several AAI-managed and privatized airports appear on both sides of the efficiency frontier depending on scale and traffic composition.

Complementing this, Thomas and Jha (2022) focus specifically on the structural efficiency of forty-two Indian regional airports over the 2014 to 2019 period using a two-stage DEA approach, finding that distance to the nearest airport, distance from the city centre, per capita income, accessibility, and profitability significantly influence structural efficiency scores, with productivity growth further assessed through the Malmquist Productivity Index. Their findings extend the efficiency literature beyond the major metro airports that dominate most prior studies, and are particularly relevant to fiscal resilience because regional airports typically operate with thinner traffic bases and are more exposed to demand volatility, making structural and locational factors a first-order determinant of financial viability.

A third contribution to the efficiency literature is offered by work published in the Journal of Air Transport Management that develops an integrated performance evaluation approach for Indian international airports, extending single-method efficiency analysis toward a multi-criteria evaluation that incorporates operational, economic, and service dimensions simultaneously. This integrated approach is instructive for fiscal resilience research because it treats financial performance as one of several interacting dimensions rather than an isolated outcome.

On the regulatory dimension, the Airports Economic Regulatory Authority (AERA) constitutes the central institutional mechanism shaping airport revenue certainty in India. Under the Hybrid Till mechanism adopted by AERA following the National Civil Aviation Policy, thirty percent of non-aeronautical revenue generated at an airport is allocated toward cross-subsidization of aeronautical charges, with AERA's tariff determination methodology incorporating this cross-subsidy into the calculation of allowed revenue for airport operators. This mechanism is central to any discussion of fiscal resilience because it directly links an airport's commercial, non-aeronautical performance to the regulated aeronautical tariffs that airlines and passengers ultimately pay. AERA itself was established as a statutory body under the Airports Economic Regulatory Authority of India Act, 2008, with its core functions including tariff determination for aeronautical services, determination of other airport charges, and monitoring of performance standards at major airports. The authority regulates airports with annual passenger traffic of at least thirty-five lakh, classified as

major airports, while airports below this threshold are regulated by their own operators with AERA's guidance.

The regulatory framework itself has been subject to ongoing revision. More recently, AERA has proposed increasing the share of non-aeronautical revenue used to offset airport fees, moving away from the current hybrid till arrangement in which operators retain seventy percent of non-aeronautical revenue while thirty percent cross-subsidizes aeronautical charges, citing international practice in the United Kingdom, France, and Spain, which predominantly use a single till mechanism. This proposed shift illustrates that the fiscal architecture of Indian airports is not static; regulatory design choices around till mechanisms materially affect the incentive of operators to invest in commercial revenue streams versus aeronautical infrastructure.

Taken together, this body of literature suggests three broad conclusions relevant to the present study. First, privatization alone does not guarantee superior economic performance; efficiency outcomes vary by airport scale, traffic composition, and locational characteristics. Second, non-aeronautical revenue has emerged as a central lever of both economic performance and fiscal resilience, but its treatment under regulatory tariff mechanisms significantly shapes operator incentives. Third, most existing efficiency studies concentrate on operational and technical efficiency rather than on fiscal resilience defined as the capacity to absorb shocks and sustain capital expenditure programs, leaving an analytical gap that the present manuscript seeks to address conceptually.

Research Gap

While the reviewed literature provides substantial evidence on technical efficiency and the mechanics of privatization, three gaps remain evident. First, efficiency studies using DEA and related frontier methods measure input-output performance at a point in time or across short panels, but do not directly model resilience, that is, the capacity of airports to sustain performance under revenue or cost shocks such as the sharp traffic collapse experienced during the COVID-19 pandemic. Second, the interaction between the regulatory till mechanism and airport capital structure has been discussed primarily in legal and regulatory commentary rather than integrated into economic performance models. Third, comparative work distinguishing metro, regional, and greenfield airports on fiscal resilience criteria, rather than technical efficiency criteria alone, remains limited. This manuscript addresses these gaps conceptually by proposing a framework that links performance drivers to resilience outcomes.



Fig. 3. Fiscal Resilience Framework

Objectives of the Study

The study is guided by the following objectives. The first objective is to identify and categorize the principal economic performance drivers operating across Indian airports of varying scale and ownership structure. The second objective is to examine the fiscal resilience mechanisms available to Indian airport operators, including revenue diversification, regulatory cross-subsidy, and capital financing structures. The third objective is to assess how the regulatory tariff framework administered by AERA interacts with operator incentives for commercial revenue generation. The fourth objective is to derive policy-relevant implications for strengthening fiscal resilience across the differentiated segments of the Indian airport network, namely metro, regional, and greenfield airports.

Research Methodology

This manuscript adopts a conceptual and literature-synthesis methodology rather than primary quantitative estimation. Given the objective of consolidating dispersed evidence on efficiency, privatization outcomes, and regulatory design into a coherent framework, the approach draws on a structured review of peer-reviewed studies, working papers, and primary regulatory documentation. Sources were selected on the basis of direct relevance to Indian airport economics, verifiability through publisher or institutional records, and methodological rigor, with priority given to studies employing DEA, Malmquist Productivity Index decomposition, or causal inference techniques. The synthesis is organized thematically around four categories of performance drivers, namely traffic and demand-side drivers, cost and operational efficiency drivers, revenue diversification drivers, and regulatory and capital structure drivers, each of which is examined for its contribution to fiscal resilience outcomes. This approach is appropriate for a topic where the underlying empirical base is fragmented across efficiency studies, legal commentary, and regulatory filings, and where the analytical contribution lies in integration rather than new primary estimation.

Conceptual Framework: Linking Performance to Resilience

Economic performance and fiscal resilience can be understood as sitting along a causal chain. Traffic growth and route network expansion generate the volume base for aeronautical revenue. Operational efficiency, as measured through frontier techniques such as DEA, determines how effectively a given level of traffic and infrastructure is converted into throughput and revenue. Non-aeronautical revenue, including retail, cargo, real estate, and advertising, provides a diversification buffer against aeronautical revenue volatility. Finally, the regulatory tariff mechanism determines how commercial revenue is treated in the calculation of allowed aeronautical charges, which in turn shapes the incentive structure for operators to invest in commercial development. Fiscal resilience emerges from the interaction of these four layers rather than from any single driver in isolation.

Table 1: Economic Performance Drivers in Indian Airports

Driver category	Representative indicators	Illustrative evidence from literature
Traffic and demand	Passenger volume, aircraft movements, cargo tonnage	Traffic scale strongly differentiates major and regional airport efficiency scores in DEA-based studies
Operational efficiency	Technical efficiency score, scale efficiency, Malmquist productivity index	Increasing returns to scale identified at ten of twenty major airports studied, with Bangalore, Chennai, Cochin, Delhi, and Mumbai showing the highest operational efficiency
Locational and structural factors	Distance to nearest airport, distance from city centre, regional per capita income	Structural efficiency of regional airports found to be significantly influenced by locational accessibility and regional income levels
Revenue diversification	Non-aeronautical revenue share, retail and real estate income	Gaps in non-aeronautical revenue per passenger relative to international airports identified as a key improvement area
Ownership and governance	Public sector, PPP concession, joint venture models	Causal evidence on infrastructure privatization suggests performance effects are contingent on governance design rather than ownership transfer alone

Discussion

Traffic growth remains the single most visible driver of airport economic performance in India, given the strong correlation between passenger throughput and both aeronautical and non-aeronautical revenue. However, the literature indicates that traffic volume alone is an incomplete predictor of financial performance. Efficiency studies consistently show that airports converting a given traffic base into revenue and operational output with lower relative input use, whether measured in expenditure, parking bays, or runway capacity, achieve superior efficiency scores. This distinction matters because it implies that capacity expansion without corresponding efficiency gains in resource utilization does not automatically translate into improved economic performance.

Locational and structural characteristics play a disproportionately large role for regional and smaller airports. Regional airports operating close to a larger competing airport, or located far from the urban centre they nominally serve, face structural disadvantages that are largely outside management control. This has direct implications for fiscal resilience, since airports facing such structural constraints require differentiated financial support mechanisms, such as the Regional Connectivity Scheme subsidies, rather than being judged against the same efficiency benchmark as metro hubs.

Non-aeronautical revenue diversification has emerged as arguably the most policy-relevant driver of both performance and resilience. Airports with a broader commercial base, encompassing retail concessions, cargo handling, real estate monetization, and advertising, are better positioned to absorb shocks to aeronautical demand, since these revenue streams are not always as tightly coupled to passenger volume fluctuations as landing and parking charges. The persistent gap identified between Indian and international airports on non-aeronautical revenue per passenger suggests substantial unrealized potential in this driver category, particularly at AAI-managed regional airports where commercial development has historically lagged behind the major metro hubs.

Ownership and governance structure, while widely debated, functions less as a direct performance driver and more as a mediating variable that shapes incentives for the other three

drivers. Private concessionaires under Public-Private Partnership arrangements have generally been associated with faster infrastructure modernization and stronger commercial revenue development, but the causal evidence on whether privatization itself improves productive efficiency, independent of the selection of high-traffic airports for privatization, remains an active area of empirical inquiry.

Table 2: Fiscal Resilience Mechanisms and Associated Risks

Resilience mechanism	Function	Associated risk if poorly designed
Hybrid till regulation	Cross-subsidizes aeronautical charges using thirty percent of non-aeronautical revenue	Reduces operator incentive to develop non-aeronautical revenue beyond the retained share
Multi-Year Tariff Proposal cycle	Provides five-year tariff certainty for capital planning	Rigidity can delay tariff response to demand shocks between control periods
Revenue diversification	Buffers aeronautical revenue volatility through commercial income	Concentration in a small number of high-value concessions increases counterparty risk
Regional Connectivity Scheme support	Provides viability gap funding for underserved regional routes	Creates dependency on continued subsidy rather than organic traffic growth
Concession and PPP capital structuring	Shifts capital expenditure financing risk to private operators	High leverage in concession-financed airports increases sensitivity to traffic shocks

Discussion: Fiscal Resilience under Regulatory Design

The Hybrid Till mechanism administered by AERA is the single most consequential regulatory design feature affecting fiscal resilience in Indian airports. Under this framework, a defined share of non-aeronautical revenue is used to reduce the aeronautical charges that would otherwise need to be levied on airlines and passengers to recover an operator's allowed revenue requirement. This arrangement produces a structural link between an airport's commercial success and its regulated tariff base, meaning that an airport which grows its non-aeronautical revenue can, over the regulatory control period, sustain lower aeronautical charges for the same allowed revenue, improving competitiveness for airlines operating from that airport.

At the same time, the proposed shift toward a model in which a larger share of non-aeronautical revenue is used to reduce user charges reflects an underlying policy debate about the appropriate balance between protecting airport operator returns and protecting passenger and airline costs. A move toward a more single-till-oriented approach could reduce the residual commercial upside retained by operators, which may in turn dampen incentives for continued investment in retail, real estate, and other commercial airport infrastructure. This is a genuine tension in resilience design: mechanisms intended to lower costs for users in the short run may, if not carefully calibrated, reduce the very commercial revenue diversification that underpins long-run fiscal resilience.

The five-year Multi-Year Tariff Proposal cycle provides operators with a degree of revenue certainty that supports long-horizon capital planning, which is essential given the capital intensity of runway, terminal, and cargo infrastructure investment. However, this same feature can introduce rigidity when demand shocks occur mid-cycle, as was evident during the sharp traffic contraction associated with the COVID-19 pandemic, when aeronautical revenue collapsed well below the traffic projections embedded in existing tariff orders. Fiscal resilience in such episodes depends on the availability of mechanisms for interim tariff review, and on the extent to which an operator's revenue base was diversified prior to the shock.

Concession-based capital structuring, used extensively in the metro airport privatizations at Delhi, Mumbai, Hyderabad, and Bangalore, has enabled substantial capacity expansion without direct sovereign capital expenditure. This financing model shifts construction and demand risk onto private operators, which supports fiscal resilience from the perspective of public finances but can concentrate financial risk within individual concessionaires if traffic underperforms projections used at the time of debt structuring. Regional airports operated by AAI, by contrast, generally carry lower leverage but also face thinner commercial revenue bases, meaning their resilience depends more heavily on continued government support through schemes such as the Regional Connectivity Scheme than on internally generated buffers.

Policy Implications

Several policy implications follow from this synthesis. Regulatory design should continue to evolve the till mechanism in a manner that preserves operator incentives for non-aeronautical revenue development while protecting airlines and passengers from excessive aeronautical charge escalation, since these two objectives are in partial tension rather than fully aligned. Differentiated resilience strategies are needed across airport categories: metro and greenfield airports under concession arrangements require close monitoring of leverage and traffic risk exposure, while regional airports require continued and predictable public support mechanisms given their structural revenue constraints. Regulatory tariff cycles could benefit from

clearer, pre-defined trigger conditions for interim review during exogenous demand shocks, reducing the lag between demand disruption and tariff response. Finally, closing the non-aeronautical revenue gap relative to international peer airports remains a significant unrealized source of both economic performance improvement and fiscal resilience, particularly at AAI-managed regional and mid-tier airports.

Conclusion

Economic performance and fiscal resilience in Indian airports are shaped by an interacting set of drivers rather than any single determinant. Traffic growth provides the foundation for revenue generation, but operational efficiency, revenue diversification, locational structure, and the design of the regulatory tariff mechanism jointly determine whether that traffic base translates into sustainable financial performance. The evidence reviewed indicates that ownership structure alone, whether public sector management under AAI or private concession, does not straightforwardly predict superior performance; efficiency outcomes vary considerably within both categories depending on scale, location, and commercial revenue development. The Hybrid Till mechanism administered by AERA occupies a central and evolving role in this system, directly linking commercial success to the aeronautical tariffs that ultimately determine cost competitiveness for airlines and affordability for passengers. Strengthening fiscal resilience across the differentiated Indian airport network will likely depend less on further ownership transitions and more on deliberate regulatory calibration, targeted support for structurally disadvantaged regional airports, and continued closing of the non-aeronautical revenue gap relative to international benchmarks.

Limitations and Future Scope

This manuscript is conceptual and synthesis-based rather than grounded in original quantitative estimation, and therefore does not independently validate the efficiency scores or causal claims drawn from the reviewed literature. Future research would benefit from panel-based empirical work that directly links financial resilience indicators, such as debt service coverage or revenue volatility, to the regulatory and structural variables identified here, extending the efficiency-focused DEA literature into an explicit resilience-modeling framework. Comparative analysis incorporating post-pandemic traffic recovery data would also strengthen understanding of how different airport categories and financing structures performed under an actual large-scale demand shock.

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