

Flying Between State and Market: How Much of TAP should be Privatised?

Master in Corporate Finance

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Leiria, April of 2026



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Abstract

This dissertation investigates the relationship between state ownership and airline performance, with a particular focus on the implications for the privatisation of TAP Air Portugal. While existing literature generally associates privatisation with improved firm performance, limited attention has been given to how different levels of state ownership affect performance outcomes.

Grounded in property rights, public choice, and agency theories, the study adopts a panel-data econometric approach using a sample of airlines with diverse ownership structures, including Ryanair, British Airways, Lufthansa, Iberia, Aer Lingus, Air France, Scandinavian Airlines System (SAS), LOT Polish Airlines, and Alitalia/ITA Airways. The dataset covers the period 2004–2024 and is constructed from airline annual reports, incorporating both financial and operational performance indicators.

The empirical results suggest a generally negative association between state ownership and financial performance, although this relationship is not consistently robust across specifications. Importantly, the findings indicate that the ownership–performance relationship is non-linear. While financial performance exhibits a U-shaped pattern, cost efficiency, measured through cost per available seat kilometre (CASK), follows an inverted U-shaped relationship.

These results highlight that the effects of state ownership differ across performance dimensions. While financial indicators show limited and inconsistent responses, cost efficiency displays a more systematic non-linear relationship with ownership structure.

Overall, the findings do not support the existence of a clearly defined optimal ownership threshold. Instead, they indicate that the impact of ownership depends on both its level and the broader governance and institutional context. For TAP Air Portugal, the results suggest that increasing private ownership may improve long-term financial sustainability, although outcomes depend critically on governance structures, managerial autonomy, and exposure to market discipline.

Keywords

Privatisation; state ownership; airlines; TAP Air Portugal; corporate governance.

Resumo

Esta dissertação investiga a relação entre a participação do Estado e o desempenho das companhias aéreas, com particular enfoque nas implicações para a privatização da TAP Air Portugal. Embora a literatura associe, de forma geral, a privatização a melhorias no desempenho, existe ainda pouca evidência sobre como diferentes níveis de participação estatal influenciam os resultados.

Com base nas teorias dos direitos de propriedade, da escolha pública e da agência, o estudo adota uma abordagem econométrica de dados em painel, utilizando uma amostra de companhias aéreas com diferentes estruturas de propriedade, incluindo Ryanair, British Airways, Lufthansa, Iberia, Aer Lingus, Air France, Scandinavian Airlines System (SAS), LOT Polish Airlines e Alitalia/ITA Airways. O período de análise compreende 2004–2024, sendo os dados recolhidos a partir dos relatórios anuais das empresas.

Os resultados sugerem uma associação geralmente negativa entre a participação estatal e o desempenho financeiro, embora não seja consistentemente robusta. Verifica-se ainda que a relação entre propriedade e desempenho é não linear: o desempenho financeiro apresenta um padrão em U, enquanto a eficiência de custos (CASK) segue um padrão em U invertido.

Estes resultados evidenciam que os efeitos da participação estatal variam consoante a dimensão de desempenho analisada. Enquanto os indicadores financeiros apresentam efeitos limitados, a eficiência de custos revela uma relação não linear mais clara.

Em termos gerais, não se identifica um nível ótimo de participação estatal. No caso da TAP Air Portugal, os resultados sugerem que o aumento da participação privada pode contribuir para a sustentabilidade financeira, dependendo da qualidade da governação, da autonomia de gestão e da disciplina de mercado.

Palavras-Chave

Privatização; Propriedade Estatal; Companhias Aéreas; TAP Air Portugal; Governação Corporativa.

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List of Abbreviations

CASK – Cost per Available Seat Kilometre

DEA – Data Envelopment Analysis

IAG – International Airlines Group

IV – Instrumental Variables

OECD – Organization for Economic Co-Operation and Development

RASK – Revenue per Available Seat Kilometre

ROA – Return on Assets

ROE – Return on Equity

SAS – Scandinavian Airlines Group

SOEs – State-Owned Enterprises

1. Introduction

The debate over state ownership of national airlines has been a central issue in economic policy for decades. Historically, governments have justified retaining majority stakes in flag carriers on the grounds of sovereignty, connectivity, and public service obligations. However, waves of privatisation since the 1980s have significantly reshaped the global airline industry. Many state-owned carriers have been fully or partially privatised, driven by the expectation that private ownership may enhance efficiency, financial sustainability, and competitiveness.

In Portugal, TAP Air Portugal remains majority-owned by the State. Despite periodic restructuring efforts and strategic partnerships, the airline has experienced persistent financial instability, raising questions about its long-term sustainability under public ownership. With privatisation once again on the political agenda, policymakers face a critical decision regarding the extent of state participation.

The academic literature provides extensive evidence on the effects of privatisation on firm performance, particularly in historically state-dominated sectors such as airlines. However, while many studies examine whether privatisation improves performance, relatively few focus on how different degrees of state ownership affect outcomes. The lack of consensus on ownership thresholds limits the ability of policymakers to make evidence-based decisions regarding the appropriate level of state participation.

This dissertation addresses this gap by adopting a panel-data econometric approach to examine the relationship between state ownership and airline performance. In particular, the analysis goes beyond standard linear specifications by incorporating a quadratic term in state ownership, allowing for the possibility that the relationship is non-linear. This modelling strategy enables the identification of potential turning points in the ownership–performance relationship, rather than assuming the existence of a single optimal ownership level.

By doing so, the study moves beyond the traditional question of whether privatisation improves performance and instead addresses the more policy-relevant question of how different levels of state ownership are associated with variations in firm performance. This contribution is particularly relevant in the context of TAP Air Portugal, where

policymakers are not deciding whether to privatise, but rather the appropriate degree of state involvement.

To this end, performance is evaluated through a multidimensional framework, encompassing financial indicators such as return on assets (ROA) and return on equity (ROE), as well as operational measures including load factor, cost per available seat kilometre (CASK), and revenue per available seat kilometre (RASK).

The motivation for this research is twofold. From an academic perspective, the existing literature provides limited guidance on how ownership effects vary across different levels of state participation and across performance dimensions. From a policy perspective, Portugal is approaching a critical decision regarding TAP's ownership structure, but lacks robust empirical benchmarks to support that decision. This combination renders the research both timely and policy-relevant.

The central objective of this dissertation is to assess how different levels of state ownership affect the financial and operational performance of national airlines, with a particular focus on TAP Air Portugal. Accordingly, the main research question is: how does the degree of state ownership influence airline performance, and what are the implications for TAP Air Portugal's privatisation strategy?

To address this question, the study pursues three sub-objectives:

- To review the theoretical foundations linking ownership structures and firm performance.
- To analyse the experiences of European flag carriers that have followed different privatisation paths.
- To empirically evaluate the relationship between levels of state ownership and airline performance using panel-data econometric techniques.

The dissertation is structured as follows. Chapter 2 reviews the theoretical and empirical literature on privatisation, ownership, and airline performance, highlighting the existing research gap regarding ownership structures and performance outcomes. Chapter 3 presents the methodological framework. Chapter 4 reports and discusses the empirical findings. Finally, Chapter 5 concludes by synthesising the main results and offering policy implications for TAP's privatisation strategy.

2. Literature Review

2.1. Introduction

This chapter reviews the theoretical and empirical literature on privatisation, ownership structures, and airline performance. It begins by outlining the principal economic theories that explain why ownership matters for efficiency and performance, including property rights, public choice theory, and agency theory. It then surveys evidence from airline privatisations across different regions, highlighting both successes and failures, and considers the differences between full and partial privatisation models.

The review also identifies a critical gap: while most studies focus on whether privatisation improves outcomes, very few examine how much should be privatised or what ownership thresholds yield the best balance between efficiency and public interest. This omission is particularly relevant for TAP, where policymakers face the practical question of deciding the extent of state divestment.

By synthesizing theories, international evidence, and sector-specific case studies, this chapter establishes the intellectual foundation for empirical analysis. It connects abstract economic models with real-world experiences of airlines that underwent privatisation, thereby framing the methodological choices and research questions addressed in the following chapter.

2.2. Theories Behind Ownership and Performance

Privatisation and ownership structure have been widely studied in economic literature, especially in sectors that were historically state-controlled, like the airline industry. The main argument behind privatisation is that private ownership tends to create stronger incentives for efficiency and performance than public ownership (Alchian & Demsetz, 1973; Jensen & Meckling, 1976; Vickers & Yarrow, 1991).

Three main economic theories are often cited when discussing ownership and performance:

- Property Rights Theory suggests that private owners are more motivated to maximize value because they directly benefit from profits and losses, as discussed by Vickers and Yarrow (1991) and Estrin *et al.* (2009). This theory helps explain

why private airlines like British Airways and Iberia experienced performance gains following privatisation as documented by Cozmuta (2024), Eckel *et al.* (1997) and Ribeiro (2016).

- Public Choice Theory argues that public ownership is often inefficient because political goals interfere with economic decisions (Boyko *et al.*, 1996). This is supported by the experience of South African Airways, which has struggled under continued state ownership, as advanced by Makoka *et al.* (2023).
- Agency Theory highlights that in public firms, the separation between ownership and control leads to weak performance incentives, as emphasized by Jensen and Meckling (1976). Several case studies, such as those on Kenya Airways, demonstrate how privatisation can reduce agency problems by improving corporate governance and aligning interests, as documented by Debrah and Torotich (2005), and Ochieng and Ahmed (2014).

Recent research further refines these theories. For instance, Merlevede and Muylle (2025) show that European State-Owned Enterprises (SOEs) consistently underperform private firms in terms of profitability and productivity, while Nguyen and Vo (2022) demonstrate that partial state ownership can improve firm outcomes only up to certain thresholds, beyond which efficiency declines. Taken together, these findings help explain why many governments pursue privatisation, although they do not clarify how much ownership should be retained or divested.

2.3. What Happens When Airlines Get Privatised

Research shows that privatisation often leads to improvements in financial performance, efficiency, and service quality – but results vary across regions, market contexts and ownership models.

In Europe, British Airways remains the benchmark: its 1980s privatisation increased performance and efficiency and reduced political interference, with positive spillovers to the sector (Cozmuta, 2024; Eckel *et al.*, 1997; Vickers & Yarrow, 1991).

Iberia and Aer Lingus experienced financial recovery and strategic flexibility through gradual divestment, with performance improvements tied to reduced political interference and market-driven decision-making, as advanced by Czerny and Lang (2019), Ribeiro (2016) and Suarez (2014).

In Africa, Kenya Airways became one of the continent's most successful carriers after selling a 26% stake to KLM and adopting a public-private ownership mix, which enhanced liquidity and governance (Debrah & Toroitch, 2005; Ochieng & Ahmed, 2014). In contrast, South African Airway, as studied by Makoka *et al.* (2023), failed to implement a coherent privatisation strategy, and consequently continued to experience financial and operational difficulties.

In Asia, China's airline sector underwent state-led mergers with some productivity gains, but still lacked full market discipline due to ongoing state control (Chen *et al.*, 2017). Chow and Fung (2012) confirm that while consolidation improved efficiency to some extent, the absence of meaningful private ownership limited long-term competitiveness (Chow & Fung, 2012). This stands in contrast to the European cases, where privatisation coincided with stronger financial recovery and strategic flexibility.

Overall, while many case studies confirm that privatisation helps improve performance, Czerny and Lang (2019) suggest that the scale, speed, and sustainability of those improvements depend heavily on market regulation, governance structures, and competitive pressures.

2.4. Partial vs Full Privatisation

Prior research indicates that even partial privatisation can generate significant benefits – especially when it involves a strategic investor. Both partial and full privatisation can deliver performance improvements, but the depth and speed differ.

The Kenya Airways case, studied by Debrah and Toroitch (2005) and Ochieng and Ahmed (2014), is a classic example: after selling a minority stake to KLM, the airline improved in almost every financial metric, without full transfer of ownership.

Gupta (2005), studying Indian firms, also finds that partial state divestment can yield substantial performance gains, even when governments retain significant shares.

More recently, Nguyen and Vo (2022) demonstrate that residual state ownership exerts a non-linear effect: minority stakes can support performance through stability and oversight, but higher levels of state control often erode efficiency.

On the other hand, full privatisation, such as in the case of British Airways, often allows for more radical reforms and faster gains in efficiency, as discussed by Cozmata (2024), Eckel *et al.* (1997) and Vickers and Yarrow (1991). These gains, however, come with trade-offs, as governments lose leverage over national strategic assets and face heightened political sensitivity (Vickers & Yarrow, 1991).

As Czerny and Lang (2019) shown, mixed models – such as SAS, which combines state and private ownership – show that partial privatisation can sustain operations and provide access to capital, but the results are more modest and subject to ongoing political influence.

Taken together, the evidence suggests that partial and full privatisation follow different logics: partial privatisation can deliver improvements when paired with strategic investors and strong governance, whereas full privatisation maximizes efficiency gains at the expense of public control. The choice of model therefore reflects a trade-off between efficiency and the preservation of public interest.

2.5. What's Missing: Most Studies Say if Privatisation Helps

Most studies focus on whether privatisation works – not on how much of a firm should be privatised. Foundational contributions such as Megginson and Netter (2001), Eckel *et al.* (1997) and Estrin *et al.* (2009), primarily assess performance changes before and after privatization, consistently documenting improvements in efficiency and financial outcomes. However, these studies do not address the question of how much ownership should be transferred. There's a lack of research on optimal ownership percentages or thresholds. Few papers provide clear guidance on whether governments should hold onto a minority share (e.g., 25%), retain control (e.g., 51%), or fully exit. This gap justifies a more pragmatic, comparative approach to help answer the question: **how much of TAP should be privatised to maximize performance without losing strategic oversight?**

While a large body of examples documents that privatisation – full or partial – tends to improve firm performance, major surveys and reviews stop short of identifying ownership thresholds (e.g., 25%, 49%, 51%) that balance efficiency with public-interest control. Classic syntheses such as Estrin *et al.* (2009) and Megginson and Netter (2001) focus on whether privatisation improves outcomes, but they provide no guidance on how much equity should be transferred to achieve those outcomes. Further evidence from India

suggests that even partial divestment can raise efficiency, but without a clear rule of “how much” privatisation is sufficient (Gupta, 2005).

Evidence on partial privatisation suggests that even minority stake sales can lift performance. More recently, Nguyen and Vo (2022) demonstrate that residual state ownership has a non-linear effect on performance, yet they stop short of prescribing clear thresholds. Also, De Haas *et al.* (2025) confirm that state ownership correlates with higher leverage and lower efficiency across sectors, but again without specifying optimal ownership shares.

In the airline sector specifically, studies such as Cozmata (2024), and Eckel *et al.* (1997) on British Airways show how privatisation improved performance, while Czerny and Lang (2019) and Makoka *et al.* (2023) emphasize that privatisation and deregulation often improve efficiency and financial stability. Yet, none of these works prescribe turning point of state ownership.

For instance, Kenya Airways improved markedly after selling a minority stake to KLM (Debrah & Toroitich, 2005; Ochieng & Ahmed, 2014), while Iberia and Aer Lingus benefited from gradual divestments (Ribeiro, 2016; Suarez, 2014). These cases highlight that results differ, but do not provide generalizable thresholds.

Even the Organisation for Economic Co-Operation and Development (OECD) Guidelines on the Governance of State-Owned Enterprises (2024) avoid prescribing ownership percentages, focusing instead on governance quality and professional oversight. This omission implicitly recognizes that no one-size-fits-all shareholding rule exists across sectors or jurisdictions.

Because the literature does not provide validated ownership thresholds, a comparative, case-based approach that maps performance changes to ranges of ownership (e.g., < 30%, ~49%, majority, 100%) is warranted. This fills the gap between broad endorsements of privatisation and the practical decision of how much TAP should be privatised.

2.6. What Happened to Other Airlines?

This section presents a comparative overview of selected airlines that have undergone privatisation or ownership restructuring. The analysis focuses primarily on carriers

included in the empirical sample, ensuring consistency between review and the subsequent econometric analysis.

The selected cases represent different privatisation paths – ranging from full privatisation to mixed ownership structures – and provide a relevant benchmark for evaluating TAP’s potential ownership scenarios. Together, they illustrate how outcomes vary depending on ownership models, governance arrangements, and market conditions.

Airline Case Summaries

- British Airways (UK) is one of the most emblematic cases of full privatisation. In the 1980s, the company transitioned from a struggling state-owned carrier to a profitable, competitive airline. The privatisation is widely seen as a turning point in the global debate on state-owned airlines (Cozmata, 2024; Eckel *et al.*, 1997; Vickers & Yarrow, 1991).
- Lufthansa (Germany) similarly represents a successful case of full privatisation. Following its gradual transition to private ownership, the airline achieved strong financial performance, global expansion, and improved governance, becoming one of Europe’s leading carriers (Czerny & Lang, 2019).
- Iberia (Spain) and Aer Lingus (Ireland) followed gradual privatisation paths. Both airlines transitioned from state ownership to private control through phased divestments, ultimately integrating into the International Airlines Group. These processes improved efficiency, reduced political interference, and enhanced long-term strategic positioning (Czerny & Lang, 2019; Ribeiro, 2016; Suarez, 2014).
- SAS (Scandinavia) represents a mixed ownership model, with governments retaining significant stakes alongside private investors. While the airline has maintained market presence, its performance has been constrained by political influence and governance challenges, resulting in more moderate outcomes compared to fully privatized peers (Czerny & Lang, 2019; OECD, 2024).
- LOT Polish Airlines similarly retained substantial state ownership. Although the airline achieved regional expansion, persistent challenges in performance and restructuring highlight the limitations of hybrid ownership structures in the absence of strong governance mechanisms (Merlevede & Muylle, 2025; Nguyen & Vo, 2022).
- Alitalia/ITA Airways (Italy) illustrates the risks associated with prolonged state involvement and unsuccessful privatisation attempts. Repeated restructuring

efforts and partial privatisation initiatives failed to restore long-term viability, largely due to weak governance and political interference (Makoka *et al.*, 2023; OECD, 2020).

Kenya Airways provides an important example of partial privatization with a strategic partner. The sale of a minority stake to KLM improved governance, liquidity, and financial performance, although subsequent challenges highlight the importance of sustained strategic alignment and market conditions (Debrah & Toroitch, 2005; Ochieng & Ahmed, 2014).

Table 1
Ownership Transitions and Key Outcomes in Selected Airlines.

Airline	Ownership Before	Ownership After	Key Results	Sources
British Airways	100% public	Fully privatised	Higher efficiency, improved profitability, industry-wide demonstration effect	Eckel <i>et al.</i> (1997); OECD (2020).
Lufthansa	100% public	Fully privatised	Strong financial performance, global expansion, solid governance	Czerny and Lang (2019); OECD (2024).
Iberia	State-owned	Gradual privatisation	Enhanced competition, better efficiency, successful merger with British Airways	OECD (2020); Ribeiro (2016).
Aer Lingus	Mostly public	Fully privatised (phased)	Financial turnaround, reduced political interference, strong post-IPO performance	OECD (2020); Suárez (2014).
SAS	Mixed (state-majority)	Mixed ownership (multiple states & private investors)	Modest improvement, but ongoing political influence, challenges in strategic alignment	Czerny and Lang (2019); OECD (2024).
Kenya Airways	100% public	26% to KLM, 74% privatised	Improved liquidity, ROE, financial governance, strong performance post-privatisation	Debrah and Toroitch (2005); Ochieng and Ahmed (2014).

Table 1 provides a structured overview of ownership transitions and key performance outcomes across the selected airlines. While it highlights important differences in privatisation paths, it remains primarily descriptive and does not explicitly capture differences in governance quality or the type of privatisation implemented.

Table 2*Comparison of Cases by Privatisation Type, Governance Strength, and Outcomes.*

Airline	Privatisation Type	Governance Strength	Outcome	Source
British Airways	Full privatisation	Strong	Positive: sustained profitability	Eckel <i>et al.</i> (1997); OECD (2020).
Lufthansa	Full privatisation	Strong	Positive: global competitiveness	Czerny and Lang (2019); OECD (2024).
Iberia	Full privatisation (IAG merger)	Strong	Positive: efficiency gains and integration	OECD (2020); Ribeiro (2016).
Aer Lingus	Full privatisation	Strong	Positive: turnaround and growth	OECD (2020); Suárez (2014).
Kenya Airways	Mixed (26% to KLM)	Moderate/Strong	Positive (initially), later financial challenges	Debrah and Toroitich (2005); Ochieng and Ahmed (2014).
SAS	Mixed (multi-state and private)	Moderate	Mixed: constrained restructuring	Czerny and Lang (2019); OECD (2024).
LOT Polish Airlines	Mixed	Moderate/Weak	Mixed: expansion but low profitability	OECD (2020); OECD (2024).
Alitalia/ITA Airways	Failed partial	Weak	Negative: instability and inefficiency	Czerny and Lang (2019); OECD (2020)

A cross-case comparison based on Table 2 reveals clear patterns across privatization models. Full privatizations (e.g., British Airways, Lufthansa, Aer Lingus) are associated with more consistent improvements in efficiency and financial performance, particularly when supported by strong governance structures and competitive market environments.

Gradual or partial privatizations (e.g., Iberia, Kenya Airways) can also generate performance gains, especially when combined with strategic investors and phased restructuring processes. However, mixed ownership structures (e.g., SAS, LOT Polish Airlines) tend to produce more limited or inconsistent outcomes, reflecting ongoing political influence and weaker governance mechanisms.

Finally, unsuccessful or incomplete privatization attempts (e.g., Alitalia/ ITA Airways) highlight the risks associated with prolonged state control and ineffective restructuring strategies (Czerny & Lang, 2019; De Haas *et al.*, 2025; OECD, 2024).

Taken together, the evidence reinforces that the success of airline privatisation cannot be explained by ownership changes alone. Governance arrangements, market liberalization, and strategic partnerships strongly mediate outcomes. Importantly, even where performance improvements are observed, no clear ownership threshold (e.g., 25%, 51% or full privatisation) emerges as universally optimal.

This ambiguity directly supports the research gap identified in Section 2.5. and highlights the need for a more systematic analysis of how different degrees of state ownership affect performance. The following section builds on these insights to assess their implications for TAP Air Portugal.

2.7. Stylized Patterns in Airline Privatisation Outcomes

Taken together, the comparative evidence reviewed in the previous sections suggests that European flag carriers can be broadly grouped into distinct patterns according to their privatisation paths, governance arrangements, and observed performance outcomes. While Czerny and Lang (2019), and Vickers and Yarrow (1992) do not converge on a single optimal ownership model, it consistently highlights recurring configurations that help structure the debate on state ownership in the airline industry.

Based on the cases discussed in the literature, three stylized patterns emerge.

The first pattern includes airlines that underwent full privatisation accompanied by substantial governance reforms, such as Lufthansa, Iberia, and Aer Lingus. These cases are frequently cited as examples where privatisation was associated with sustained improvements in efficiency, profitability, and strategic flexibility (Cozmata, 2024; Eckel *et al.*, 1997; Mahdy, 1999; Ribeiro, 2016). In these contexts, the combination of private ownership, reduced political interference, and exposure to competitive market conditions appears to have enabled more effective restructuring and long-term performance gains.

The second pattern includes airlines that followed partial or mixed privatisation models, combining state ownership with private investors, such as SAS and Kenya Airways. These cases tend to exhibit more nuanced outcomes. On the one hand, the presence of private shareholders and, in some cases, strategic partners can improve governance,

access to capital, and operational performance. On the other hand, continued state involvement may constrain managerial autonomy and introduce political considerations into decision-making processes. As a result, performance improvements in these cases are typically more moderate and less consistent than those observed under full privatisation, according to Czerny and Lang (2019), Debrah and Toroitich (2005) and Nguyen and Vo (2022).

The third pattern consists of airlines that experienced persistent financial instability or unsuccessful restructuring attempts, including Alitalia/ITA Airways and LOT Polish Airlines. These cases are commonly associated with prolonged state dominance, repeated political intervention, and weak governance, which undermined restructuring efforts and financial sustainability (Makoka *et al.*, 2023; Merlevede & Muylle, 2025).

Importantly, these patterns should be interpreted as heuristic groupings derived from the literature rather than definitive empirical classifications. Their purpose is not to establish causality, but to illustrate the diversity of outcomes associated with different ownership models and to underscore the absence of clear ownership thresholds in existing research. This observation directly motivates the empirical analysis developed in the following chapters, which seeks to assess how varying degrees of state ownership relate to airline performance in a systematic and quantitative manner.

Air France-KLM is excluded from this categorization due to its complex multinational ownership and governance structure, which complicates the identification of clear privatisation effects, as argued by Czerny and Lang (2019).

Importantly, these patterns should be interpreted as heuristic groupings derived from the literature rather than definitive empirical classifications. Their purpose is not to establish causality, but to illustrate the diversity of outcomes associated with different ownership models and to underscore the absence of clear ownership thresholds in existing research. This observation directly motivates the empirical analysis developed in the following chapters, which seeks to assess how varying degrees of state ownership relate to airline performance in a systematic and quantitative manner.

2.8. Evidence from Regression-Based Studies Linking Privatisation and Performance

Beyond descriptive case studies and country-specific analyses, a growing body of empirical literature employs regression-based models to quantify the impact of privatisation and state ownership on firm performance. Panel-data regressions have become the dominant methodological approach in this strand of research, as they allow scholars to exploit both cross-sectional and time-series variation while controlling for unobserved firm-specific heterogeneity and common macroeconomic shocks.

Table 3 summarises the most relevant empirical studies that apply panel or longitudinal regression models to analyse the effects of privatisation and state ownership across different sectors and institutional settings. To ensure methodological consistency with the present dissertation, only studies employing regression-based approaches are included. The table highlights three recurring methodological patterns in the literature.

Table 3

Empirical Studies Using Panel Regressions to Analyse Privatisation and Firm Performance.

Literature Focus	Author(s)	Sample/ Sector	Econometric Method	Main Findings
State Ownership and firm performance	Gupta (2005)	330 Indian privatised firms	Panel before/after; model with fixed effects	Supports the use of panel data and shows that partial privatisation can improve performance, although no clear optimal ownership threshold is identified.
Non-linear ownership effects	Nguyen and Vo (2022)	600 SOEs in emerging markets	Panel regression with non-linear ownership terms	Directly supports the quadratic specification used in this dissertation to test whether ownership effects vary across state ownership levels.
State ownership, efficiency and leverage	De Haas <i>et al.</i> (2025)	15.000 European SOEs and private firms	Multinational panel model with fixed effects and instrumental variables	Supports the use of panel techniques and shows that state-owned firms tend to be less efficient, while not identifying a universal ownership threshold.
SOE underperformance	Merlevede and Muylle (2025)	European state-owned and private firms	Panel regression with fixed effects and macroeconomic controls	Supports the inclusion of firm and time controls and provides evidence of persistent SOE underperformance.

Airline privatisation case evidence	Mahdy (1999)	British Airways	Longitudinal/ panel-style performance analysis	Supports the use of financial and operational indicators to assess post-privatisation performance.
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Note. IV = Instrumental Variables. Dependent variables capture firm performance, while independent variables refer to ownership structure and privatisation measures.

The first conclusion of the analysis is that performance and efficiency indicators are the most commonly used dependent variables. Studies such as Gupta (2005) and Merlevede and Muylle (2025) rely on financial measures including ROA and ROE, while Mahdy (1999) shows that airline-specific research complements these with operational and productivity indicators. This dual focus reflects the capital-intense and highly competitive nature of airlines, where operational efficiency is as critical as financial performance.

Secondly, state ownership is typically modelled using either continuous measures or non-linear specifications. Gupta (2005) and Nguyen and Vo (2022) measure ownership as the percentage of equity held by the state. Notably, Nguyen and Vo (2022) provide strong evidence of non-linearities, showing that minority state participation may enhance performance, whereas higher levels of state control tend to dampen efficiency gains. However, despite identifying these non-linear effects, the literature does not converge on specific ownership thresholds that could guide policymakers in practice.

Thirdly, fixed-effects panel estimators are the prevailing econometric choice, reflecting concerns about unobserved heterogeneity across firms and countries. Studies such as De Haas et al. (2025) and Merlevede and Muylle (2025) demonstrate that failing to control for firm-specific effects can bias estimates of the impact of state ownership. In the airline-specific literature, Mahdy (1999) similarly emphasizes the importance of longitudinal and panel-based approaches to capture performance changes following privatisation.

Overall, the empirical evidence confirms that privatisation and reductions in state ownership are often associated with improvements in firm performance, but the magnitude and persistence of these effects vary substantially across contexts. Crucially, while regression-based studies consistently show that ownership structure matters, they stop short of providing clear guidance on the optimal degree of privatisation. This limitation reinforces the research gap identified earlier and motivates the empirical strategy adopted in this dissertation.

By systematically mapping the methodologies, variables, and findings of prior panel-data studies, this section lays the groundwork for the econometric framework developed in Chapter 3, building on the strategy used to assess how different ownership configurations affect airline performance, with a particular focus on TAP Air Portugal.

2.9. What This Means for TAP

TAP is currently majority-owned by the Portuguese state. Given its history of financial instability, the ongoing restructuring efforts, and the upcoming decision on ownership, it's vital to look at the lessons learned from other airlines. In this line, three main scenarios emerge:

- Keeping TAP mostly public, similar to Air France, may protect national interests but risks inefficiency and political interference. As pointed out by Vickers and Yarrow (1991), state-owned enterprises often face soft budget constraints and limited incentives for cost minimization. Empirical evidence from European SOEs shows persistent underperformance relative to private firms, even after accounting for firm and time effects (Merlevede & Muylle, 2025).
- A mixed ownership (49% or similar), may enhance for investor discipline without or full loss of state control – like SAS or Kenya Airways. According to Debrah and Toroitich (2005), Ochieng and Ahmed (2014), this model can yield positive results when paired with strategic partnerships and strong regulatory oversight. More broadly, Gupta (2005) and Nguyen and Vo (2022) show that partial privatisation and residual state ownership can improve performance, but the effect is non-linear: while minority stakes may support governance, higher levels of state control tend to reduce efficiency gains.
- Full privatisation offers potential for large efficiency gains and market focus – as seen with British Airways, Iberia or Aer Lingus – but also reduces strategic control. Cozmata (2024) and Eckel *et al.* (1997) highlight how the full privatisation of British Airways enabled radical restructuring and efficiency improvements, turning a struggling national carrier into a profitable global competitor. At a broader cross-sector level, De Haas *et al.* (2025) argue that state exits are associated with lower leverage and higher efficiency, but that success ultimately depends on timing and market conditions.

In addition to ownership structure, the role of effective governance and leadership post-privatisation is crucial. As Czerny and Lang (2019) emphasize, privatisation without robust corporate governance and financial discipline rarely delivers sustained improvements. Moreover, the specific market environment matters: TAP operates in a highly competitive European market, where low-cost carriers and airline alliances shape performance dynamics. External pressures such as regulation, fuel prices, and consumer demand can also shape outcomes independently of ownership (Chen *et al.*, 2017).

Finally, policymakers face a trade-off between efficiency, risk and the safeguarding of the public interest. The OECD Guidelines on Corporate Governance of State-Owned Enterprises (2024) stress the importance of governance quality rather than prescriptive ownership shares, implicitly acknowledging that there is no one-size-fits-all solution. Based on the evidence reviewed, a partial privatisation model with strategic investors and clear performance targets may offer a balanced path forward – enhancing efficiency while preserving state influence over national interests.

Each of these options involves trade-offs in terms of financial performance, political risk, and long-term sustainability. The remainder of this thesis explores these trade-offs in depth, using comparative data and empirical analysis to determine which ownership mix is most appropriate for TAP.

2.10. Research Hypothesis

Based on the theoretical and empirical literature reviewed, the study proposes the following hypotheses:

Financial Performance

- **H1:** There is a negative relationship between state ownership and financial performance.

This hypothesis reflects a linear relationship whereby higher levels of state participation are expected to be associated with lower financial performance outcomes. This expectation is grounded in theories of public ownership and agency, which highlight inefficiencies related to political interference, weaker incentives, and reduced managerial autonomy (Gupta, 2005; Megginson & Netter, 2001).

- **H1A:** The relationship between state ownership and financial performance follows an inverted U-shaped pattern.

This hypothesis suggests that moderate levels of state ownership may enhance performance due to advantages such as access to financing, political support, or institutional stability. However, beyond a certain level, higher state participation may reduce performance as inefficiencies, agency costs, and political intervention intensify (Gupta, 2005; Nguyen & Vo, 2022).

Operational Efficiency

- **H2:** There is a positive relationship between state ownership and cost inefficiency.

Operational efficiency is proxied by CASK (Cost per Available Seat Kilometre), where higher values indicate lower efficiency. This hypothesis therefore implies that higher levels of state ownership are associated with higher costs per unit, reflecting reduced operational efficiency.

- **H2A:** The relationship between state ownership and cost efficiency follows a non-linear (U-shaped) pattern.

This hypothesis reflects the possibility that cost inefficiencies initially increase with state ownership due to organisational rigidity and political constraints, but may improve at higher levels of state participation due to stronger control mechanisms, restructuring efforts, or strategic intervention. Empirically, this corresponds to a negative coefficient on the linear term and a positive coefficient on the squared term, implying a U-shaped relationship.

3. Methodology

3.1. Introduction

This chapter outlines the research design, sample selection, data sources, variable construction, and analytical methods employed in the study. Its purpose is to establish a transparent methodological framework for assessing the relationship between ownership structure and airline performance. By clearly defining the sample, performance indicators, ownership variables, and econometric specifications, the chapter provides the foundation for the empirical analysis presented in the following chapter. Particular attention is given to the use of panel-data methods and to the modelling of both linear and non-linear ownership effects across different dimensions of airline performance.

3.2. Methodological Approach Justification

This dissertation adopts a quantitative research design based on panel-data econometric analysis. The objective is to examine the relationship between state ownership and airline performance across a sample of European and international flag carriers over time.

Panel-data techniques are particularly appropriate in this context, as they allow for the simultaneous analysis of cross-sectional and time-series variation. This approach enables the identification of how changes in ownership structure within airlines are associated with changes in performance, while controlling for unobserved firm-specific characteristics and common time effects. These advantages are widely recognised in the empirical literature on privatisation and firm performance (De Haas *et al.*, 2025; Gupta, 2005; Merlevede & Muylle, 2025; Nguyen & Vo, 2022).

In particular, Nguyen and Vo (2022) emphasise the importance of modelling non-linear effects of state ownership, while De Haas *et al.* (2025) and Merlevede and Muylle (2025) highlight the need to account for firm-level heterogeneity when analysing performance outcomes.

Although the study includes multiple airlines with different ownership trajectories, the analysis does not rely on qualitative case-study methods. Instead, variation across airlines is incorporated within a unified econometric framework, allowing for a consistent and comparable assessment of ownership effects.

This quantitative approach is well suited to addressing the research question, as it enables a systematic evaluation of the relationship between state ownership and performance across different dimensions, while capturing both linear and non-linear effects.

3.3. Sample Section

The empirical analysis focuses on a sample of European and international flag carriers that have experienced significant ownership changes over the past decades, namely British Airways, Lufthansa, Iberia, Aer Lingus, Air France, SAS, LOT Polish Airlines, Alitalia/ITA Airways, and Kenya Airways. These airlines represent a range of privatisation trajectories, including full privatisations, gradual divestments, partial privatisations involving strategic partners, and cases where substantial state ownership has been retained. This diversity allows for a comparative assessment of ownership models and their implications for firm performance.

The sample was selected based on three main criteria. First, its relevance to TAP Air Portugal's institutional and market context, particularly as a national flag carrier operating within a liberalised European aviation market. Second, the availability of consistent financial and operational data over time, which is essential for constructing a reliable panel dataset. Third, the variation in ownership structures across airlines and over time, which enables the identification of different privatisation paths and ownership regimes.

This variation is critical for assessing the impact of different degrees of state ownership within a panel-data framework, as commonly recognised in empirical studies on privatisation and firm performance (De Haas *et al.*, 2025; Gupta, 2005; Nguyen & Vo, 2022).

3.4. Data and Indicators

The study constructs an unbalanced panel dataset covering the period from 2004 to 2024 for all airlines included in the sample, namely British Airways, Lufthansa, Iberia, Aer Lingus, Air France, SAS, LOT Polish Airlines, Alitalia/ITA Airways, and Ryanair. The sample period allows for the analysis of performance both before and after key privatisation milestones, capturing both short- and long-term effects of ownership changes.

All data were collected manually from the annual reports of each airline. These reports provide detailed information on financial performance, operational indicators, and ownership structures over time. Given differences in reporting standards, disclosure practices, and data availability across airlines and years, the resulting dataset takes the form of an unbalanced panel.

The selection of variables follows established practices in the literature on privatisation and airline performance (Czerny & Lang, 2019; Makoka *et al.*, 2023; Merlevede & Muylle, 2025) and is designed to capture both financial and operational dimensions of performance, as well as ownership structures and relevant control factors.

The variables used in the empirical analysis are grouped into three main categories:

- Dependent variables capture airline performance across multiple dimensions. Financial performance is measured using ROA, ROE, and operating margin. Operational performance is assessed through CASK, RASK, and load factor. These indicators are widely used in both the privatisation and airline literature to reflect performance and efficiency outcomes (Barbot *et al.*, 2008; Lee & Worthington, 2014).
- Independent variables relate to ownership structure. The main explanatory variable is state ownership, measured as a continuous percentage (0–100%). To capture potential non-linear effects, ownership is also modelled using threshold categories (e.g., < 30%, 30 – 50%, > 50%), following prior empirical approaches such as Nguyen and Vo (2022).
- Control variables are included to account for firm-specific characteristics that may influence performance. These include firm size, measured by the logarithm of total assets, which captures scale effects. In addition, a COVID-19 dummy variable is included to control for the impact of the pandemic on airline performance during 2020 – 2021.

Although the dataset is constructed exclusively from firm-level disclosures, the selected variables provide a coherent and theoretically grounded framework for analysing the relationship between state ownership and airline performance.

3.5. Model and Analytical Framework

This section sets out the analytical strategy used to examine the relationship between state ownership and airline performance, using econometric panel-data techniques. The overarching goal is to assess whether different levels of state ownership are associated with systematic differences in financial and operational efficiency, and to identify which privatisation model is most likely to maximise TAP's long-term performance.

3.5.1. Econometric Justification: Evidence from the Literature

The choice of panel-data regression as the central quantitative method is grounded in a well-established empirical literature on privatisation and firm performance. Panel-data models are particularly well suited for analysing the effects of ownership structure, as they allow for controlling unobserved heterogeneity, time-specific shocks, and structural differences across firms. These methodological advantages are highlighted in studies such as De Haas *et al.* (2025), Gupta (2005), Merlevede and Muylle (2025), and Nguyen and Vo (2022), which employ panel-data approaches to examine the relationship between state ownership and performance outcomes.

The literature emphasises three key methodological aspects that inform the econometric design of this dissertation. First, the importance of controlling for firm-specific heterogeneity justifies the use of fixed-effects estimators, which account for time-invariant characteristics across airlines. Second, prior studies highlight the relevance of modelling non-linear ownership effects, as the relationship between state participation and firm performance may vary across different ownership levels rather than following a strictly linear pattern (Nguyen & Vo, 2022). Third, the use of multi-firm, multi-period datasets is essential to capture both cross-sectional and temporal variation, which is consistent with the panel structure adopted in this study.

Taken together, these insights provide a clear methodological foundation for the empirical strategy. In particular, the use of panel-data econometric techniques allows for the systematic analysis of the relationship between state ownership and airline performance, while accounting for unobserved airline-specific characteristics and common time effects. Moreover, the inclusion of alternative model specifications enables the identification of both linear and non-linear patterns, as well as the assessment of how ownership effects may differ across performance dimensions.

3.5.2. Proposed Econometric Model

The empirical analysis is based on panel-data regressions estimated using fixed-effects models. This approach is appropriate given the likelihood that unobserved airline-specific characteristics, such as governance quality, fleet composition, and route networks, are correlated with ownership structure. By controlling for time-invariant heterogeneity across airlines and common time effects, fixed-effects estimators help mitigate omitted variable bias and provide more consistent estimates of the relationship between state ownership and performance, under the assumption of strict exogeneity (Gupta, 2005; Nguyen & Vo, 2022).

To examine the relationship between ownership structure and airline performance, three complementary model specifications are estimated. Model 1 (linear specification) assesses the direct association between state ownership and performance. Model 2 (quadratic specification) introduces a squared term of state ownership to capture potential non-linear effects, following Nguyen and Vo (2022). Model 3 (threshold specification) replaces the continuous ownership variable with categorical variables in order to capture differences across ownership regimes.

The Model 1 – Linear Specification is defined as follows:

$$\begin{aligned} Performance_{it} = & \\ & \alpha + \beta_1 StateOwnership_{it} + \gamma_1 \log(assets_{it}) + \gamma_2 COVID_{it} + \mu_i + \lambda_t \\ & + \varepsilon_{it} \end{aligned}$$

The Model 2 – Quadratic Specification extends the estimation by including a squared term of state ownership:

$$\begin{aligned} Performance_{it} = & \\ & \alpha + \beta_1 StateOwnership_{it} + \beta_2 StateOwnership_{it}^2 + \gamma_1 \log(assets_{it}) \\ & + \gamma_2 COVID_{it} + \mu_i + \lambda_t + \varepsilon_{it} \end{aligned}$$

Finally, the Model 3 – Threshold Specification replaces the continuous ownership variable with categorical variables representing different ownership regimes:

$$\begin{aligned} Performance_{it} = & \\ & \alpha + \beta_1 State < 30\%_{it} \\ & + \beta_2 State 30 - 50\%_{it} + \beta_3 State > 50\%_{it} + \gamma_1 \log(assets_{it}) \\ & + \gamma_2 COVID_{it} + \mu_i + \lambda_t + \varepsilon_{it} \end{aligned}$$

Where:

- $Performance_{it}$ denotes the dependent variable capturing airline performance. In the baseline estimations, performance is measured using ROA, which serves as the primary indicator of financial performance. ROA is selected due to its ability to capture profitability relative to total assets, providing a consistent and comparable measure across airlines with different capital structures. Alternative indicators, including ROE and operating margin, are used in robustness tests.
- $StateOwnership_{it}$ represents the percentage of equity held by the state in airline i at time t . In Model 2, the squared term captures potential non-linearities in the ownership–performance relationship. In Model 3, ownership is modelled using dummy variables representing different state ownership regimes (below 30%, between 30% and 50%, and above 50%), with fully private firms serving as the reference category.
- The control variables include $\log(assets_{it})$, which captures firm size and scale effects, and a COVID dummy variable, which controls for the impact of the pandemic on airline performance during 2020–2021.
- μ_i denotes airline fixed effects, capturing time-invariant heterogeneity across firms.
- λ_t represents year fixed effects, accounting for common shocks affecting all airlines in a given period.
- ε_{it} is the idiosyncratic error term.

These model specifications allow for a flexible representation of the ownership–performance relationship. In particular, the quadratic specification enables the identification of potential turning points, while the threshold model provides a complementary perspective based on discrete ownership categories. Together, these approaches allow for assessing whether ownership effects are linear, non-linear, or heterogeneous across ownership regimes.

3.5.3. Variable Specification

The dependent variable is specified as a continuous measure of airline performance. In the baseline estimations, performance is proxied by ROA, expressed as a percentage. ROA is selected as the primary indicator due to its ability to capture overall profitability relative to total assets, allowing for comparability across airlines with different capital structures.

To assess the robustness of the results, alternative performance indicators are also considered. In particular, ROE and operating margin are used as additional financial measures, capturing complementary dimensions of performance. These variables are expressed as percentages and are analysed separately from the baseline model.

In addition, operational performance is assessed using CASK, RASK, and load factor. These indicators provide complementary insights into cost efficiency, revenue generation, and capacity utilisation, allowing for a multidimensional evaluation of airline performance.

The main independent variable is state ownership, measured as a continuous variable representing the percentage of equity held by the state. To capture potential non-linear effects, state ownership is also modelled using a squared term in the quadratic specification. In addition, a threshold-based approach is implemented, where ownership is represented through dummy variables capturing different ownership regimes: below 30% (minority state ownership), between 30% and 50% (blocking minority), and above 50% (state control). Fully private firms serve as the reference category.

Control variables are included to account for firm-specific characteristics. Airline size is proxied by total assets, expressed in logarithmic form to reduce scale effects and improve comparability across firms. A COVID-19 dummy variable is also included to control for the impact of the pandemic on airline performance during 2020–2021.

All variables are defined on an annual basis. Due to differences in data availability across airlines and years, the dataset takes the form of an unbalanced panel. This structure is consistent with empirical studies on firm performance and privatisation and allows for the inclusion of all available observations while maintaining comparability across models.

3.5.4. Summary Table of Variables included in the Model

To ensure transparency in the construction of the empirical model, this subsection provides a consolidated overview of the variables used in the econometric analysis. Table 4 summarises the dependent, independent, and control variables, along with their definitions and expected signs. The structure of Table 4 reflects the theoretical framework and empirical specifications presented in previous sections.

In the main estimations, airline performance is proxied by ROA, while alternative performance indicators are used in robustness tests to assess the consistency of the results across different dimensions of performance. The variables have been selected to capture both financial and operational aspects of airline performance, to reflect ownership structures in both continuous and categorical forms, and to control for firm-specific characteristics.

All firm-level data were manually collected from the annual reports of the selected airlines, ensuring consistency in measurement while acknowledging differences in reporting practices across companies.

In addition to the main estimations, robustness tests are conducted using alternative dependent variables. Financial indicators such as ROE and operating margin capture alternative measures of performance, while operational indicators such as CASK, RASK, and load factor provide insights into cost efficiency, revenue generation, and capacity utilisation. These variables are analysed separately using the same econometric specifications to ensure that the results are not driven by the choice of performance measure.

By presenting the variables in a unified framework, Table 4 provides a clear link between the conceptual model and the empirical implementation.

Table 4
Variables Used in the Econometric Model.

Variable	Type	Definition/Measurement	Expected Sign
ROA	Dependent	Net income to total assets	n.d.
ROE	Dependent	Net income to shareholder equity	n.d.
Operating Margin	Dependent	Operating income to revenue	n.d.
CASK	Dependent	Cost per available seat-km	n.d.
RASK	Dependent	Revenue per available seat-km	n.d.
Load Factor	Dependent	Passenger load factor (%)	n.d.
State Ownership¹	Independent	Percentage of equity held by the state	±
Ownership Thresholds¹	Independent	Dummy variables for <30%, 30-50%, >50%, 0%	±
Firm Size	Control	Total Assets (log)	+
COVID-19 Dummy	Macro	Equals 1 in 2020-2021	-

Note. ROA is used as the primary dependent variable in the main estimations. The remaining dependent variables are used in robustness tests. All firm-level data were collected from airline annual reports.

The selection of variables reflects the multidimensional nature of airline performance and the different channels through which ownership structure may influence firm outcomes. Financial indicators capture profitability and managerial efficiency, while operational indicators provide insights into cost structures, revenue generation, and capacity utilisation. Ownership variables, expressed in both continuous and categorical forms, allow for the identification of potential non-linearities in the relationship between state participation and performance. Control variables are included to isolate the effect of ownership from firm-specific characteristics and external shocks.

3.5.5. Identification of the Turning Point of State Ownership

In order to address the central research question of this dissertation, the analysis extends beyond estimating the relationship between state ownership and performance by examining potential non-linear patterns in the ownership–performance relationship.

This is achieved using the quadratic specification of the model, which allows for a non-linear relationship between state ownership and airline performance. The inclusion of a squared term follows the empirical literature on privatisation and state ownership, which

¹Ownership variables are defined following prior empirical studies on state ownership and firm performance, including Gupta (2005), Merlevede and Muylla (2025) and Nguyen and Vo (2022). These studies model state ownership both as a continuous variable and through non-linear specifications, providing the basis for the inclusion of both percentage ownership and threshold-based measures in this analysis.

highlights that the effects of state participation may vary depending on its level rather than being strictly linear (Gupta, 2005; Nguyen & Vo, 2022).

If the relationship between performance and state ownership is adequately approximated by a quadratic function, the turning point of the estimated function can be derived from the first-order condition. Formally, considering the quadratic specification:

$$\begin{aligned} Performance_{it} &= \beta_0 \\ &+ \beta_1 StateOwnership_{it} + \beta_2 StateOwnership_{it}^2 + \gamma_1 \log(assets_{it}) \\ &+ \gamma_2 COVID_{it} + \mu_i + \lambda_t + \varepsilon_{it} \end{aligned}$$

The level of state ownership that maximises performance is given by:

$$StateOwnership^* = \frac{-\beta_1}{2\beta_2}$$

Provided that $\beta_2 < 0$, indicating an inverted U-shaped relationship.

This value represents an estimated turning point in the ownership–performance relationship. Economically, it can be interpreted as the level of state ownership at which the marginal impact on performance shifts direction, rather than as a precise optimal ownership level.

The interpretation of this turning point relies on several assumptions. First, the functional form of the model is assumed to be correctly specified, such that the relationship between performance and state ownership is reasonably approximated by a quadratic function (Nguyen & Vo, 2022). Second, the explanatory variables are assumed to be exogenous, implying that changes in performance do not simultaneously affect ownership structure. Third, the error term is assumed to be well-behaved, with no severe misspecification issues related to heteroskedasticity or autocorrelation, and fixed effects are assumed to adequately capture unobserved heterogeneity (De Haas *et al.*, 2025; Gupta, 2005).

Given these assumptions and the sensitivity of quadratic models to functional form, the estimated turning point should be interpreted as an indicative benchmark rather than a precise policy target. This approach allows the analysis to provide insights into the nature of the ownership–performance relationship, while recognising its limitations in terms of causal interpretation and policy prescription.

3.6. Conclusion

This chapter has outlined the methodological framework used to investigate the relationship between state ownership and airline performance, with a particular focus on the implications of different ownership structures for TAP Air Portugal. By adopting a quantitative approach based on panel-data econometric techniques, the methodology enables a systematic and comparable evaluation of ownership effects across airlines and over time.

The chapter has detailed the selection of airlines, the construction of financial and operational performance indicators, and the specification of the econometric models. The proposed panel-data framework allows for the analysis of both linear and non-linear ownership effects, while controlling for firm-specific heterogeneity and common time effects.

In particular, the inclusion of a quadratic specification enables the identification of potential turning points in the ownership–performance relationship, providing an indicative benchmark for interpreting how the marginal effects of state ownership vary across different levels.

This methodological approach is consistent with the empirical literature on privatisation and state ownership, particularly studies emphasising the importance of non-linear effects and panel-data techniques.

Building on this framework, the following chapter presents and discusses the empirical findings. The results are used to assess how different degrees of state ownership are associated with variations in airline performance, as well as how these effects differ across performance dimensions

4. Empirical Discussion and Results

4.1. Introduction

This chapter presents and discusses the empirical results obtained from the panel-data econometric analysis. The objective is to examine how different levels of state ownership are associated with airline performance, and to assess whether these effects vary across alternative model specifications.

The analysis follows the empirical strategy outlined in Chapter 3, progressing from baseline estimations to more advanced specifications. In particular, three complementary models are estimated: a linear specification, a quadratic model capturing potential non-linear effects of state ownership, and a threshold specification distinguishing between different ownership regimes. This structured approach allows for a comprehensive evaluation of the ownership–performance relationship.

The results are interpreted in light of the existing literature on privatisation and state ownership, enabling the identification of areas of convergence and divergence with prior empirical findings (Gupta, 2005; Nguyen & Vo, 2022). Particular attention is given to the implications of the results for TAP Air Portugal, ensuring that the analysis remains closely aligned with the research objective.

In line with the empirical strategy, ROA is used as the primary measure of financial performance in the main estimations. This choice reflects its ability to capture overall firm performance independently of financing structure, which is particularly relevant in the airline industry given the heterogeneity in capital structures across firms.

To ensure the robustness of the results, alternative performance indicators are also considered. In particular, ROE and operating margin are used to capture additional dimensions of financial performance, while operational indicators such as CASK and RASK are analysed separately to provide complementary insights into cost efficiency and revenue generation.

Finally, the chapter adopts a structured presentation of results, beginning with the baseline estimations using ROA, followed by extended specifications and robustness tests. This approach allows for a clear and systematic interpretation of how ownership structure influences airline performance.

4.2. Descriptive Statistics

This section presents the descriptive statistics of the main variables used in the empirical analysis. To ensure consistency with the econometric framework, variables are grouped into financial performance indicators, operational performance indicators, ownership variables, and firm-level controls.

Table 5
Descriptive Statistics of Variables.

Variables	Mean	Median	Std. Dev.	Minimum	Maximum
ROA	0.0690	0.0221	0,0730	- 0.4945	0.1147
ROE	-0.0685	0.0662	0,4528	-25000	0.3222
Operating Margin	0.0130	0.0375	0,1404	-0.95256	0.3021
Load Factor	0.7778	0.7850	0,0677	0.6000	0.9600
CASK	7.6245	7.6000	1,1954	4.6000	10.500
RASK	7,7783	7.8500	0,8790	4.2000	9.8500
Assets	16 525	10 800	12 912	500.00	48 000
State Ownership	0,3298	0,1800	0,3459	0	1
State Ownership < 30%	0,1939	0	0,3966	0	1
State Ownership 30 – 50%	0,0424	0	0,2022	0	1
State Ownership > 50%	0,2849	0	0,4527	0	1

Note. This table reports descriptive statistics for the variables used in the empirical analysis. Financial variables are expressed as ratios or monetary values, as reported in airline annual reports. CASK and RASK are measured in monetary units per available seat-kilometre. Load factor is expressed as a percentage of seat occupancy. State ownership is measured as the percentage of equity held by the state (ranging from 0 to 1). Ownership threshold variables (<30%, 30–50%, >50%) are defined as dummy variables equal to 1 when the airline-year observation falls within the respective ownership category, and 0 otherwise.

Financial performance indicators reveal a high degree of variability across airlines and over time. The average ROA is relatively low, reflecting the structurally thin margins of the airline industry, while the median value is higher, indicating the presence of negative outliers. ROE exhibits even greater dispersion, with a negative mean and extreme minimum values, suggesting that some airlines experienced periods of significant financial distress, often associated with low or negative equity levels. The operating margin remains modest on average, further confirming the limited performance typical of the sector.

Operational performance indicators display more stable patterns. The average CASK and RASK are closely aligned, indicating tight operating margins and a strong sensitivity of performance to small changes in costs or revenues. The load factor presents relatively low variability, with an average close to 78%, suggesting a consistent level of capacity utilisation across airlines.

Ownership variables show substantial heterogeneity within the sample. The average level of state ownership is approximately 33%, while the median is significantly lower, indicating that most airline-year observations are characterised by relatively limited state participation, alongside a smaller group of cases with higher levels of government control.

The distribution of ownership thresholds provides further insight into the composition of the sample. Approximately 19% of observations correspond to minority state ownership (below 30%), around 4% fall within the intermediate range (30–50%), and about 28% reflect majority state ownership (above 50%). The remaining observations correspond to fully private ownership.

This distribution highlights that the sample includes a broad range of ownership configurations, although intermediate ownership levels are relatively less frequent. This justifies the use of threshold-based specifications, while also suggesting that the results for the middle category should be interpreted with caution due to the lower number of observations. Firm-level variables such as assets and revenue exhibit considerable dispersion, reflecting structural differences in size and market positioning across airlines. This heterogeneity further justifies the use of panel-data techniques that control for firm-specific characteristics.

Overall, the descriptive statistics highlight the volatility of financial performance, the relative stability of operational indicators, and the diversity of ownership structures within the sample. These patterns reinforce the relevance of the econometric framework adopted in this study, particularly the use of fixed-effects models to account for unobserved heterogeneity across airlines and over time.

4.3. Descriptive Patterns and Preliminary Evidence

This section provides preliminary evidence on the relationship between ownership structure and airline performance, based on cross-company comparisons and observable patterns in the data.

Table 6
Average Performance Indicators by Airline.

Airline	ROA	ROE	Op. Margin	CASK	RASK	Load Factor	State Ownership
Ryanair	0.069	0.135	0.137	5.46	7.35	0.86	0.00
Iberia	0.036	0.085	0.036	7.04	7.41	0.78	0.00
British Airways	0.025	0.122	0.053	7.31	7.98	0.77	0.00
Aer Lingus	0.025	0.052	0.046	6.81	7.27	0.77	0.45
IAG	0.018	-0.066	-0.017	7.94	8.25	0.81	0.00
Lufthansa	0.002	0.050	0.016	7.45	7.72	0.78	0.01
Air France	-0.009	-0.093	0.002	7.51	7.50	0.82	0.20
LOT	-0.004	-0.004	-0.001	8.14	8.17	0.74	0.75
SAS	-0.010	-0.114	-0.022	8.66	8.17	0.75	0.75
Alitalia	-0.039	-0.564	-0.073	9.05	7.76	0.70	0.64

Note. Values represent sample averages for each airline over the period analysed (2004–2024). Financial indicators (ROA and operating margin) are expressed as ratios. CASK and RASK are measured in monetary units per available seat-kilometre, while load factor represents the percentage of seat occupancy. State ownership corresponds to the average proportion of equity held by the state over the sample period.

The comparison of financial performance indicators reveals noticeable differences across airlines. Fully private carriers, such as Ryanair, exhibit relatively strong performance, with higher average levels of ROA and operating margins. Other predominantly private airlines, including British Airways and Iberia, also display positive and relatively stable profitability. In contrast, airlines with higher levels of state ownership, such as SAS, LOT, and Alitalia, tend to show weaker financial outcomes, often characterised by lower or negative average returns. These descriptive patterns are consistent with the possibility of a negative association between higher levels of state ownership and financial performance.

Operational indicators provide further insight into these differences. Cost efficiency, as measured by CASK, varies considerably across airlines, with low-cost carriers such as

Ryanair achieving significantly lower cost levels compared to traditional flag carriers. Airlines with higher degrees of state ownership tend to exhibit higher average costs, which may reflect differences in cost structures, organisational constraints, or business models. Revenue performance, captured by RASK, shows less systematic variation across ownership structures but remains closely aligned with cost levels, highlighting the importance of cost control in determining performance.

In contrast, load factors appear relatively stable across airlines, with most carriers maintaining occupancy rates within a relatively narrow range. This suggests that capacity utilisation is less sensitive to ownership structure and may be more strongly influenced by demand conditions and network characteristics.

The distribution of ownership structures confirms substantial heterogeneity within the sample, ranging from fully private airlines to firms with majority state control. This variation provides an appropriate empirical setting to examine potential non-linear effects of state ownership on performance outcomes.

4.4. Econometric Results

This section presents the econometric results obtained from the panel-data analysis, aiming to formally assess the relationship between state ownership and airline performance. The analysis follows the empirical strategy outlined in Chapter 3, based on fixed-effects estimations that control for unobserved heterogeneity across airlines and common time effects.

To examine the ownership–performance relationship, three complementary model specifications are estimated. First, a linear model is used to assess the direct effect of state ownership on performance. Second, a quadratic specification is introduced to capture potential non-linear effects, allowing for the possibility that the impact of state ownership varies across different levels of participation. Third, a threshold-based model is estimated to distinguish between different ownership regimes and to identify potential structural differences across categories of state ownership.

The analysis begins with the baseline results using ROA as the primary measure of financial performance. These results are then extended through alternative specifications

and robustness tests, providing a comprehensive assessment of the relationship between ownership structure and airline performance.

4.4.1. Financial and Operational Performance (ROA + Load Factor)

Financial Performance

This subsection examines the relationship between state ownership and financial performance, using ROA as the dependent variable. As discussed in Chapter 3, ROA is used as the primary measure of financial performance because it captures profitability relative to total assets and allows for greater comparability across airlines with different capital structures. Three model specifications are estimated: a linear specification, a quadratic specification, and a threshold specification.

Model 1 – Linear Specification

Model 1 estimates the relationship between state ownership and financial performance using a fixed-effects specification. The model includes airline-specific fixed effects and year dummies to control for unobserved heterogeneity across airlines and common time effects. In addition, firm size is controlled for through the inclusion of logarithm of total assets, and a COVID-19 dummy variable is introduced to account for the impact of the pandemic. Table 7 presents fixed effects of model 1.

Table 7
Fixed Effects Model – Linear Specification (ROA).

Variable	Coefficient	Std. Error	p-value
State Ownership	-0.02520	0.0498	0.6252
Log(assets)	0.0031	0.0082	0.7157
COVID Dummy	-0.0494	0.0738	0.5202
Constant	0.0076	0.0910	0.9352
Model Statistics			
Observations	165		
Number of Airlines	10		
Within R ²	0.632		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is ROA. The model includes airline fixed effects and year dummies. Standard errors are clustered at the airline level.

The results indicate a negative relationship between state ownership and performance. The estimated coefficient suggests that higher levels of government participation are associated with lower ROA. However, this effect is not statistically significant, implying that no robust linear relationship can be established in this specification. The control variables do not exhibit statistically significant effects. The coefficient on log(assets) is positive, suggesting potential scale effects, but it is not statistically significant. Similarly, the COVID-19 dummy variable does not show a significant impact on ROA within this model.

The inclusion of time effects proves to be relevant, as several time periods exhibit statistically significant impacts on performance. This finding highlights the importance of common shocks, such as macroeconomic conditions and industry-wide disruptions, in shaping airline performance over time. The presence of fixed effects also confirms the existence of unobserved, time-invariant differences across airlines, supporting the use of a fixed-effects specification.

Overall, while the linear model provides initial evidence of a negative association between state ownership and performance, the lack of statistical significance suggests that the relationship may be more complex and potentially non-linear. This motivates the analysis of the quadratic specification in the following model.

Model 2 – Quadratic Specification

To further investigate the relationship between state ownership and airline performance, this section introduces a quadratic specification that allows for potential non-linear effects. This approach follows Nguyen and Vo (2022), who highlight that the impact of state ownership may vary depending on its level, rather than being strictly linear. Table 8 presents the estimations results for the quadratic specification.

Table 8
Fixed Effects Model - Quadratic Specification (ROA).

Variable	Coefficient	Std. Error	p-value
State Ownership	-1.1671*	0.5826	0.0761
State Ownership ²	0.8748*	0.4412	0.0787
Log(assets)	0.0244	0.0196	0.2433
COVID Dummy	-0.0217	0.0501	0.6753
Constant	-0.0025	0.1518	0.9873
Model Statistics			
Observations	165		
Number of Airlines	10		
Within R ²	0.734		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is ROA. The model includes airline fixed effects and year dummies. *, ** denote statistical significance at the 10% and 5% levels, respectively.

The results provide evidence of a non-linear relationship between state ownership and financial performance. The coefficient on state ownership is negative and statistically significant at the 10% level, while the squared term is positive and also statistically significant. The signs of the estimated coefficients ($\beta_1 < 0$; $\beta_2 > 0$) indicate a U-shaped relationship between state ownership and ROA.

From an economic perspective, this suggests that increases in state ownership are initially associated with declines in performance. However, beyond a certain threshold, further increases in state participation are associated with improvements in performance. Based on the estimated coefficients, the turning point of the relationship is approximately 0.67, indicating that the marginal effect of state ownership becomes positive beyond this level. The coefficient on log(assets) is positive but not statistically significant, indicating that

firm size does not appear to be a key determinant of financial performance once fixed effects are taken into account.

These findings are consistent with the empirical literature, which emphasises the presence of non-linear effects in the relationship between state ownership and firm performance, as studied by Gupta (2005) and Nguyen and Vo (2022). They may also reflect differences in governance structures, political influence, and managerial incentives across ownership regimes (Estrin *et al.*, 2009; Megginson & Netter, 2001).

Overall, the results suggest that the effect of state ownership on performance is conditional on its level, rather than uniform across ownership structures, highlighting the importance of considering non-linearities in the ownership–performance relationship.

Model 3 – Threshold Specification

To further examine potential non-linearities in the relationship between state ownership and airline performance, this model replaces the continuous ownership variable with categorical variables representing different ownership regimes. Specifically, three dummy variables are included to capture minority state ownership (below 30%), intermediate ownership (between 30% and 50%), and majority state ownership (above 50%), with fully private firms serving as the reference category. Table 9 presents the estimation results for the threshold specification.

Table 9
Fixed Effects Model – Threshold Specification (ROA).

Variable	Coefficient	Std. Error	p-value
State < 30%	-0.0824	0.0488	0.1254
State 30 - 50%	-0.0305	0.0304	0.3427
State > 50%	-0.0478	0.0320	0.1688
Log(assets)	0.0017	0.0064	0.7913
COVID Dummy	-0.0516	0.0690	0.4741
Constant	0.0403	0.0648	0.5497
Model Statistics			
Observations	165		
Airlines	10		
Within R ²	0.671		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is ROA. The model includes airline fixed effects and year dummies. The omitted category corresponds to fully private ownership. Robust standard errors are clustered at the airline level. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The results do not provide strong evidence of statistically significant differences in performance across ownership regimes. Although the estimated coefficients for all ownership categories are negative, suggesting that state participation may be associated with lower performance, none of these effects are statistically significant.

This indicates that, while the direction of the relationship is consistent with the linear specification, the threshold approach does not identify clear performance differences between specific ownership regimes. In particular, no ownership category appears to significantly outperform or underperform relative to fully private airlines.

Compared to the quadratic specification, which revealed a statistically significant U-shaped relationship, the threshold model provides less precise evidence regarding the structure of the ownership–performance relationship. This suggests that the effects of state ownership may be better captured through a continuous non-linear specification rather than discrete ownership categories.

Overall, the results reinforce the conclusion that the relationship between state ownership and financial performance is complex and cannot be fully explained by simple ownership thresholds.

In addition to financial performance, the analysis is extended to include load factor as a complementary indicator of operational performance.

Unlike cost-based measures such as CASK, load factor follows the same directional interpretation as financial performance indicators, with higher values reflecting better performance through improved capacity utilisation. As such, it is analysed alongside ROA to provide a more comprehensive assessment of airline performance.

Operational Performance

Having examined financial performance, the analysis is now extended to operating performance, using load factor as the primary operational indicator. Load factor captures capacity utilisation and reflects how efficiently airlines fill available seats, making it a key measure of operational performance in the airline industry. As in the previous subsection, three model specifications are estimated: a linear specification, a quadratic specification, and a threshold specification.

Model 1 – Linear Specification

Model 1 estimates the relationship between state ownership and load factor using a fixed-effects specification. The model includes airline-specific fixed effects and year dummies to control for unobserved heterogeneity across airlines and common time effects. Firm size is controlled for through $\log(\text{assets})$, and a COVID-19 dummy variable is included to account for the impact of the pandemic. Table 10 presents the estimation results.

Table 10*Fixed Effects Model - Linear Specification (Load Factor).*

Variable	Coefficient	Std. Error	p-value
State Ownership	0.0152	0.0364	0.6871
Log(assets)	0.0034	0.0066	0.6189
COVID Dummy	-0.5840	0.0817	0.4930
Constant	0.7068***	0.0598	8.75e ⁻⁰⁷
Model Statistics			
Observations	165		
Airlines	10		
Within R²	0.739		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is load factor. The model includes airline fixed effects and year dummies. Robust standard errors are clustered at the airline level. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The results do not provide evidence of a statistically significant linear relationship between state ownership and operational performance. Although the coefficient on state ownership is positive, it is not statistically significant, suggesting that no robust linear association can be established between state participation and capacity utilisation.

Firm size, measured by log(assets), is also not statistically significant in this specification, suggesting that differences in airline size do not explain variations in load factor once fixed effects are controlled for. Similarly, the COVID-19 dummy variable is not statistically significant, indicating that, within this specification, the pandemic effect is absorbed by time fixed effects.

Overall, the results suggest that operational performance, as measured by load factor, is not linearly associated with state ownership.

Model 2 – Quadratic Specification

To explore potential non-linear effects, Model 2 introduces a squared term of state ownership. Table 11 presents the estimation results for the quadratic specification.

Table 11

Fixed Effects Model - Quadratic Specification (Load Factor).

Variable	Coefficient	Std. Error	p-value
State Ownership	-0.3477***	0.0947	0.0052
State Ownership ²	0.2780***	0.0615	0.0014
Log(assets)	0.0102*	0.0052	0.0797
COVID Dummy	-0.0496	0.0781	0.5409
Constant	0.7036***	0.0426	4.83e ⁻⁰⁸
Model Statistics			
Observations	165		
Airlines	10		
Within R ²	0.758		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is load factor. The model includes airline fixed effects and year dummies. Robust standard errors are clustered at the airline level. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The results reveal a statistically significant non-linear relationship between state ownership and load factor. The coefficient on the linear term is negative, while the squared term is positive, indicating a U-shaped. This suggests that:

- At lower levels of state ownership, increases in state participation are associated with lower load factors
- Beyond a certain threshold, further increases in state ownership lead to improvements in capacity utilisation

The estimated turning point is approximately:

$$\text{Turning Point} = -\frac{\beta_1}{2\beta_2} \approx \frac{0.3477}{2 \times 0.2780} \approx 0.63$$

This implies that the marginal effect of state ownership becomes positive when state ownership exceeds roughly 63%.

From an economic perspective, this pattern suggests that moderate levels of state ownership may introduce inefficiencies (e.g., governance frictions or mixed incentives), while high levels of state control may restore coordination and strategic alignment, leading to improved operational performance.

Importantly, $\log(\text{assets})$ becomes marginally significant, indicating that larger airlines may achieve slightly higher load factors, possibly reflecting network scale advantages.

Model 3 – Threshold Specification

Finally, Model 3 replaces the continuous ownership variable with categorical variables representing different ownership regimes. Table 12 presents the estimation results.

Table 12

Fixed Effects Model - Threshold Specification (Load Factor).

Variable	Coefficient	Std. Error	p-value
State < 30%	0.0003	0.0289	0.9906
State 30 – 50%	0.0210	0.0157	0.2136
State > 50%	0.0270	0.0163	0.1320
Log(assets)	0.0046	0.0056	0.4275
COVID Dummy	-0.0546	0.0817	0.5208
Constant	0.6887**	0.0470	$1.37e^{-07}$
Model Statistics			
Observations	165		
Airlines	10		
Within R ²	0.750		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is load factor. The model includes airline fixed effects and year dummies. The omitted category corresponds to fully private ownership. Robust standard errors are clustered at the airline level. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The threshold specification does not provide statistically significant evidence of differences in load factor across ownership regimes. None of the ownership categories (State < 30%; State 30 – 50%, State > 50%) are statistically significant at conventional levels. This suggests that discrete ownership categories fail to capture the relationship between state ownership and operational performance. The lack of significance contrasts

with the quadratic model and indicates that the effect of ownership is likely continuous and non-linear, rather than segmented into clear regimes.

Log(assets) and the COVID-19 dummy also remain statistically insignificant in this specification.

The results indicate that the relationship between state ownership and operational performance is not linear and cannot be adequately captured using simple ownership categories.

Instead, the quadratic specification provides robust evidence of a U-shaped relationship, suggesting that:

- Partial state ownership is associated with lower efficiency (lower load factors).
- High levels of state ownership are associated with improved capacity utilisation.

This finding is consistent with the results obtained for financial performance and reinforces the idea that the impact of state ownership depends critically on its level. Moreover, the results support the argument in the literature (e.g., Gupta, 2005; Nguyen and Vo, 2022) that the effects of state ownership are inherently non-linear and vary across different performance dimensions.

4.4.2. Cost Efficiency (CASK)

After examining financial and operational performance, the analysis turns to cost efficiency using CASK as the primary indicator. CASK captures airlines' cost structure and is widely used as a measure of efficiency, as it reflects how effectively operating expenses are managed relative to capacity. As in the previous subsection, three model specifications are estimated: a linear, a quadratic, and a threshold specification.

Model 1 – Linear Specification

Model 1 estimates the relationship between state ownership and load factor using a fixed-effects specification. The model includes airline-specific fixed effects and year dummies to control for unobserved heterogeneity across airlines and common time effects. Firm

size is controlled for through $\log(\text{assets})$, and a COVID-19 dummy variable is included to account for the impact of the pandemic. Table 13 presents the estimation results.

Table 13

Fixed Effects Model - Linear Specification (CASK).

Variable	Coefficient	Std. Error	p-value
State Ownership	-0.0490	0.5487	0.9307
Log(assets)	0.1834**	0.0643	0.0190
COVID Dummy	0.5901	0.5529	0.3144
Constant	5.2476***	0.6364	1.74e ⁻⁰⁵
Model Statistics			
Observations	165		
Airlines	10		
Within R ²	0.702		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is load factor. The model includes airline fixed effects and year dummies. Robust standard errors are clustered at the airline level. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The results do not provide evidence of a statistically significant linear relationship between state ownership and CASK. Although the coefficient on state ownership is close to zero and not statistically significant, indicating that, in a linear framework, government participation does not appear to systematically affect cost efficiency.

In contrast, the coefficient on $\log(\text{assets})$ is positive and statistically significant at the 5% level, suggesting that larger airlines tend to exhibit higher unit costs. This may reflect increased operational complexity, legacy cost structures, or inefficiencies associated with scale in traditional carriers.

Overall, the linear specification suggests that cost efficiency is not directly influenced by state ownership when assuming a linear relationship, but is instead more closely related to structural characteristics such as firm size.

Model 2 – Quadratic Specification

To explore potential non-linear effects, Model 2 introduces a squared term of state ownership. Table 14 presents the estimation results for the quadratic specification.

Table 14
Fixed Effects Model - Quadratic Specification (CASK).

Variable	Coefficient	Std. Error	p-value
State Ownership	6.2598**	2.0074	0.0124
State Ownership ²	-4.8335**	1.5043	0.0106
Log(assets)	0.0654	0.0833	0.4524
COVID Dummy	0.4362	0.4955	0.4017
Constant	5.3034	0.5277	3.43e ⁻⁰⁶
Model Statistics			
Observations	165		
Airlines	10		
Within R ²	0.745		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is load factor. The model includes airline fixed effects and year dummies. Robust standard errors are clustered at the airline level. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The results reveal a statistically significant non-linear relationship between state ownership and operational performance. The coefficient on the linear term is positive and statistically significant, while the squared term is negative and also statistically significant. These signs ($\beta_1 > 0$; $\beta_2 < 0$) indicate an inverted U-shaped relationship between state ownership and CASK.

From an economic perspective, this suggests that increases in state ownership are initially associated with higher operating costs (lower efficiency). However, beyond a certain threshold, further increases in state participation are associated with reductions in CASK, indicating improvements in cost efficiency.

This pattern may reflect the coexistence of different mechanisms. At intermediate levels of state ownership, political interference and weaker incentives may increase inefficiencies. At higher levels of state ownership, however, stronger control, restructuring efforts, or government support may improve cost discipline and operational performance.

Importantly, this is the strongest and most statistically robust result in the analysis of operational performance, indicating that ownership structure plays a meaningful role in shaping cost efficiency when non-linearities are taken into account.

Model 3 – Threshold Specification

Model 3 replaces the continuous ownership variable with categorical thresholds. Table 15 presents the estimation results.

Table 15

Fixed Effects Model - Threshold Specification (CASK).

Variable	Coefficient	Std. Error	p-value
State < 30%	-0.0155	0.2749	0.9562
State 30 – 50%	-0.0233	0.2627	0.3989
State > 50%	-0.1134	0.1670	0.5140
Log(assets)	0.1698*	0.0763	0.0530
COVID Dummy	0.5793	0.5567	0.3252
Constant	5.4061***	0.6687	2.04e ⁻⁰⁵
Model Statistics			
Observations	165		
Airlines	10		
Within R ²	0.704		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes (clustered by airline)		

Note. Dependent variable is load factor. The model includes airline fixed effects and year dummies. The omitted category corresponds to fully private ownership. Robust standard errors are clustered at the airline level. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Although the coefficients for all ownership categories are negative, none of them are statistically significant. This suggests that grouping ownership into discrete categories may mask important variation within each interval.

Compared to the quadratic specification, the threshold model provides weaker explanatory power, reinforcing the idea that the ownership–performance relationship is better captured as a continuous non-linear function rather than through discrete classifications.

Taken together, the results indicate that the relationship between state ownership and cost efficiency is non-linear and follows an inverted U-shaped pattern. While no significant linear effect is identified, the quadratic specification reveals that ownership structure influences cost efficiency in a complex and conditional manner.

This finding is broadly consistent with the empirical literature, which documents non-linear effects of state ownership on firm performance. However, the direction of the relationship is not uniform across studies. While some contributions find that efficiency deteriorates at higher levels of state ownership, others report different non-linear patterns depending on the institutional and sectoral context (Gupta, 2005; Nguyen & Vo, 2022).

These findings contrast with the results obtained for financial performance (ROA), where the non-linear relationship followed a U-shaped pattern. This difference highlights the multidimensional nature of firm performance and is consistent with Czerny and Lang (2019), who show that performance outcomes vary across financial and operational dimensions.

In particular, the results suggest that state ownership may play a more relevant role in shaping internal efficiency mechanisms, such as cost control, than in influencing financial performance or revenue generation. This interpretation is in line with Estrin *et al.* (2009) and Vickers and Yarrow (1991), who emphasise that inefficiencies often arise from governance structures and incentive misalignment rather than purely operational factors. Furthermore, Merlevede and Muylle (2025) suggest that ownership effects remain heterogeneous even after controlling for firm-level characteristics.

4.4.3. Robustness Checks

To assess the robustness of the main findings, the analysis is extended by employing alternative performance measures and model specifications. In addition to financial indicators such as ROE and operating margin, operational measures including CASK and RASK are also considered. This approach allows for evaluating whether the relationship between ownership structure and performance remains consistent across different performance dimensions.

Table 16*Robustness Checks – Quadratic Specification Results.*

Dependent Variable	ROE		Operating Margin		CASK		RASK	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
State Ownership	-0.33	0.85	-0.39	0.28	6.26**	0.01	4.41	0.46
State Ownership²	0.46	0.71	0.30	0.23	-4.83**	0.01	-3.05	0.51
Log(assets)	-0.03	0.69	-0.04**	0.04	0.07	0.45	0.20	0.41
Within R²	0.40		0.61		0.74		0.60	

Note. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The results provide mixed evidence regarding the relationship between state ownership and performance across different indicators.

For ROE, no statistically significant relationship is identified, and the model lacks overall explanatory power. This suggests that ROE may be less suitable for capturing ownership effects in this context, likely due to its sensitivity to leverage and capital structure differences across airlines.

For operating margin, no statistically significant relationship is identified between state ownership and performance. This indicates that the impact of ownership structure on operational profitability is not robust across specifications. However, firm size, measured by log(assets), is negatively and statistically significant, suggesting that larger airlines may experience lower operating margins, possibly due to higher complexity or cost structures.

In contrast, the analysis of cost efficiency, measured through CASK, reveals a statistically significant inverted U-shaped relationship. The positive coefficient on the linear term and the negative coefficient on the squared term indicate that costs initially increase with state ownership, but begin to decline beyond a certain threshold, implying improvements in cost efficiency at higher levels of state participation. Based on the estimated coefficients, this turning point occurs at approximately 64.8% state ownership, corresponding to around 35.2% private ownership. This result should, however, be interpreted as an indicative benchmark rather than a precise policy target.

For RASK, no statistically significant relationship is identified, indicating that ownership structure does not appear to influence revenue generation efficiency.

To further assess the robustness of the results, an alternative specification based on ownership thresholds is estimated using CASK as the dependent variable.

Table 17

Ownership Threshold Model (CASK).

Variable	Coefficient	Std. Error	p-value
State < 30%	-0.0882	0.1839	0.6431
State 30 - 50%	-0.0183	0.2738	0.9482
State > 50%	-0.1079	0.1277	0.4204
Assets	4.23e ⁻⁰⁵	1.04e ⁻⁰⁵	0.0028***
Revenue	-1.56e ⁻⁰⁵	1.58e ⁻⁰⁵	0.3482
COVID Dummy	0.5993	0.5794	0.3279
Model Statistics			
Observations	165		
Airlines	10		
Within R ²	0.750		
Fixed Effects	Yes		
Time Effects	Yes		
Robust SE	Yes		

Note. The dependent variable is CASK. The model is estimated using fixed-effects panel regression and includes airline and year fixed effects. Robust standard errors are clustered at the airline level. The omitted category corresponds to fully private ownership. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

The results do not provide evidence of a statistically significant relationship between ownership categories and cost efficiency. Although the coefficients for all ownership categories are negative, suggesting a potential reduction in costs relative to fully private firms, none of these effects are statistically significant.

This result is particularly important, as it is consistent with the non-linear relationship previously identified for cost efficiency, reinforcing the view that this relationship is better captured by a continuous specification rather than discrete ownership categories.

The contrast between the quadratic and threshold specifications provides important insights into the nature of the ownership–performance relationship. While the quadratic model reveals a statistically significant non-linear relationship between state ownership and cost efficiency, the threshold model fails to detect any significant effects. This difference suggests that the impact of ownership is not adequately captured by discrete ownership categories, but instead follows a continuous and non-linear pattern across the full distribution of ownership levels.

Threshold models, by construction, group observations into broad categories and may therefore mask important variation within each ownership interval, whereas the quadratic specification provides a more flexible representation of the relationship.

Taken together, the robustness checks provide strong support for the conclusion that the relationship between state ownership and airline performance is both non-linear and inherently multidimensional. The results indicate that:

- State ownership plays a more significant role in shaping cost efficiency (CASK).
- Ownership structure does not significantly affect revenue generation (RASK), suggesting that ownership structure influences internal efficiency mechanisms rather than market-facing performance outcomes.
- It has limited and non-robust effects on financial performance (ROE and operating margin).

Importantly, these findings do not contradict the main results obtained for ROA and load factor. Instead, they complement them by highlighting that the effects of ownership vary depending on the dimension of performance considered.

From a policy perspective, this evidence suggests that privatisation strategies may yield heterogeneous outcomes. While changes in ownership structure may not immediately translate into improved performance or revenue outcomes, they can have meaningful effects on operational efficiency, particularly in terms of cost management.

These results are consistent with the empirical literature, including Gupta (2005) and Nguyen and Vo (2022), which emphasise that the effects of state ownership are often non-linear and vary across different performance dimensions.

4.5. Discussion

4.5.1. Hypotheses Testing Summary

This section summarises the empirical findings in relation to the hypotheses formulated in Chapter 2.

- **H1** proposed a negative linear relationship between state ownership and airline performance. The empirical results provide only limited support for this hypothesis. While the linear specification indicates a negative association between

state ownership and ROA, the effect is not statistically significant. Therefore, H1 is not supported by the data, diverging from expectations in the privatisation literature (Gupta, 2005; Megginson and Netter, 2001).

- **H2** suggested that the relationship between state ownership and performance is non-linear. This hypothesis is supported by the empirical findings. The quadratic specifications for both ROA and CASK reveal statistically significant non-linear relationships, confirming that the impact of state ownership varies depending on its level, consistent with recent empirical evidence (Nguyen & Vo, 2022).
- **H2A** proposed that this non-linear relationship follows an inverted U-shaped pattern. The results provide only partial support for this hypothesis. While the findings for cost efficiency (CASK) are consistent with an inverted U-shaped relationship, the results for financial performance (ROA) indicate a U-shaped pattern.

This divergence suggests that the impact of state ownership differs across performance dimensions. In particular, while moderate levels of state ownership are associated with higher cost inefficiencies, financial performance appears to improve at higher levels of state participation. These findings highlight the multidimensional and context-dependent nature of ownership effects (Estrin *et al.*, 2009).

Overall, the empirical evidence supports the existence of non-linear effects (H2), but provides only partial support for the expected inverted U-shaped relationship (H2A). These results reinforce the importance of flexible empirical specifications and suggest that the relationship between state ownership and performance may differ across performance dimensions.

4.5.2. Discussion

This section integrates the empirical findings from the descriptive analysis and panel-data estimations, providing a comprehensive interpretation of how ownership structure affects airline performance. By combining evidence from different performance indicators and econometric specifications, the analysis offers a nuanced understanding of the role of state ownership in the airline industry, with direct implications for TAP Air Portugal.

The results suggest that higher levels of state ownership may be associated with weaker financial performance, particularly when measured by ROA. However, this relationship

is not consistently statistically significant across specifications. This effect becomes more pronounced when control variables are included and is consistent with the privatisation literature, which highlights inefficiencies associated with government participation, including political interference, weaker governance incentives, and reduced managerial autonomy, as emphasized by Estrin *et al.* (2001), Gupta (2005) and Megginson and Netter (2001). However, this relationship should be interpreted with caution given its limited statistical significance across specifications.

However, the relationship between ownership and performance is not strictly linear. While the threshold specification does not provide robust evidence of differences across ownership categories, the quadratic models — which explicitly include both the linear State Ownership term and its squared component — reveal statistically significant non-linear effects. In particular, the linear and squared terms are jointly statistically significant, confirming that the marginal effect of state ownership varies depending on its level. This specification allows for the identification of turning points in the ownership–performance relationship and provides a more flexible representation than linear or categorical models. These findings are consistent with recent empirical studies highlighting non-linear and context-dependent effects of state participation (Nguyen & Vo, 2022).

Importantly, the results differ across performance dimensions. The robustness analysis shows that financial indicators such as ROE and operating margin are not significantly affected by ownership structure. Similarly, no significant relationship is found for revenue efficiency (RASK).

In contrast, cost efficiency, measured through CASK, displays a statistically significant non-linear relationship with state ownership. The quadratic specification reveals an inverted U-shaped pattern, where costs initially increase with higher levels of state participation but begin to decline beyond a certain threshold, implying improvements in cost efficiency at higher levels of state ownership. This suggests that the impact of ownership structure varies across ownership levels, with different mechanisms dominating at different degrees of state involvement.

These findings challenge the conventional assumption that state ownership uniformly leads to cost inefficiencies. Instead, they support the view that performance differences are more likely to arise through governance structures, strategic decision-making, and incentive alignment rather than purely operational factors (Cozmata, 2023; Estrin *et al.*,

2009; Vickers & Yarrow, 1991). In line with Czerny and Lang (2019), these findings also highlight the importance of institutional context in determining performance outcomes.

From a policy perspective, the results suggest that increasing private ownership may improve financial performance, but ownership structure alone is not sufficient to explain performance outcomes. The effectiveness of privatisation depends critically on governance quality, managerial autonomy, and exposure to market discipline. Moreover, the heterogeneous results across performance indicators indicate that privatisation may generate uneven effects, improving internal efficiency without necessarily translating into immediate gains in profitability or revenue outcomes.

Overall, the findings reinforce a multidimensional view of airline performance. The impact of state ownership is neither uniform nor linear, but depends on both its level and the specific dimension of performance considered. These results provide a robust empirical foundation for the policy implications discussed in the following chapter.

5. Conclusion

5.1. Main Findings

This dissertation set out to examine the relationship between state ownership and airline performance, with a particular focus on identifying whether a turning point of privatisation exists. By combining comparative case analysis with panel-data econometric techniques, the study provides a comprehensive assessment of how different ownership structures influence financial and operational outcomes.

The empirical findings suggest that higher levels of state ownership may be associated with weaker financial performance, particularly when measured by ROA. However, this relationship is not consistently statistically significant across specifications and should therefore be interpreted with caution. These results broadly align with the conclusions of Estrin *et al.* (2009) and Megginson and Netter (2001), who document efficiency gains following privatisation across a wide range of sectors. Similarly, Gupta (2005) finds that reductions in state ownership are associated with improvements in firm performance, including in cases of partial privatisation.

However, the results of this study also extend the literature by providing more nuanced evidence regarding the nature of this relationship. In line with Nguyen and Vo (2022), the analysis highlights the importance of non-linear ownership effects. Nevertheless, the findings do not support the existence of a clearly optimal intermediate ownership level. Instead, they indicate that the impact of state ownership varies across its distribution and depends on the specific performance dimension considered.

Furthermore, the results reveal that the effects of state ownership differ across performance indicators. While financial measures such as ROA, ROE and operating margin show limited or inconsistent effects, the analysis of cost efficiency (CASK) provides stronger evidence of a statistically significant non-linear relationship. In particular, the results suggest an inverted U-shaped pattern, indicating that costs initially increase with state ownership but begin to decline beyond a certain threshold, implying improvements in cost efficiency at higher levels of state participation.

These findings suggest that the effects of state ownership are more pronounced in internal efficiency mechanisms than in market-facing outcomes. Rather than uniformly reducing efficiency, state ownership appears to influence performance through governance

structures, strategic decision-making, and incentive alignment, as highlighted in the literature (Czerny & Lang, 2019; Estrin *et al.*, 2009; Vickers & Yarrow, 1991).

Overall, the results indicate that the relationship between state ownership and airline performance is both non-linear and multidimensional. The impact of ownership varies across performance dimensions and cannot be fully captured by a single empirical specification, reinforcing the need for flexible modelling approaches and context-specific interpretation.

5.2. Policy Implications for TAP Air Portugal

The findings of this study have direct implications for the ongoing debate regarding the future ownership structure of TAP Air Portugal. The empirical evidence suggests that higher levels of private ownership may be associated with improved financial performance, particularly in terms of long-term sustainability. However, this relationship is not consistently robust across specifications and should therefore be interpreted with caution.

More importantly, the results indicate that the effects of ownership structure are not uniform across different dimensions of performance. While financial indicators show limited and inconsistent responses to changes in ownership, the analysis of cost efficiency reveals stronger and more systematic effects. In particular, the evidence suggests that ownership structure may influence internal efficiency mechanisms more directly than market-facing outcomes such as revenue generation or profitability.

From a policy perspective, these findings indicate that privatisation strategies are likely to generate heterogeneous outcomes. Changes in ownership structure alone are unlikely to guarantee improvements in overall performance unless they are accompanied by appropriate governance reforms and stronger incentive alignment, as emphasised in the literature (Gupta, 2005).

Therefore, the design of TAP's privatisation process should not focus exclusively on the percentage of state ownership. Instead, greater emphasis should be placed on the institutional and governance framework, including board independence, managerial autonomy, and exposure to market discipline. These elements are critical in ensuring that changes in ownership structure translate into tangible performance improvements.

An additional insight from the quadratic specification relates to the estimated turning point of the ownership–performance relationship. The results suggest that the marginal effect of state ownership may become more favourable beyond relatively high levels of state participation. However, this estimate should be interpreted with caution. The absence of consistent evidence across alternative model specifications, together with the sensitivity of quadratic models to functional form assumptions, limits its use as a precise policy target.

Instead, this result should be viewed as an indicative benchmark, reinforcing the idea that the effects of state ownership are context-dependent and do not follow a simple linear pattern. From a policy perspective, this further highlights the importance of focusing not only on ownership shares, but also on governance structures and institutional design when evaluating privatisation strategies for TAP Air Portugal.

5.3. Contributions to the Literature

This dissertation contributes to the literature on privatisation and state ownership in several important ways.

First, it provides new empirical evidence on the relationship between ownership structure and airline performance using a multi-country panel dataset. In doing so, it extends existing studies that often rely on single-country analyses or individual case studies, thereby offering a broader and more generalisable assessment of ownership effects across different institutional contexts (Estrin et al., 2009; Megginson and Netter, 2001).

Second, the study advances the literature by explicitly modelling non-linear ownership effects. While prior research has often focused on binary distinctions between public and private ownership, this dissertation demonstrates that such approaches may overlook important variations across ownership levels. By incorporating quadratic and threshold specifications, the analysis provides robust evidence that the ownership–performance relationship is inherently non-linear, consistent with recent contributions such as Nguyen and Vo (2022).

Third, the dissertation adopts a multidimensional approach to performance by jointly analysing financial, operational, and cost efficiency indicators. This responds to recent

calls in the literature for more comprehensive frameworks that capture the complexity of firm performance beyond single financial metrics (Czerny & Lang, 2019).

Importantly, the findings show that the effects of state ownership differ across performance dimensions. While financial performance exhibits limited and inconsistent responses to ownership structure, cost efficiency displays a significant non-linear relationship. This highlights that ownership effects are not uniform and may operate through different mechanisms depending on the performance dimension considered.

Finally, the findings contribute to the airline-specific literature by showing that the effects of state ownership are not primarily driven by cost inefficiencies alone. Instead, the results suggest that governance structures and strategic decision-making processes play a central role in mediating ownership effects, thereby refining existing interpretations of state ownership inefficiencies (Cozmata, 2023; Vickers & Yarrow, 1991).

5.4. Limitations and Suggestions for Future Research

Despite the robustness of the empirical approach, several limitations should be acknowledged.

First, the dataset is constructed exclusively from airline annual reports, which may involve differences in accounting practices, reporting standards, and disclosure quality across firms and over time. These differences may affect the comparability of certain variables, particularly in an industry where operational indicators are not always reported using fully standardised criteria.

Second, the use of an unbalanced panel reflects variations in data availability across airlines and years. While this structure is common in empirical studies on firm performance and privatisation and remains compatible with panel-data estimation (Gupta, 2005; Nguyen and Vo, 2022), it may reduce the efficiency of the estimates and limit comparability across time periods.

Third, some variables, particularly those related to competition intensity, market conditions, and macroeconomic influences, are approximated using available information rather than drawn from fully harmonised external datasets. Although this approach is consistent with the firm-level nature of the dataset, it may affect the precision of the estimated relationships.

In addition, potential endogeneity represents an important limitation. Ownership structure and firm performance may be jointly determined, as weaker firms may be more likely to retain state ownership or become subject to state intervention. While the use of fixed-effects models helps mitigate unobserved heterogeneity, it does not fully address reverse causality or omitted variable bias, thereby limiting the ability to draw strong causal inferences. This concern is widely recognised in the literature on privatisation and state ownership (Estrin *et al.*, 2009; Nguyen and Vo, 2022).

Another limitation relates to the scope of the sample. The analysis focuses on a relatively small group of flag carriers, which is appropriate given the objective of drawing implications for TAP Air Portugal, but may limit the generalisability of the findings to other airline business models, such as low-cost carriers or airlines operating in different regulatory environments.

Future research could address these limitations in several ways. First, it could incorporate more comprehensive and standardised external datasets, particularly for macroeconomic, competitive, and industry-level variables. Second, alternative econometric approaches — such as instrumental variable techniques or dynamic panel models — could be employed to better address endogeneity concerns and strengthen causal inference. Third, future studies could expand the sample to include a broader range of airlines and institutional contexts.

Finally, further research should explore governance mechanisms more explicitly, in order to better identify the channels through which ownership structure affects airline performance, particularly in light of the non-linear and multidimensional relationships identified in this study.

5.5. Final Remarks

In light of the empirical findings, it is possible to provide a direct answer to the research question posed in this dissertation. This study set out to determine whether an turning point of privatisation exists for TAP Air Portugal in order to enhance financial performance while preserving strategic national interests. The results do not support the existence of a clearly identifiable “optimal” ownership threshold.

Instead, the evidence indicates that the relationship between state ownership and airline performance does not conform to a single, uniform pattern and varies significantly across both ownership levels and performance dimensions. While higher levels of private ownership may be associated with improved financial performance, this relationship is not consistently robust across specifications.

At the same time, the findings reveal that the effects of ownership differ across performance indicators. In particular, cost efficiency exhibits a statistically significant non-linear relationship with state ownership, suggesting that ownership structure may influence internal efficiency mechanisms in a more systematic way than market-facing outcomes such as profitability or revenue generation.

For TAP Air Portugal, these results imply that increasing private ownership may contribute to improved long-term financial sustainability. However, the effectiveness of any privatisation strategy will depend less on the precise ownership share and more on its institutional design, including governance structures, managerial autonomy, and exposure to market discipline.

More broadly, this dissertation demonstrates that ownership structure plays an important role in shaping airline performance, although its effects are neither uniform nor unidimensional. The findings highlight the importance of adopting a multidimensional perspective when evaluating privatisation strategies, taking into account the complex and non-linear nature of ownership effects.

These findings contribute to a more nuanced understanding of privatisation, suggesting that ownership effects are inherently non-linear and vary across performance dimensions.

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