The Downstream Effects of Airport Privatization: Evidence from Brazil

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Abstract

I examine how the staggered privatization of airports in Brazil affects airline operations and the markets those airports serve. Privatization improves services provided to both airlines and passengers. Delays decline on the routes served by privatized airports, and passengers report greater satisfaction with those airports. In contrast, market concentration and average fares rise. Airlines that already have more pronounced operations at a privatized airport gain market share on the routes the airport serves, while airlines with little presence lose share. Effects are stronger after the deadline for the mandated infrastructure investments.

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1 Introduction

Governments often privatize industry operations to raise revenue and improve industry performance. In many cases, a private firm operates the privatized enterprise under a long-term contract and maximizes profit subject to regulatory policy. The privatized enterprise can produce an input used by firms that compete to serve final consumers. In such a case, the effects of privatization depend not only on the performance of the privatized input supplier, but also on the performance of downstream suppliers. Most studies focus on the privatization of downstream industries. In contrast, this research focuses on the effects of input privatization on downstream performance. In particular, I examine the effects of airport privatization in Brazil on downstream airline operations and markets. Airlines use airport services as an input to serve passengers. After seven rounds of privatization since 2011, 89 percent of domestic passengers are served by a privately operated airport. The resulting variation from the implementation of airport privatization in Brazil allows me to identify and estimate the effects on airline operations and market outcomes.

I find that privatization is associated with improved performance on several dimensions of airline operations. Delays decline on the routes served by the privatized airports, and passengers report higher satisfaction with those airports. In contrast, market concentration and average fares rise in the markets those airports serve. I provide evidence consistent with an asymmetric impact of privatization of an input on downstream competitors.

The operational improvements are most pronounced after the deadline for the investments mandated in the privatization contract. These mandated investments include new runways and expanded and modernized terminals. Privatization improves operations and also increases the market concentration of airlines. The increased concentration may arise if the efficiency gains induced by privatization are of particular value to airlines with a larger presence at the airport. For example, the benefits from reduced delays may exhibit economies of scale. Airlines with many flights at the airport are more likely to carry passengers connecting there, so reduced delays lower operating costs of these airlines by more than for airlines with few flights. I find that the impact of privatizing an airport is asymmetric across the airlines that use that airport. Airlines with a larger presence at an airport before privatization gain share in the markets that airport serves. Higher fares likely reflect both the increase in concentration and the higher cost of providing the improved conditions.

The privatization of airports in Brazil combines three features that are rarely available in the same setting. First, the staggered implementation of privatization allows for a cleaner estimation of its effects. Second, I observe details of the privatization contract terms, which allow me to examine the mechanisms through which privatization can affect the outcomes studied. Third, microdata on airline operations allow me to accurately measure operational and market variables. Together, these features make it possible to analyze the impact of input privatization on downstream firms.

The privatization contracts specify the particular elements that change at the airport, including the responsibilities transferred to the private operator and those that remain public. For example, the private operator runs the airport's facilities and the services airlines use, while air traffic control remains a responsibility of the public authority. I record the key contractual dates that define the operational phases established in the contract. The contracts also regulate the operator's revenue and set the standards that are employed to assess performance.

I measure airline operations with flight-level microdata on all domestic flights and market outcomes with ticket-level microdata on airfares, from 2010 to 2025. The ticket data record the fares paid and the number of seats sold

at each fare by each airline. I use a passenger survey as an independent measure of airport conditions.

I use a difference-in-differences design that exploits the staggered privatization of airports and the network that connects them. I observe each airline on each route in each month, where a route connects two airports in a given direction. The decision to privatize is made at the airport level, and a route can be exposed to privatization at the origin, at the destination, or at both airports. The privatization contract defines two main operational phases, before and after mandatory infrastructure investments. Two airports a route connects can be in different phases in the same month. My empirical strategy uses variation that comes from changes in privatization status and contract phase of the two airports connected by each route. It is unlikely that changes in privatization status and operational phases are driven by outcomes of specific routes. The estimates come from changes within a route as its endpoints change status and phase.

Private operation changes the party that is responsible for passenger processing, baggage handling, gate availability, and taxiway coordination, all of which affect whether flights depart on time. Delays are a central outcome because they capture service quality for passengers and operational efficiency for airlines. Passengers experience the burden caused by delays directly, and airlines bear the cost of disrupted schedules for aircraft and crew.

Privatization reduces the fraction of flights with short delays. In contrast, the fraction of flights delayed more than two hours does not change. On routes where both endpoint airports are privatized, and after the mandatory investment deadline, the fraction of flights delayed by more than 30 minutes declines by about 1.45 percentage points, or roughly 16 percent relative to the baseline. The reported causes of delays support this pattern: short delays are attributed mostly to airport-related causes, longer delays to airlines and weather. Privatization reduces the fraction of delays attributed to the airport, with no effect on the fraction caused by weather or by air traffic control, which remains a public responsibility. I also find that passenger satisfaction rises after the mandatory investment deadline.

The conditions airlines face at an airport affect the routes, frequencies and fares they choose. Specifically, I document increases in market concentration. Concentration is measured across airlines within a market, and a market is a directional origin–destination pair. The pattern appears on several measures, including the Herfindahl–Hirschman index (HHI), the two-firm concentration ratio, the share of the largest airline, and the number of airlines serving the market. In markets where both endpoint airports are privatized, the HHI rises by about 9 percent after privatization and by about 25 percent after the mandated investments.

To explain the observed change in concentration, I estimate how privatization changes an airline's share of a market, allowing the change to differ with the airline's presence at the privatized airport. Presence reflects an airline's activities at the airport before privatization, for example its average monthly flights. An airline with 10 percent more departures at the airport gains about 2 percent more market share in the markets that airport serves. The heterogeneous responses of airlines to changes in airport conditions offer an explanation for the average increase in concentration. Better conditions at an airport, such as improved runway and terminal capacity or fewer delays, reduce the cost of operating there. An airline that already operates more at the airport has more of its activity exposed to that change, so a given improvement has a more pronounced impact on that airline.

Airfares rise after privatization, and the increase is largest in markets where both endpoint airports are privatized and after the mandatory investment deadline, when the average fare rises by about 7 percent. Most of the increase falls on passengers paying higher fares. The 90th percentile rises, the median rises modestly, and the 10th percentile does not change. Privatization does not broadly raise the number of flights operated. Where more flights are

offered, the change comes after the mandatory investment deadline and is concentrated among airlines with mid-sized operations at the airport.

The paper proceeds as follows. Section 2 describes airport operations and airport privatization in Brazil. Section 3 presents the data and the empirical strategy. Section 4 examines operational outcomes, Section 5 analyzes market outcomes, and Section 6 offers an explanation for the findings. Section 7 concludes, and the appendix reports robustness exercises and additional detail.

1.1 Literature Review

This paper is related to three strands of the literature: the empirical literature on privatization, the literature on airport privatization, and the literature on airline behavior and competition.

The empirical literature examines the effects of privatization on the privatized firm and which firms are selected for privatization. Megginson and Netter (2001) report that most studies of privatization find improvements in firm performance across a range of measures and country contexts. This literature has given limited attention to broader welfare implications. Recent work addresses selection into privatization, since firms selected may differ systematically from those that remain state-owned,[1] while continuing to focus primarily on firm-level performance, often measured through productivity, total factor productivity, profitability, wage bills, or efficiency measures. Within this focus, effects are heterogeneous and depend on selection, timing, firm characteristics, competitive conditions, and the continued role of the state.[2] This literature has examined the dimensions on which the effects of privatization depend, measuring those effects on the privatized firm. This paper adds a dimension of a different kind, what happens to the firms that use the privatized asset, and through them to the consumers they serve.

The empirical literature on airport privatization evaluates how ownership affects airport performance, as opposed to airline performance. Studies such as Gutiérrez and Lozano (2016), Adler and Liebert (2014), Assaf and Gillen (2012), and Oum et al. (2008) rely on efficiency methods[3] and generally find that private airports perform better. Assaf and Gillen (2012), however, show that regulation has a larger effect on efficiency than ownership itself, and Bel and Fageda (2010), using a cross-section of European airports, find that privatized airports may charge higher prices when unregulated.

[1] See Knyazeva et al. (2013), Gupta et al. (2008), Dinc and Gupta (2011), Du and Liu (2015), and Mergele et al. (2025). For example, using data from India, Dinc and Gupta (2011) find that profitable firms and firms with lower wage bills were privatized earlier. Using data from East Germany, Mergele et al. (2025) find that initially more productive firms were privatized faster. Selection patterns may also be more complex: using data from China, Du and Liu (2015) show that both the worst- and best-performing state-owned enterprises were more likely to remain state-owned.

[2] For example, using data from China, Chen et al. (2021) estimate a structural model and find that private firms are more productive than state-owned enterprises on average, but that the benefits of privatization take several years to fully materialize. They also find that the productivity gap varies with firm size, local economic liberalization, and industry characteristics. Huang et al. (2025) use matching and difference-in-differences and find productivity gains from privatization in China, especially among firms in more competitive industries. Brown et al. (2016) study firms in five East European economies and find average improvements in firm performance after privatization, with substantial heterogeneity across countries, time periods, ownership concentration, firm quality, and institutional environment. Harrison et al. (2025) show that privatized firms may continue to receive government support relative to private-sector counterparts. See also Sanches et al. (2018) and Duggan et al. (2023).

[3] Methods such as Data Envelopment Analysis (DEA) and stochastic frontier approaches applied to airport-level data evaluate relative efficiency based on observed inputs and outputs. While useful for benchmarking, these methods focus on overall efficiency rather than effects on specific outcomes, and they do not rely on an explicit identification strategy. For instance, Oum et al. (2008) use a stochastic cost frontier on a panel of global airports.

A recent and closely related paper is Howell et al. (2024), which studies airport privatization in a global setting. They use airport-level data from many countries and focus on differences across ownership types, especially private equity ownership, exploiting privatization auctions in which the two finalists are a private equity firm and a non-private-equity firm to construct a comparable sample. Their main finding is that privatization does not lead to clear improvements in airport performance, while airports owned by private equity firms show more consistent gains. Their main outcomes include flights, passengers, passengers per flight, cancellations, and airport operator financial outcomes, all measured at the airport level. In contrast, I examine operational and market outcomes measured with airline-level data, and study a single institutional setting, which reduces concerns about differences in national regulatory, legal, and market conditions across countries.

Basso (2008) shows in a theoretical model that when airlines have market power, the welfare effects of airport deregulation cannot be determined from airport-level outcomes alone, because they depend on what happens in the airline markets downstream.[4] I provide empirical evidence on how changes in airport operation affect airline choices and market outcomes.

This paper also relates to the applied transportation literature on Brazilian airport privatization. Using route-level data, Brito et al. (2021) study the first four privatization rounds and find that Brazilian airport privatization is associated with higher domestic airfares.[5] Rolim et al. (2016) study the privatization of three airports in 2012 and find that privatization is associated with increases in route-level passenger demand.[6] These papers each analyze one outcome, while I examine several operational and market outcomes and interpret them together. I first establish that operations changed on the activities for which the operator is responsible before turning to the markets airlines serve. Also, my empirical design exploits the staggered rollout across routes and the network that connects them, covering all privatization rounds. The design allows me to compare results across different levels of exposure to privatization and to separate changes associated with private management from changes associated with the investment requirements.

This paper also contributes to the literature on the airline industry. Changes in airport ownership and management may affect factors such as capacity, congestion, and operational efficiency. Airline outcomes such as delays, cancellations, and market structure have been widely studied in the literature. Airport characteristics, such as capacity constraints, congestion, and access to gates or slots, are recognized as important determinants of these outcomes. However, they are typically treated as part of the institutional environment of the industry. A related literature studies the interaction between airline behavior and airport conditions within a given airport setting, such as competition under congestion, airport investment, and scheduling decisions, as in Brueckner (2002), A. Zhang and Y. Zhang (2006), and Mayer and Sinai (2003). I add to this literature by examining changes in airport characteristics as a source of changes to airlines' operational and market outcomes.

[4] Basso (2008) studies airport pricing, capacity, and congestion under deregulation versus public operation, modeling airports as upstream firms choosing prices and capacity and airlines as downstream Cournot oligopolists choosing quantities.

[5] They use data until 2018, when 10 airports had been privatized. Their sample is restricted to routes involving state capitals, and their control group is defined based on regional economic relevance and geographic distance to privatized airports. They implement a Heckman-style correction to account for selection into privatization and an instrumental variables approach with instruments selected through LASSO.

[6] They estimate a route-level regression of average daily passenger traffic on route and time fixed effects, with controls for prices, costs, and market characteristics, cost-based instruments for prices, and a Heckit-type correction for selection into privatization.

2 Airport Privatization and Rollout in Brazil

Taken together, airport privatization was one component of a broader federal policy of expanding private participation in infrastructure, and the airport program eventually included airports of different sizes and roles in the national air transport network rather than only the largest airports.

Brazilian airports were publicly administered until 2011, when the airport privatization program began. After seven privatization rounds, 89% of domestic passenger traffic and 98% of total cargo transport are now handled by privately managed airports. Private companies handle all airport investment, operation, and management under long-term contracts, usually 25 or 30 years. The initial rounds auctioned individual airports, while later rounds auctioned regional blocks of airports, resulting in 59 airports operated by private companies among the 180 airports with regular flights.[7]

Figure 1 shows the staggered nature of the privatization program in Brazil and its geographical coverage. Each color indicates one privatization round. In the same round, multiple airports were offered, and contracts were signed with different private operators. The airports privatized over these rounds include both major hubs and regional airports, suggesting that the program expanded beyond only the largest airports. While all Brazilian airports were publicly administered before 2011, most domestic passenger traffic and nearly all cargo transport are now handled by privately managed airports.

The early rounds included some of the largest airports and occurred in a context of expected infrastructure expansion needs and upcoming major international events, especially the 2014 FIFA World Cup and the 2016 Olympic Games.[8]

The high revenue from the first rounds and the government's satisfaction with the operation of the first privatized airports motivated the government to expand the privatization program. For example, the second round raised R$24.535 billion,[9] with an average premium of 348% over the minimum bid prices.[10] The auction-fee structure and the regulation of airport charges are described below. Brazil was also experiencing a political and economic crisis between 2013 and 2016, and the program was used to promote investment and collect revenue. Governments constrained in their ability to sell bonds may instead favor equity sales (Vickers and Yarrow, 1991), as in the case of some Latin American countries facing debt crisis.

[7] https://www.gov.br/anac/pt-br/assuntos/concessoes

[8] The first privatization round, in 2011, was unusual and was considered a trial experience. It was the only case in which the privatization encompassed not only the operation of the airport but also its construction. Brasília, Guarulhos (São Paulo's main international airport), and Viracopos (located about 100 km from São Paulo) were auctioned in the second round in 2012. Galeao International Airport in Rio de Janeiro and Confins Airport in Belo Horizonte were auctioned in the third round in April 2014.

[9] At the time, this total was equivalent to approximately US$ 14.26 billion, according to media reports.

[10] https://oglobo.globo.com/economia/leilao-dos-aeroportos-termina-com-agio-de-ate-673-3889433



Figure 1: Privatization Coverage and Timeline

Notes: Source: National Civil Aviation Agency of Brazil (ANAC).[a] Each color represents a privatization round.

[a] https://www.gov.br/anac/pt-br/assuntos/concessoes

The first three privatization rounds took place during President Dilma Rousseff's administration, when other major privatizations also occurred in sectors beyond airports.[11] Following her impeachment in 2016, Vice President Michel Temer assumed office and pushed for greater private sector participation in publicly operated services and companies. He created the Investment Partnership Program (PPI), which remains active to this day. The PPI was established in 2016 within the Office of the President with the goal of "expanding and strengthening the interaction between the State and the private sector through the signing of partnership agreements and other privatization measures."[12] The PPI focused on infrastructure projects, especially in sectors such as energy generation and distribution, mining, ports, airports, and highways. Subsequent airport privatizations became part of the PPI framework.[13] Strong international interest in infrastructure assets also helped make the privatization program politically and technically viable.

In the fifth, sixth, and seventh rounds, airports were offered in blocks that mixed larger, profitable airports with smaller, less lucrative ones, enabling cross-subsidization. In each of these three rounds, three airport blocks were

[11] For instance, the 11th round of oil and gas auctions raised R$2.8 billion, and the rights to use the 2.5 GHz frequency band for mobile phone and broadband services (4G) generated R$2.9 billion. One of the most prominent transactions was the Libra oil field contract, which included a bonus payment of R$15 billion and 41.65% of the surplus oil assigned to the federal government. According to government estimates, exploration of the Libra field could generate up to R$1 trillion in revenue for the federal government over the next 35 years. https://g1.globo.com/economia/negocios/noticia/2013/11/governo-arrecada-r-208-bilhoes-com-leilao-de-confins-e-do-galeao.html

[12] https://ppi.gov.br/quem-somos/

[13] https://ppi.gov.br/projetos/

offered, resulting in 49 airports privatized. Airports of all types were included in the program, from large, profitable international hubs to medium, small, and regional facilities. For example, Congonhas Airport, located in São Paulo and the second-busiest domestic airport in Brazil, was privatized in the seventh round in 2022.

2.1 Contract Structure and Investment Requirements

In each privatization round, the process began with the publication of the auction notice, the official document that defined the rules, timeline, qualification requirements, and privatization terms. Potential bidders then submitted the required documents and financial bids, after which the public auction was held and the winning bidder was selected.[14] Shortly after the contract was signed and became effective, the operator began formal operations.[15]

The privatization is awarded to the highest bidder, who pays the winning bid to the federal government for a long-term right, usually 25 or 30 years, to operate the airport and collect its regulated revenues. This bid has a minimum value set in the auction notice plus any premium above it, so a higher premium reflects more optimistic expectations of future revenue.[16]

After the auction is completed and the contract becomes effective, the privatization program proceeds through two main phases: Phase I and Phase II. The length of these phases varies across contracts. The private operator starts its formal activities in Phase I, when it becomes responsible for airport operations and begins the initial investment period, which typically lasts around three years.[17]

Phase I is subdivided into Phase I-A and Phase I-B. Phase I-A covers the transfer of airport operations from the public operator, Empresa Brasileira de Infraestrutura Aeroportuária (Infraero), to the private operator. Once this transition is completed, after approximately four months on average across airports, Phase I-A ends and Phase I-B begins. In Phase I-B, the private operator continues operating the airport and delivers the initial mandatory investments. Investment requirements varied across airports according to their specific needs. The goal of Phase I is to bring the airport to the desired and pre-established level of operations and performance. The typical investment requirements are discussed below.

Phase II starts after Phase I-B and covers the remainder of the contract. It focuses on maintaining the required service level. During this period, additional investments may still be required, including when predefined demand or service-level triggers are met or when additional obligations arise under the contract, such as investments needed to meet new regulatory requirements.[18] Table 1 illustrates this contract structure for Brasília Airport.

[14] In the first three privatization rounds in Brazil, the winning bidders were mostly consortia formed by large Brazilian infrastructure groups partnered with foreign airport operators. Later rounds attracted strong participation from large global airport operators, leading in some cases to fully foreign-controlled airports. Private operators were required to have previous experience managing airports.

[15] There is a short lag between contract signing and the beginning of operations, which reflects administrative and regulatory procedures. The contract becomes legally effective only after official publication and the issuance of a formal Service Order by ANAC, which authorizes the private operator to initiate operations.

[16] The payment structure changed across rounds: the early rounds were paid as fixed annual installments over the life of the contract, while the later block rounds shifted the fixed fee to a large upfront payment plus a variable fee tied to the operator's gross revenue. Collected fees are allocated to the National Civil Aviation Fund (FNAC).

[17] For detailed discussions of the institutional structure of Brazil's airport privatization contracts and the phase definitions, see Longo and Fonseca (2022) and Machado et al. (2019).

[18] For some airports, the contracts included additional phase definitions. For five airports from the second and fourth rounds, the contracts included a Phase I-C, which continued the investment obligations of Phase I-B. To maintain consistency across airports, I classify Phase I-C as part of Phase I-B when constructing the dataset.

Table 1: Illustrative Contract Structure: Brasília (2012 round)

Contract signing	**Phase I-A**	**Phase I-B** [19]	**Phase II**
June 2012. Private operator assumes control of airport operations.	July 2012 – March 2013. Transfer of airport operations from Infraero to the private operator.	March 2013 – May 2016. Infrastructure expansion and service level improvements.	Post-2016. Maintenance of service standards and capacity-triggered investment requirements.

Examples of Phase I investments:

- Passenger terminal with capacity to process simultaneously 1,000 passengers at departure and 1,200 passengers at arrival.
- Apron for 24 aircraft, with 15 parking positions served by boarding bridges.
- Road access and parking facilities to meet expected demand.
- Removal of obstacles and leveling of runway strips, preparation of runway system, implementation of runway end safety areas.

Notes: The table shows the contract timeline for Brasília, privatized in the 2012 round, as an illustration of the structure shared by the privatization contracts. The investments listed are examples from that contract and not the full set. Source: National Civil Aviation Agency of Brazil (ANAC).

2.2 Airport Operations

This section illustrates how the privatization contract is not just a change in ownership, but a transfer of operational and managerial responsibilities. The information discussed in this section is based on the actual contracts signed by the private operators in Brazil.[20]

The operator is responsible for maintaining the infrastructure used to provide airport services and for personnel management, including staffing and training.[21] The private operator manages and operates the airport, including the provision of core aeronautical services and non-aeronautical commercial activities, such as parking facilities and food services. These non-aeronautical activities can be provided either directly by the operator or through third parties.[22] The private operator is not responsible for air navigation or air traffic control (ATC) services, which remain exclusively with the public authority.

The operator has two main sources of revenue: aeronautical services and non-aeronautical commercial activities. Aeronautical revenue is collected through fees defined in the contract. Boarding and connection fees cover the use of the passenger terminal, and the landing and parking fees cover the use of the runway and taxiway system and the designated aircraft parking areas, respectively. Storage and handling fees cover services within the airport's air

[20] Copies of each contract can be accessed at `https://www.gov.br/anac/pt-br/assuntos/concessoes/aeroportos-concedidos`.

[21] The private operator must ensure the adequate provision of airport services in accordance with federal law and the Airport Exploration Plan (PEA), which defines the scope of airport operation under the contract, sets minimum infrastructure and service standards, establishes investment and maintenance obligations, and specifies service quality requirements and performance parameters. Annex 2 of the contracts contains the PEA. These parameters include measurable indicators such as passenger waiting times, service availability standards, and operational performance benchmarks.

[22] Other examples of non-aeronautical commercial activities include retail and food services, office and cargo space leasing, hotels and convention centers, car rentals, parking, passenger transport services, and other complementary activities within the airport complex. The operator must also provide certain basic passenger services free of charge, such as restrooms, baggage carts, accessibility assistance, and medical facilities.

cargo terminals, where the storage fee covers the warehousing of cargo in the bonded terminal and the handling fee covers loading, unloading, and moving cargo.

The boarding fee is paid directly by the passenger; the connection, landing, and parking fees are paid by the aircraft operator, typically the airline; and the storage and handling fees are paid by the consignee or carrier of the cargo.[23]

These fees are regulated, and the regulatory policy changed across rounds. In the first three privatization rounds, each regulated activity was subject to a price cap, with the regulator setting a maximum fee for each service. Because the operator kept any savings from operating below its allowed cost, a price cap of this kind may reward cost reduction while giving weaker incentives to expand capacity or to charge more for congested infrastructure.[24]

The fourth round kept the price cap but allowed limited fee management: the operator could raise a given fee by up to 100% as long as offsetting reductions kept the average at or below the cap.[25] From the fifth round onward, when airports were auctioned in blocks, the price cap was replaced at the larger airports by a revenue cap per passenger.[26] Under this rule, the operator sets individual fees, subject to non-discrimination, but the revenue per passenger is capped, so the operator may raise revenue mainly by processing more passengers.

These mechanisms may reward cost control and, under the revenue cap, growth in passenger traffic, but they may not directly reward service quality, which is costly to provide. Left to these incentives alone, a cost-minimizing operator could economize on it. The contract therefore does not rely on revenue-side incentives alone: it mandates specific infrastructure investments and monitors service quality by comparing realized service quality to the target levels specified in each contract.[27] When results fall below the contractual values, the operator must submit a corrective action plan, and persistent failure to meet contractual obligations exposes the operator to graduated penalties.[28] Together, the mandatory investments, the monitored service standards, and these penalties are intended to provide the operator with ongoing incentives to meet them.

Because airport services are inputs into airline operations, changes in airport management may affect downstream outcomes by altering the reliability, capacity, and quality of the infrastructure used by airlines and passengers. These effects may operate through two main channels: a managerial channel and an infrastructure channel.

Managerial Channel. The airport operator is responsible for several services used by passengers and airlines, including passenger processing systems, security screening, baggage handling, runway maintenance, coordination of taxiway operations, and general terminal operations. Even without new infrastructure investment, managerial decisions over the organization of these services may influence perceived service quality and airline operations. For example, improved queue management at security screening may reduce waiting times, make boarding smoother,

[23] Although the boarding fee is contractually due by the passenger, in practice it is collected by the airline at the time of ticket purchase, included in the total ticket price, and then remitted to the airport operator.

[24] For example, under a fixed cap the operator cannot price peak use of the apron or runways according to demand, which could encourage congestion at peak hours.

[25] This added some flexibility, for example to move traffic away from congested peak periods.

[26] Smaller airports in the blocks, with little traffic and market power, are not subject to the revenue cap; their fees are monitored instead.

[27] Annex 2 of the contracts, Airport Exploration Plan, describes the monitored service-quality indicators, which include measures such as inspection-queue time, cleanliness, availability of elevators and escalators, thermal comfort, and ease of terminal access.

[28] The penalties are set out in the privatization contracts (Chapter VIII): a warning, a fine, suspension of the right to bid for or contract with ANAC, and, for total or partial non-performance, a declaration of unsuitability to contract with the public administration; fine procedures and values are in Annex 3.

and reduce congestion.

The operator is also responsible for airside operations such as runway maintenance, coordination of taxiway operations, and gate-related infrastructure. For example, managerial decisions in these areas may affect temporary runway closures, operational disruptions, boarding and disembarkation times, and therefore delays or cancellations.

In addition, the contracts mandate specific infrastructure investments by the private operator, which may further affect passengers and airlines through changes in capacity and airport quality.

Infrastructure Channel. The privatization contracts mandate infrastructure investments by the private operator. These obligations include terminal expansions designed to increase passenger processing capacity for domestic and international departures and arrivals, as well as upgrades to baggage handling and security screening systems. They also include airside capacity expansions, such as requirements for a minimum number of aircraft parking positions, with a specified share served by boarding bridges rather than remote stands, as well as runway improvements and taxiway upgrades.[29]

The renovation of terminals and passenger areas directly affects passenger experience. More boarding bridges, additional X-ray machines, or a larger check-in area may lead to a smoother and faster travel experience. The contract also requires passenger and baggage processing capacity to meet identified peak-hour demand thresholds. For airlines, these investments may affect gate availability, aircraft turnaround times, runway and taxiway congestion, and the ability to schedule flights reliably during peak periods. These operational changes may help address issues that could otherwise lead to delays and cancellations.

Overall, expanded capacity and modern infrastructure may improve both services and airline operations, while reducing congestion.

Downstream Market Outcomes. Together, managerial changes and mandatory infrastructure investments may affect airline behavior by changing airport capacity, congestion, reliability, and operating conditions. Greater capacity and more reliable airport services may allow airlines to adjust flight frequency, route choices, hub operations, and pricing strategies. These changes may also facilitate airline operations by improving turnaround times and reducing congestion, which may in turn affect the costs of operating at the airport. Through these margins, privatization may ultimately influence market outcomes such as prices and airline concentration.

These changes may also affect airline market concentration by altering airlines' incentives to allocate flights across airports and routes. Airlines face fixed and operational costs when serving a market, and their network structure makes scale and airport presence important for route-level decisions. As a result, some airlines may find it more attractive to expand service at specific airports, while others may reduce activity or reallocate aircraft elsewhere. These adjustments may change how passenger demand is distributed across airlines, with potential implications for market shares and concentration.

[29]The specific level of each requirement varies by airport and is established in the respective contract. Additional examples from the contracts include apron enlargements designed to accommodate aircraft in specified operational categories, runway and taxiway geometry upgrades to meet aviation safety and performance standards, adaptations allowing airports to operate larger aircraft categories without restrictions, and, where required, new runways within defined timelines. The contracts also require runway end safety areas, visual approach guidance systems, and other regulatory safety requirements.

3 Data and Empirical Strategy

3.1 Data

To study how airport privatization affects downstream airline operations and market outcomes, I combine datasets from the National Civil Aviation Agency of Brazil (ANAC) on flight operations, passenger satisfaction, and airfare sales with information from airport privatization contracts. From these sources I build the two main datasets used in the analysis: a panel of airline operations on each route, and a panel of ticket sales in each market. I merge the privatization contract dates into both, so that every observation carries the privatization status and contract phase of the airports involved.

Privatization data. I collected the contract information from the privatization contracts provided by ANAC. Key contract information is also reported on ANAC's summary page for each airport privatization.[30] The collected data include the date of contract signing, the date the contract became effective, the end of transition periods, and deadlines for mandatory investments.

Flight operations data. I use two flight-level datasets provided by ANAC, covering the universe of flights operated in Brazil, to construct a route-airline-month panel with measures of flights, delays, and cancellations. I restrict the analysis sample to domestic direct passenger flights.[31] I merge the two datasets at the flight level using common flight identifiers, yielding approximately 12.4 million domestic direct passenger flights from January 2010 to April 2025. I then aggregate the data to a panel in which each observation is a route-airline-month. A route is defined as a one-directional origin-destination airport pair. The final panel contains several operational outcomes: the number of flights, the share of flights delayed beyond each threshold, the share of flights falling within each delay interval, and the share of canceled flights. Summary statistics for the full sample are reported in Appendix Table 8.

Passenger satisfaction survey. I use ANAC's passenger satisfaction survey to measure perceived service quality at airports. The survey is conducted with passengers at airports and records responses at the passenger-airport-date level. Passengers rate overall satisfaction and specific aspects of airport services on a 1–5 scale, where 1 means very poor and 5 means very good. I use these measures to assess changes in passenger satisfaction and to complement the operational measures of airport quality.[32]

Prices and market outcomes. To analyze prices and market outcomes, I use airfare sales data provided by ANAC.[33] The data report ticket prices, origin and destination airports, airline, month and year of sale, and the number of seats sold at each price. For example, the data record that Azul Airlines sold 3 seats from airport A to airport B in July 2017 at 500 BRL per ticket. The month-year refers to the ticket purchase month, independent of the travel date. Round-trip and multi-destination tickets are split and reported as individual tickets with a single origin and destination.

[30] The airport privatization webpage is available at `https://www.gov.br/anac/pt-br/assuntos/concessoes/aeroportos-concedidos`.

[31] International flights, cargo flights, and nonregular services, including charter flights, are excluded.

[32] Survey coverage varies across airports and over time. Details are discussed in the passenger satisfaction analysis.

[33] The data are a 50 percent sample of the airfares recorded as sold in Brazil.

I define a market as a one-directional origin-destination airport pair. A market counts all tickets sold on an origin-destination pair, including those served through a connection. The airfare data are based on ticketed origin-destination markets and do not distinguish direct flights from connecting itineraries, while the operations sample includes only direct flights.[34]

The sample covers January 2011 to April 2025 and includes domestic origin-destination markets in Brazil.[35] I deflate fares so that all prices are expressed in January 2010 BRL.[36]

Price and airline-share outcomes are constructed at the airline-market-month level, and measures of market concentration at the market-month level. Market concentration measures include the Herfindahl–Hirschman Index (HHI), the concentration ratio of the two largest airlines (CR2), the number of airlines, and the market share of the largest airline.

3.2 Empirical Strategy

To examine how airport privatization affects airline operations and market outcomes, I exploit two features of the setting: the network structure of the airline industry and the staggered implementation of airport privatization. Privatization decisions are made at the airport level, but the outcomes of interest are observed at the route or market level. I use two samples: a panel of nonstop flights for operational outcomes and the fare sample for market outcomes. The same design is applied to both panels. Routes therefore become exposed to privatization when one or both endpoint airports enter the privatization process. Because airports are privatized at different times and each airport is connected to multiple routes, the privatization program generates variation in route-level exposure over time.

The unit of observation is a route-airline-month, where routes are directional origin-destination airport pairs. For each observation, treatment is assigned using the privatization status and contract phase of the two endpoint airports. I define treatment using phase-specific route categories. Let $p \in \{I, II\}$ denote the contract phase of an airport. For each phase p, I classify each route-month according to whether phase p is present at the origin airport only, at the destination airport only, at both endpoint airports, or at neither endpoint.

$$Y_{rta} = \sum_{p \in \{\text{I, II}\}} \left[\beta_B^p \, \mathbf{1}\{\text{both_priv_phase}_{rt}^p\} + \beta_O^p \, \mathbf{1}\{\text{origin_only_phase}_{rt}^p\} + \beta_D^p \, \mathbf{1}\{\text{dest_only_phase}_{rt}^p\} \right] + \alpha_r + \tau_t + \gamma_a + \varepsilon_{rta} \tag{1}$$

In this specification, Y_{rta} represents the outcome of interest for route r, airline a, and month-year t. For example, the share of delayed flights operated by airline a on route r in month t, or the Herfindahl–Hirschman Index in market r in month t.

For each phase p, the route-level category takes four values: public, origin-only, destination-only, and both-endpoints. The subscripts B, O, and D refer to both endpoints, origin only, and destination only, respectively. The omitted baseline category is public–public routes. Route fixed effects, α_r, absorb time-invariant differences across

[34] This distinction matters because airlines also compete for connecting passengers: an airline that does not serve an origin-destination pair directly may still compete for passengers on that market through connecting itineraries. For example, an airline that offers no nonstop service between two airports A and C still contributes to concentration on the A–C market, since it can serve that market through a connection at airport B.

[35] Tickets are restricted to those priced above 50 BRL, sold to the general adult public, and to markets with at least 10 seats sold in a month.

[36] The inflation index is the IPCA, Brazil's broad consumer price index.

routes. Airline fixed effects, γ_a, absorb persistent differences across airlines. Month-year fixed effects, τ_t, absorb aggregate shocks common to all routes and airlines. I cluster standard errors at the route level. The main results are robust to two-way clustering by origin and destination airport.

Each coefficient measures the change in the outcome associated with a given contract phase and route privatization status, such as both endpoint airports being in Phase I, relative to the public–public baseline. Conditional on route, airline, and month-year fixed effects, the coefficients are identified from within-route changes in the privatization status and contract phase of the endpoint airports. For market-level outcomes, which are defined for a market-month rather than for an airline, the airline subscript and the airline fixed effects are not included in the specification.

The main source of variation comes from changes in the privatization status and contract phase of the two airports connected by each route. At any point in time, a route can connect two public airports, one public and one private airport, or two private airports. As a result, there are four possible route-level privatization statuses: public–public, public–private, private–public, and private–private. At the same time, privatized airports move through the contract phases described in the institutional section: Phase I, running from contract signature to the deadline for mandatory investments, and Phase II, after it. I also estimate the specification with the finer phases, separating the period between contract signature and the start of private operation, Phase I-A, and Phase I-B, and the main conclusion remain.

As airports enter private operation and move through contract phases, routes can change their privatization status over time. For example, a route may move from public–public to private–public when private operation begins at the origin airport, and later become private–private if the destination airport also enters private operation. In the regressions, these changes are captured by phase-specific route indicators that distinguish whether a given phase is present at the origin airport, at the destination airport, or at both endpoints. This within-route change in exposure is the main source of identifying variation in the regressions. The timing of these privatization and phase transitions reflects airport-level privatization timing and the pre-existing network structure, rather than direct assignment based on route-level outcomes.

Figure 2 illustrates the route-level changes in privatization status generated by the privatization program. The figure reports the monthly share of routes for which neither airport is privatized, only the origin or destination airport is privatized, and both airports are privatized. As airports enter private operation at different points in time, routes first move into partial privatization when one endpoint is privatized and later into full privatization when both endpoint airports are privately operated. These transitions occur gradually over time, reflecting the staggered timing of airport privatization and the way airport-level decisions map into route-level exposure through the existing network.

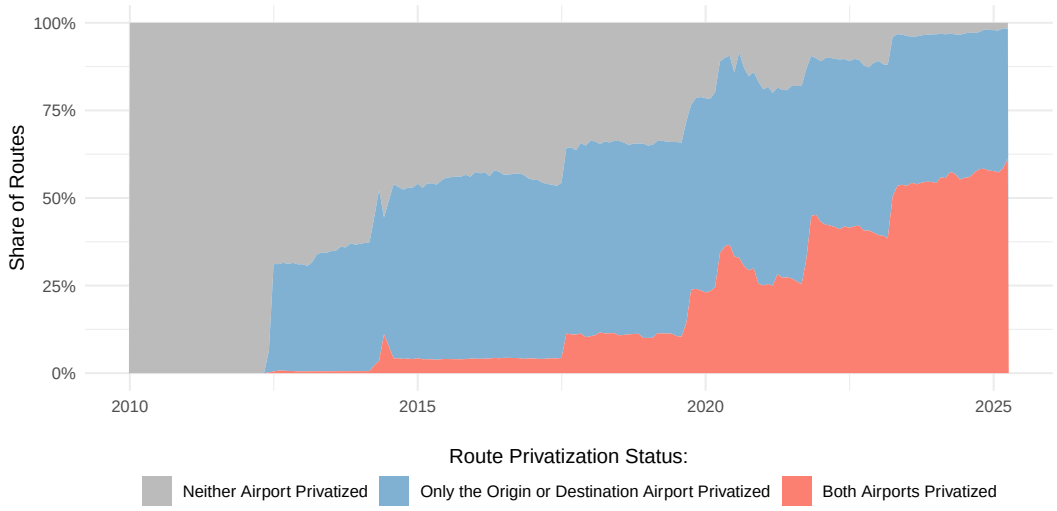


Figure 2: Network Composition by Route Privatization Status

Notes: The figure reports the monthly share of routes by privatization status. Routes are classified according to whether neither airport, only the origin or destination airport, or both airports have been privatized.

3.3 Identification

The main empirical challenge is selection. Governments do not privatize airports randomly. Importantly, the choice of airports to privatize is made at the airport level. Airports may be selected because they are profitable, because they require investment, because they are congested, because they are politically feasible to auction, or because they are attractive to private operators. For this reason, a simple comparison of outcomes between privatized and non-privatized airports could capture the characteristics that led an airport to be privatized rather than the effect of private operation itself.

The mapping from airport-level decisions to route-level exposure is important for the empirical design. The government chooses airports to privatize, not individual route-airline markets. Thus, airport selection remains the central concern, but the route-level transitions used in the regressions are unlikely to be chosen because of delays, prices, frequency, or market concentration on specific routes.

Recent work on difference-in-differences has shown that standard two-way fixed effects (TWFE) estimates can be difficult to interpret in staggered adoption settings when treatment effects vary across cohorts or over time, as estimates may rely on comparisons between newly treated and already-treated units (Sun and Abraham, 2021). Estimators such as Callaway and Sant'Anna (2021) and Sun and Abraham (2021) address this concern by restricting comparisons to units that are either not yet treated or never treated, but they are designed for a single treatment. They do not directly accommodate the structure of this setting, where airport privatization is implemented through multiple contract phases and route exposure depends on whether privatization occurs at the origin airport, at the destination airport, or at both endpoints.

For these reasons, the main specification maps the institutional structure of the privatization program directly into the route-airline-month panel, rather than using a standard TWFE design or collapsing treatment into a single post-privatization indicator. The specification estimates phase-specific route exposure effects that vary by the status of the origin and destination airports. I then assess whether the results are sensitive to staggered-adoption concerns

using stacked DiD specifications with clean comparison groups. Similar stacked or event-specific comparison designs have been used in applied work (Cengiz et al. (2019), Deshpande and Li (2019), Butters et al. (2022), Callison and Kaestner (2014)), and are closely related to the stacked DiD framework formalized by Wing et al. (2024). This approach constructs cohort-specific comparison samples and interacts the fixed effects with cohort, so identification comes from comparisons between treated routes and routes that are not yet treated or never treated in the same event window.[37]

The identifying assumption is that routes exposed to privatization would have followed similar trends to routes not exposed, in the absence of privatization. A route passes through several transitions in privatization status and contract phase, at dates set by the contracts of its two endpoint airports and their respective investment deadlines. A violation would therefore require a shock unrelated to privatization that moves these outcomes systematically with all of those transitions. I assess pre-treatment evidence below.

Table 2 reports balance statistics for the 24 months before each route first becomes exposed to privatization, defined as the first month in which either endpoint airport is privatized. For each treatment cohort, pre-treatment observations from routes that later become exposed are compared to observations from routes whose endpoint airports were not yet privatized, or were never privatized, during those same months. These cohort-specific comparisons are then stacked across all adoption cohorts. The table reports treated and control means, their difference, and standardized mean differences.[38]

Balance is assessed at the route-airline-month level, matching the unit of observation in the main regressions. Most operational outcomes are well balanced, with standardized mean differences below 0.10. However, treated routes are somewhat larger and longer-haul before privatization, consistent with some of the largest airports being privatized earlier. These level differences are absorbed by route fixed effects in the main specification. The key remaining concern is whether treated routes were already following different trends before treatment, which I assess in the event-study analysis below. A further concern is that the estimates could reflect dynamics specific to larger hub routes rather than privatization itself, which I examine by checking whether the effects differ by route frequency and market size.

[37] Howell et al. (2024) also report standard staggered-adoption specifications as complementary evidence alongside their main analysis in a related airport-privatization setting.

[38] For each variable k, I report the absolute standardized mean difference, defined as $\text{SMD}_k = \left| \frac{\bar{x}_{T,k} - \bar{x}_{C,k}}{\sqrt{\frac{1}{2}\left(s^2_{T,k} + s^2_{C,k}\right)}} \right|$, where $\bar{x}_{T,k}$ and $\bar{x}_{C,k}$ are the treated- and control-group means, and $s^2_{T,k}$ and $s^2_{C,k}$ are the corresponding variances. Standardized differences below 0.10 are commonly interpreted as small in balance assessments (Imbens and Rubin, 2015).

Table 2: Route-Airline-Month Balance Statistics Before Privatization

Variable	Control Group Mean	Treated Group Mean	Difference	Standardized Mean Difference
Total Flights	54.242	64.873	10.631	0.156
Total Passengers	4449.190	6087.878	1638.688	0.229
Average Distance (km)	741.611	970.765	229.154	0.387
Average Occupancy Rate	0.680	0.734	0.054	0.332
Cancellation Rate	0.072	0.064	-0.008	0.068
Share of On-Time Flights	0.615	0.616	0.001	0.004
Average Delay (min)	9.445	8.862	-0.583	0.036
Median Delay (min)	2.729	2.216	-0.513	0.037
Share of Flights Delayed over 1 Minute	0.209	0.224	0.015	0.081
Share of Flights Delayed over 15 Minutes	0.178	0.180	0.003	0.016
Share of Flights Delayed over 30 Minutes	0.095	0.093	-0.002	0.018
Share of Flights Delayed over 60 Minutes	0.036	0.034	-0.003	0.043
Share of Flights Delayed over 90 Minutes	0.019	0.017	-0.002	0.042
Share of Flights Delayed over 120 Minutes	0.011	0.010	-0.001	0.028

Notes: Route–airline–month observations from the 24 months before each route first becomes exposed to privatization, defined as the first month in which either endpoint airport is privatized. For each treatment cohort, pre-treatment observations from routes that later become exposed are compared with observations from routes whose endpoint airports were not yet privatized, or never privatized, during those same months, and the cohort-specific comparisons are stacked across all adoption cohorts. The columns report the control group mean, the treated group mean, their difference, and the absolute standardized mean difference. Standardized differences below 0.10 are commonly interpreted as small.

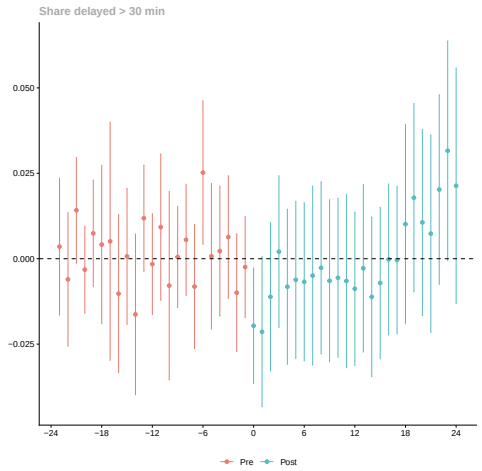
Pre-trends. Due to the staggered rollout of privatization, I estimate pre-treatment dynamics using the difference-in-differences framework of Callaway and Sant'Anna (2021). This approach is appropriate because airports are privatized at different points in time and treatment effects may vary across cohorts and calendar time. For each cohort privatized in a given period, treated units are compared to units that are either never privatized or not yet privatized at that point in time. The units are airports in the airport-level estimates and routes or markets in the others. The estimator first recovers cohort-time-specific effects and then aggregates them using weights that reflect the relative size and timing of each cohort.

I define the treatment date as the date of contract signing, when the airport enters the privatization process. Using any later phase as the treatment date would place periods already under private operation inside the pre-treatment window, contaminating the pre-trend test. I focus on a 24-month window before and after the contract signing, which allows me to examine whether selected airports were already changing in the two years before privatization. This window is also plausible on institutional grounds: privatization rounds were roughly two years apart, so in the two years before a round the government was focused on selecting the airports for that round rather than those auctioned in later rounds.

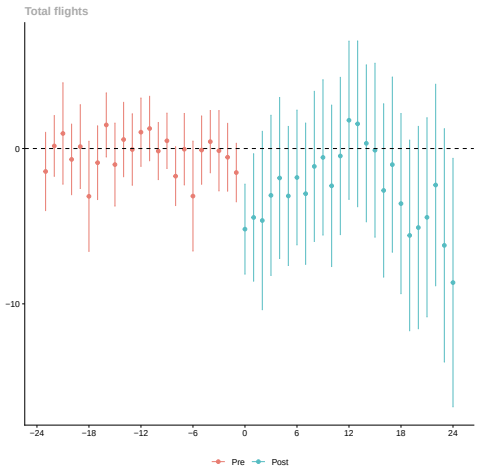
To further assess the window, I collected the publication date of the auction notice for each round, the official document that sets the rules and formalizes the privatization of the airports. Appendix Table 9 shows that all rounds had less than one year between the auction notice publication and the start of private operation. A two-year window therefore covers the formal information period before private operation and extends more than a year further back than the point at which firms could observe the finalized auction rules. Results using a 36-month window and the full sample are reported in Appendix B.2.1.

Figure 3 reports Callaway and Sant'Anna (2021) event-study estimates. The treatment date is defined as the date of contract signing at the first endpoint to be privatized. The outcomes cover the operating conditions airlines face

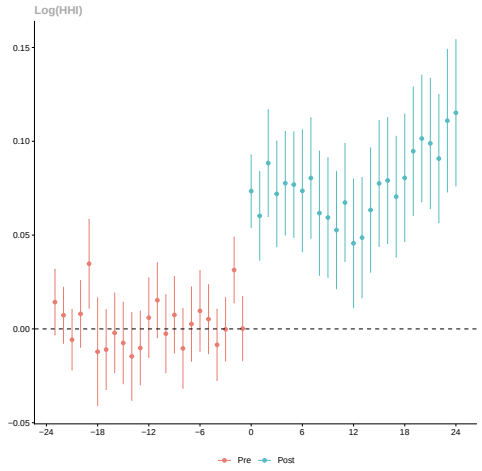
at the airports, through delays and flights, and the markets those airports serve, through concentration and fares. The pre-period estimates show no evidence of differential pre-treatment trends. Further route- and market-level event studies are reported in Appendix B.2.



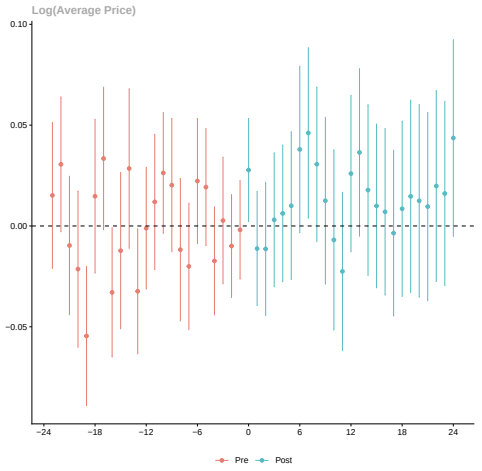
(a) Share of flights delayed over 30 minutes (route)



(b) Total flights (route)



(c) Log HHI (market)



(d) Log average fare (market)

Figure 3: Route- and Market-Level Pre-Trend Estimates

Notes: The figure displays event-study estimates using the Callaway and Sant'Anna (2021) estimator. The treatment date is the contract signing at the first endpoint airport to be privatized. Each point is a coefficient estimate and the vertical lines are 95 percent confidence intervals. Red coefficients are periods before treatment and blue coefficients are periods after treatment.

Because endogeneity concerns may arise from airport-level differences that motivate the government's choice to privatize, I also examine pre-treatment trends in outcomes aggregated by airport of origin. These measures summarize outcomes for routes departing from each airport and allow me to assess whether airports selected for privatization were already serving routes on different performance trajectories before treatment.[39] The airport-level estimates are reported in Appendix B.1. The estimates do not show evidence that airports privatized in a given

[39]For example, the average share of delays or cancellations on routes departing from a given airport.

round were following different trends from airports not yet or never privatized at that time.

As a complementary check, I also estimate stacked event-study specifications based on Wing et al. (2024). For each privatization cohort, I construct a separate comparison sample over the 24 months before and after contract signing, using airports that are never privatized or not yet privatized as controls.[40] The stacked specification includes cohort-specific airport and time fixed effects, so comparisons are made within cohort-specific samples. The results show no clear systematic pre-treatment pattern. The plots are reported in Appendix B.1.2.

I use the route- and market-level event studies primarily as pre-trend diagnostics. For operational outcomes, including delays, simple event time relative to privatization is less suited to summarize post-treatment effects because the expected operational effects may occur only after later contract phases, including mandatory investment deadlines, and event-study estimates become less precise at longer horizons.

4 Effects of Airport Privatization on Airline Operations

In this section, I provide evidence that the conditions airlines and passengers face at the airport changed after private operation began. I examine flight delays and cancellations, the number of flights operated, and passenger satisfaction. These findings describe the operating environment behind the market outcomes examined in Section 5.

4.1 Flight Delays

Airlines schedule aircraft, crews, and passengers around planned departure and arrival times, so delays disrupt airline operations and reduce service reliability for passengers. Although delays are often attributed to airlines, airport operators control several margins — passenger processing, baggage handling, gate availability, and taxiway coordination — that directly affect whether flights depart on time. I examine whether changes in airport management and required infrastructure investments affect this important component of airline operations.

Effects on Delays. Table 3 reports the estimated effects of airport privatization on delay and cancellation outcomes, based on equation (1). Each coefficient corresponds to a specific contract phase and route ownership status. These categories indicate whether private operation applies to both endpoints, only the origin, or only the destination. The omitted category is public–public routes, where neither endpoint is privately operated.

[40] For example, for airports privatized in 2012, I create a sample in which these airports are treated and compared to airports that are either never privatized or not yet privatized in 2012 during the same calendar months.

Table 3: Effects of Airport Privatization on Delays and Cancellations by Contract Phase

Model:	Delayed 15+ (1)	Delayed 30+ (2)	Delayed 45+ (3)	Delayed 60+ (4)	Delayed 120+ (5)	Median Delay (6)	Mean Delay (7)	Cancellation (8)
Variables								
Fully Privatized (Phase I)	-0.0097*	-0.0073***	-0.0044**	-0.0024*	-0.0002	0.5049	0.2100	0.0042
	(0.0050)	(0.0027)	(0.0018)	(0.0013)	(0.0007)	(0.3919)	(0.4803)	(0.0032)
Destination Only Privatized (Phase I)	-0.0016	-0.0008	-0.0008	-0.0002	-0.0003	0.1129	-0.2365	0.0037*
	(0.0032)	(0.0018)	(0.0011)	(0.0008)	(0.0004)	(0.2521)	(0.2953)	(0.0019)
Origin Only Privatized (Phase I)	-0.0073**	-0.0041**	-0.0021*	-0.0010	-0.0003	-0.2936	-0.3743	0.0021
	(0.0031)	(0.0018)	(0.0011)	(0.0008)	(0.0004)	(0.2382)	(0.2739)	(0.0020)
Fully Privatized (Phase II)	-0.0262***	-0.0145***	-0.0071***	-0.0037***	-0.0004	0.2168	-0.8114	-0.0059
	(0.0058)	(0.0033)	(0.0020)	(0.0014)	(0.0008)	(0.4429)	(0.5145)	(0.0037)
Destination Only Privatized (Phase II)	-0.0023	0.0005	0.0010	0.0011	0.0008	-0.1065	-0.0784	-0.0084***
	(0.0045)	(0.0026)	(0.0016)	(0.0012)	(0.0006)	(0.3795)	(0.4128)	(0.0026)
Origin Only Privatized (Phase II)	-0.0254***	-0.0127***	-0.0055***	-0.0029**	0.0003	0.6495*	0.0984	-0.0088***
	(0.0046)	(0.0027)	(0.0017)	(0.0012)	(0.0006)	(0.3710)	(0.4014)	(0.0026)
Fixed-effects								
Route	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics								
Observations	209,456	209,456	209,456	209,456	209,456	205,443	205,443	209,456
R^2	0.24376	0.21700	0.19558	0.18083	0.12095	0.24857	0.28175	0.23263
Within R^2	0.00144	0.00095	0.00043	0.00023	6.49×10^{-5}	0.00034	0.00016	0.00067

Notes: Route–airline–month observations. Columns 1 to 5 report the share of flights delayed beyond the indicated threshold, columns 6 and 7 report median and mean delay in minutes, and column 8 reports the cancellation rate. The specification is equation (1). Each coefficient corresponds to a contract phase and a route privatization status, indicating whether private operation applies to both endpoints, the origin only, or the destination only. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is routes with two public endpoints. Route, month–year and airline fixed effects. Standard errors clustered by route in parentheses. */**/***: 10/5/1%.

The clearest pattern is a statistically significant reduction in the share of flights delayed more than 15, 30, 45, and 60 minutes in Phase II, after the deadline for mandatory investments. These effects are less consistent in earlier phases and are also less systematic for average and median delay, suggesting that privatization affects specific parts of the delay distribution rather than reducing all delay measures uniformly. As will be discussed when I examine the causes of delays, these delay ranges are more likely to be related to the activities controlled by the airport operator. The estimates are also stronger when the origin airport is privately operated, suggesting that departure-side airport operations are an important margin behind the results.

The magnitudes are economically meaningful: the share of flights delayed more than 30 minutes falls by approximately 1.45 percentage points when both endpoint airports are in Phase II, relative to a baseline of about 9 percent, a reduction of roughly 16 percent.

The reductions are present in Phase I but are clearest in Phase II, after the mandatory investments. This is consistent with both operational management and required infrastructure investments mattering for delay reductions, rather than with effects coming from the formal transfer of operations alone.

To further examine the nature of these effects, Appendix Table 10 reports estimates for delay intervals rather than delay thresholds. I group flights into intervals such as 0–15, 15–30, 30–60, and 60–120 minutes. This allows

me to assess whether the threshold effects reflect a shift in the delay distribution toward shorter delays.

The results support this interpretation. The pattern is strongest for fully privatized routes and for routes where only the origin airport is privatized, especially in Phase II. For these routes, the share of flights delayed 0–15 minutes increases by about 1.9 percentage points. At the same time, the shares delayed 15–30 minutes and 30–60 minutes fall by about one percentage point each, while the share delayed 60–120 minutes falls by about 0.3 percentage points. In contrast, the estimates for destination-only routes in Phase II are small and mostly insignificant.

This pattern suggests that privatization reduces delays by shortening some delays that would otherwise fall into longer delay intervals. For example, if a flight that would have been delayed by around 25 or 35 minutes is shortened to less than 15 minutes, the share of flights in the longer interval declines and the share in the 0–15 minute interval increases.

4.1.1 Reported Causes of Delays

The results above show that privatization reduces shorter delays. It is therefore important to examine whether these shorter delays are indeed the ones most affected by airport operations. To investigate this, I turn to the reported causes of delays in the flight operations dataset. For each delayed flight, the data records a field stating the airline-reported reason for the delay, which I use to examine whether privatization reduces specifically the delays the airport operator can influence.

Airlines were required to report the delay reason through 2019, and the field is not available in later years, so this analysis covers the pre-2020 period. The main results are robust over this pre-COVID window, which matches the sample period of the causes data.[41]

I group the reasons into categories defined by which party can plausibly affect them, following the operational responsibilities assigned to operators in the contracts. The airport operator category covers reasons reported as airport operating under operational restrictions, restrictions in airport support facilities, failure of ground equipment and passenger service, and security, passenger, cargo, and alarm screening.[42]

The remaining main categories are air navigation and air traffic control (ATC) services, weather, and airline-related causes such as aircraft technical problems, a late-arriving inbound aircraft, and aircraft swaps. I keep temporary airport closures, reported as airport interdiction, as a separate category. A closure is by definition an airport event, but the field does not record its specific cause, for example whether it is weather- or incident-driven, so I cannot tell whether it falls within the airport operator's control. Since it could be operator-related rather than weather-related, I keep it apart rather than assigning it to weather.[43] The full mapping of reasons to categories is reported in Appendix Table 14.

Figure 4 reports, within each delay-length interval, the share of delayed flights attributed to each reported cause. Airport-related reasons dominate the shorter delays, while weather and airline-related causes dominate the longer ones: airport-operator causes account for 30 percent of flights delayed 15 to 30 minutes and for 8 percent of those delayed more than 120 minutes. The full composition by interval is reported in Appendix Table 11.

[41] The resulting sample includes approximately 8.9 million flight legs, and within this window the field is populated for about 99% of delayed flights.

[42] The results are robust to a narrower definition of airport-operator causes that includes only operating under operational restrictions and restrictions in airport support facilities, the reasons most directly within the operator's control.

[43] As a robustness check, I also consider these closures as part of airport-related causes, and the conclusions remain.

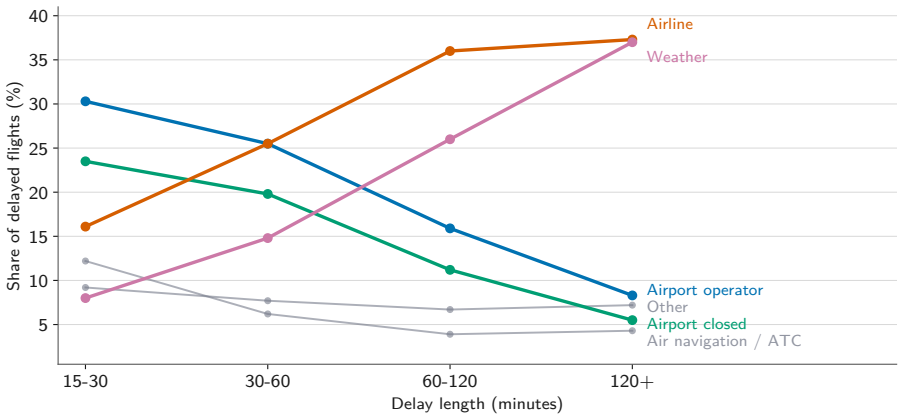


Figure 4: Composition of delays by reported cause and delay length

Notes: Delayed flights over the pre-2020 period, the window in which the reported- cause field is available. Each line is a reported cause category and each point is the share of delayed flights in that delay-length interval attributed to that cause, so the shares within an interval sum to 100 percent. Causes are airline-reported. Airport-operator causes group reasons reported as the airport operating under operational restrictions, restrictions in airport support facilities, failure of ground equipment and passenger service, and security, passenger, cargo, and alarm screening. Temporary closures, reported as airport interdiction, are kept as a separate category. The full composition by interval is reported in Appendix Table 11.

The delays reported as airport-related are thus concentrated in the shorter intervals, precisely where the main results point to the largest effects of private operation. This pattern is not simply driven by some causes being more common overall. An over-representation analysis, reported in Appendix Table 13, compares each cause's frequency at a given delay length to its frequency across all delays and shows the same concentration of airport-related causes in short delays and of weather and airline causes in long ones. Whether these airport-related delays in fact respond to private operation is what the regression below tests.

I estimate the main specification, equation (1), using as the dependent variable the share of a route-airline-month's flights delayed for each cause category, for example the share delayed for airport-related reasons or the share delayed because of weather disruptions.

Figure 5 plots the Phase II coefficients from these regressions, one for each cause category. For a given cause, the plot shows the estimated coefficients for each route privatization status: both endpoints privately operated, origin only, and destination only. The horizontal lines are 95 percent confidence intervals from standard errors clustered by route. The Phase I coefficients are estimated but not plotted, and the full estimates are reported in Appendix Table 12.

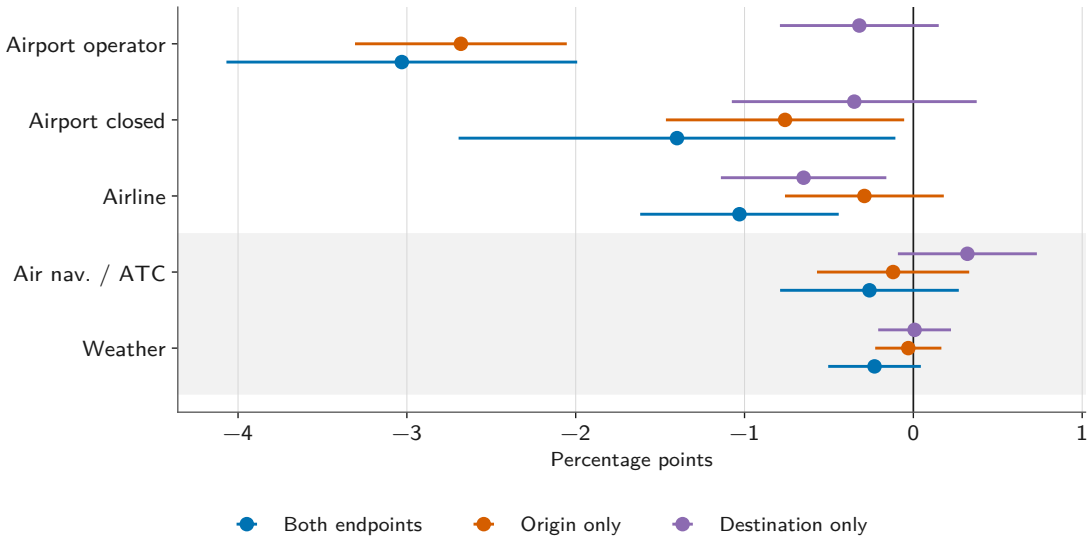


Figure 5: Effect of airport privatization on delay shares by reported cause

Notes: Route–airline–month observations over the pre-2020 period. Each point is the estimated effect of privatization on the share of a route–airline–month's flights delayed for the cause named on the vertical axis, in percentage points, from equation (1). Only Phase II coefficients are shown, where Phase II is the period after the deadline for the mandated investments. Colours distinguish routes with both endpoints privatized, the origin airport only and the destination airport only; the omitted category is routes with two public endpoints. Horizontal lines are 95 percent confidence intervals, constructed from standard errors clustered by route. The shaded rows, air navigation and ATC and weather, are causes outside the airport operator's control and serve as placebo tests.

Privatization reduces the share of flights delayed for airport-operator reasons, while the shares delayed for ATC and weather reasons are unchanged. The share of delays attributed to the airport operator declines by 3.03 percentage points for fully privatized routes, while the effect for destination-only routes is near zero and insignificant. As in the main delay results, the effects appear in Phase II and only where the origin airport is privately operated. Temporary airport closures also decline, which is consistent with an airport channel where the private operator may be better able to manage such disruptions. This may reflect both its financial incentive to maintain reliable operation, on which its traffic and revenue depend, and its control over staffing, equipment, and operational procedures.[44] The share delayed for airline-related reasons declines modestly, consistent with airline operations being shaped by airport operations. A better-run airport may, for example, speed aircraft turnaround and reduce the consequent delays from a late-arriving aircraft that are attributed to the airline.

The estimates for weather and ATC serve as placebo tests. Weather disruptions are outside the airport operator's control, and ATC remains the responsibility of the public authority. The estimated effects for these two categories are small throughout, and none is statistically significant in Phase II.

The composition of causes within each delay interval, in Appendix Table 11, shows that airport-related causes dominate the shorter delays, and the decomposition shows that privatization reduces precisely these causes. Taken together, these results indicate that the delay improvements operate through the margins the airport operator controls, rather than through factors outside its control.

[44]This pattern holds when airport closures are grouped together with airport-operator causes, as a robustness check on the airport category definition.

As a robustness check, I re-estimate the decomposition under two alternative definitions of the airport-operator category. The first groups temporary closures as an airport-operator cause. The second narrows the category to "airport operating under operational restrictions" and "restrictions in airport support facilities", excluding "failure of ground equipment and passenger service" and "security, passenger, cargo, and alarm screening". The results are reported in Appendix Section C.1.4 and the main pattern is robust.

Discussion. To explain these findings, observe that airport operators do not control all sources of airline delays. Their role is more limited: privatization in Brazil transferred operational responsibilities directly connected to airline operations, including passenger processing, security screening, baggage handling, staffing, gate-related infrastructure, runway maintenance, and taxiway coordination. These activities connect the passenger side of the airport to the aircraft side, and frictions in any of them can slow aircraft turnaround and pushback, contributing to departure delays. The causes decomposition confirms that the effects operate through these margins: privatization reduces the share of delays attributed to airport-operator causes, while leaving weather and air traffic control unaffected. This is consistent with improvements in these margins reducing local bottlenecks, rather than eliminating major disruptions.

The same logic applies to the infrastructure investments required by the contracts — terminal expansions, baggage and security upgrades, aircraft parking positions, boarding bridges, and taxiway upgrades — which affect airport capacity and congestion especially when demand is high. In contrast, very long delays, average delay, and cancellations are more likely to reflect factors largely outside the airport operator's control, such as weather, air traffic control, crew availability, mechanical problems, and network disruptions.

This mechanism helps explain why the effects are stronger when the privatized airport is the origin. The origin airport is where most pre-departure operations take place, including passenger processing, baggage loading, boarding, gate use, turnaround, pushback, and taxiway movement. These steps determine whether a flight leaves on time, so improvements at the origin airport have a more direct effect on delays than improvements at the destination.

The effects are stronger in Phase II, which is when the operator has both responded to the contract's incentives and the required infrastructure is in place, so the reductions are consistent with both the managerial and infrastructure channels through which the airport may affect airline operations, rather than with the ownership transfer alone. The causes decomposition shows the same Phase II concentration in airport-operator delays.

Overall, the results suggest that privatization reduces the probability that flights experience longer delays, operating through the margins the airport operator controls, rather than reducing all delay measures uniformly.

4.1.2 Robustness

Staggered Timing. To address concerns that fixed-effects estimates in staggered adoption settings may be affected by comparisons between newly treated and already-treated units, I re-estimate the main specification using stacked DiD samples that restrict identification to clean comparison groups. I define a cohort by the first month in which either endpoint airport of a route is privatized, so that the pre-treatment period for each cohort is fully public. For each cohort, I construct a separate stacked sample containing the cohort's treated routes and comparison routes that are either never privatized or not yet privatized over the event window, which extends up to 84 months before and after the first privatization, truncated by the start and end of the panel. I choose this window length so that it is long enough to contain Phase II. The contract phases, including Phase II, are not used to time the event window. They

enter only through the phase indicators, as in the main specification. I then stack these cohort-specific samples and include route-by-cohort, month-year-by-cohort, and airline fixed effects, so that already-treated routes do not serve as controls. Standard errors are clustered by route.

Overall, the estimates are similar and the main pattern holds. Fully privatized routes and origin-only routes continue to show significant reductions in the delay-threshold outcomes, while destination-only routes do not. The full estimates are reported in Appendix Section C.2.

COVID. I estimate the baseline specification excluding observations from 2020 onward. This removes the COVID period and allows me to assess whether the main delay results are driven by the large disruption to air travel during and after the pandemic. The main pattern is robust and, if anything, stronger in the pre-COVID sample. In Phase II, fully privatized routes and origin-only routes show larger reductions in the share of flights delayed more than 15, 30, 45, and 60 minutes than in the full sample. Destination-only routes continue to show little evidence of reductions in delay-threshold outcomes. Rather than suggesting that the baseline results are driven by pandemic-period changes in traffic, the pre-COVID estimates indicate that delay reductions are present, and somewhat larger, in a period without the structural disruption of the pandemic.

Frequency Heterogeneity. I examine whether the delay effects differ by route frequency, which also addresses the concern that results may reflect the dynamics of large hub routes rather than privatization itself. I classify routes using their average monthly number of flights in pre-treatment public months: low frequency routes have up to 30 flights per month, medium frequency routes have 31 to 90 flights, and high frequency routes have more than 90 flights. I then re-estimate the baseline specification separately for each group. The delay reductions are not driven by low-frequency routes and are present across both medium and high frequency routes. They are therefore not an artifact of small or irregular route markets, nor of the dynamics of large hub routes specifically. The results are reported in Appendix C.2.3.

Alternative Fixed Effects. I also re-estimate the main regressions using fixed-effects structures that absorbs more variation. First, I include airline-by-month fixed effects, which allow each airline to have its own monthly shocks. This absorbs airline-specific disruptions in a given month, such as temporary operational problems, fleet reallocation, or network adjustments. Second, I include airline-by-route fixed effects, which absorb permanent differences in how a given airline operates on a specific route. A final specification includes both sets of interactions. The results remain qualitatively similar, although the estimates become smaller in magnitude when both interactions are included, as these fixed effects absorb more of the identifying variation. The full results are reported in Appendix C.2.4.

4.1.3 Flight Cancellations

Table 3 also presents effects on the cancellation rate. The cancellation rate is defined as the share of an airline's scheduled flights on a route in a given month that were reported as canceled. The estimates do not show a consistent effect, and the evidence is mixed across specifications.

Cancellations decline in Phase II. In the baseline specification, the decline is concentrated in low-frequency routes, falling by about 3 to 3.8 percentage points for routes with fewer than 30 flights per month, while the reduction is much smaller on medium-frequency routes, around 0.6 percentage points. Because cancellation shares

on low-frequency routes are highly variable, with each canceled flight representing a large share of few operated flights, the baseline pattern alone would suggest caution. Under the stacked difference-in-differences specification with clean control groups, however, the Phase II reductions are larger and statistically significant for fully privatized, origin-only, and destination-only routes. The two checks therefore point in different directions, and I do not draw a firm conclusion about whether cancellations fall in Phase II.

Overall, the cancellation results are less systematic than the delay results, which are robust across specifications and strengthen on regularly served routes.

4.2 Number of Flights Operated

This section examines whether airport privatization affects the number of flights operated. Private operators control aeronautical fees, terminal capacity, and gate and apron availability, which affect airline scheduling decisions and the profitability of operating at a given airport. The operator also collects revenue from flights and passengers, so it may have an incentive to grow the airport's overall traffic. Because that incentive is about total traffic rather than specific routes, effects may not appear systematically route by route, and may instead show at the airport level. I therefore examine both.

The evidence does not support a general increase in the number of flights. The results indicate that privatization affects flight activity, with proportional increases in both the route and airport-airline samples that are strongest after the deadline. However, these increases are neither broad nor consistent across measures or size groups. Results are reported in Appendix Section D.

Appendix Table 20 reports the results for the route-level sample. The proportional effects are positive and significant only after the deadline for mandatory investments. The level estimates do not follow the same timing: they are significant in Phase I and do not strengthen afterward.

Across size groups, terciles of the route's average flights before privatization, the estimates do not point in a common direction. Small routes contract in Phase I, in both proportional and level terms. Medium routes show effects in proportional but not level terms after the deadline. Large routes show effects in level but not proportional terms. No single measure or size group accounts for the result on its own, so the route-level evidence points to a change in flights after the deadline without a consistent pattern across measures or route size. Excluding the COVID period, the proportional effects remain but the Phase II level effects do not, and significant proportional effects appear on medium routes.

I aggregate the data to the airport-airline level, so the outcome is the number of flights operated by a given airline at an airport, and its logarithm. Treatment is the airport's privatization phase relative to public operation. The specification includes airport, airline, and month-year fixed effects.

Appendix Table 21 reports the results for the airport-airline sample. In the full sample the proportional effect and level effects are positive in both phases. The effect is concentrated in the middle tercile, where the number of flights rises in both phases and in both levels and logs. The smallest and largest terciles show no effect. The airport-airline estimates are consistent with growth in mid-sized operations rather than a broad increase.

Aggregating the data to the airport level, total activity shows no significant proportional effect and a negative level effect in Phase II. Excluding the COVID period, a positive proportional effect appears. Results are in Appendix Table 23.

I report flights in levels and in logarithms. Both have limitations: an effect of a given size in levels is economically

very different across routes, since 6 additional flights matter far more on a route flown 8 times a month than on one flown 100 times, and logs do not solve this, because a small absolute increase on a small route can produce a large percentage change. I therefore split routes into terciles by their average number of flights before privatization, so that the grouping is chosen ahead of treatment. I refer to these terciles as small, medium, and large routes.[45]

Figure 3 and Appendix Figure 10 present Callaway and Sant'Anna (2021) event-study estimates for route-level flights, in levels and in logarithms. Neither shows clear pre-trends.[46]

4.3 Passenger Satisfaction

The delay results provide evidence that conditions at the airport changed. I now provide evidence measured at the airport itself, from a survey of passengers who experience those conditions directly. I use a survey of passenger satisfaction conducted by ANAC to provide evidence that supports the pattern found in the airline results: effects appear, or are stronger, after the deadline for mandatory investments. It is difficult to obtain precise data on the amenities available to passengers and airlines, but passenger satisfaction provides a way to assess whether service provision changed after the transfer of airport management to private operators. The regression analysis suggests that overall satisfaction improves only after the investment deadline. This is consistent with the phases corresponding to real changes at the airport rather than to contractual milestones alone.

The survey. The survey is conducted in departure and arrival areas. Passengers respond to airport-related questions and rate each item on a 1–5 scale, where 1 is "very poor" and 5 is "very good." It includes questions on overall satisfaction and on specific aspects of airport services.[47] The results must be read with the coverage in mind: the survey includes some of the largest airports, 15 for most years. Coverage of some items varies over time, and some airports were already privatized when the survey began.

Panel A of Table 4 reports average satisfaction by privatization phase. Overall satisfaction does not improve right after contract signing, but are higher after Phase I.

To examine this further, I estimate

$$\text{Satisfaction}_{iat} = \beta_1 \cdot \text{Phase I}_{at} + \beta_2 \cdot \text{Phase II}_{at} + \alpha_a + \delta_t + \epsilon_{iat},$$

where $\text{Satisfaction}_{iat}$ is the satisfaction reported by passenger i at airport a in month t, α_a denotes airport fixed effects, and δ_t month fixed effects. The phase indicators are mutually exclusive and sequential, so each phase begins when the previous one ends, and the omitted category is the pre-privatization period. The coefficients identify the within-airport change in satisfaction in each phase, relative to the airport's own pre-privatization period.

[45] I do not group routes by their current flights, because the number of flights is the outcome and a route that expands would move between groups, which would condition the sample on the dependent variable.

[46] The corresponding airport-level estimates are reported in Section 3.2.

[47] Examples include security and check-in wait times, staff behavior, signage, Wi-Fi, power outlets, seating, cleanliness, baggage claim, parking, food and retail services, immigration, and public transport.

Table 4: Passenger Satisfaction

Panel A. Mean reported satisfaction by phase

Variable	Pre-privatization	Phase I	Phase II
Overall Reported Satisfaction	4.178	4.179	4.423

Panel B. Within-airport effect of privatization

Overall Satisfaction	Phase I	Phase II - post mandatory investments
Coefficient	-0.0713	0.1949***
	(0.0453)	(0.0655)
Fixed-effects: Airport (Yes), Survey date (Yes)		
Fit statistics: Observations = 777,908, R^2 = 0.12603		

Notes: ANAC passenger satisfaction survey. Passengers rate each item from 1, very poor, to 5, very good. Panel A reports unadjusted means. Panel B regresses satisfaction on phase indicators with airport and survey-date fixed effects; the omitted category is the pre-privatization period. Standard errors clustered by airport in parentheses. */**/***: 10/5/1%.

The estimated effect on passenger satisfaction is positive, but it appears only after the investment deadline. Two things happen at that point: the deadline for the mandatory investments passes, and the private operator has been running the airport beyond the transition period. Most airports in the survey sample reached the mandatory-investment deadline near or after the onset of the pandemic.[48] Excluding the COVID period therefore removes most of the Phase II variation. The estimate is similar in magnitude but no longer statistically significant, which I read as a consequence of the missing treated observations rather than as evidence that the effect is absent.

5 Effects of Airport Privatization on Market Outcomes

This section examines the effects of airport privatization on market outcomes. The previous section showed that delays fell on the routes served by privatized airports, that the reductions came from the causes the airport operator controls, and that passengers reported higher satisfaction. Privatization changes airport infrastructure and operations, altering airlines' costs and operating conditions through aeronautical fees, the capacity of runways, gates, and terminals, the resulting congestion, and pricing and incentive schemes. These conditions enter airlines' decisions about pricing, route entry and exit, and how frequently to serve each route. Because airlines differ in their scale and presence across airports, a change in airport conditions may affect them differently, and thereby affect the distribution of activity across airlines in a market.

5.1 Airfares

I estimate (1) for airfares. The results point to higher airfares. I first estimate the specification without airline fixed effects, so the coefficient reflects the overall change in average fares in the market across airlines. I then add airline

[48] The survey's Phase II variation is concentrated in a handful of airports before 2020: of the 16 airports observed in Phase II, only 9 have any Phase II observations before that year, and several of those have very few.

fixed effects, allowing the estimates to reflect whether an airline changes airfares when a market becomes privatized. As robustness, I estimate the same specification on the market-level sample. Fares rise in all three, so the increase is not only a change in which airlines serve the market.

Table 5 presents the effect on the logarithm of the average fare an airline charges in a market. An observation is an airline in a market in a month. The specification does not include airline fixed effects, so the coefficient captures the effect of privatization on the average price charged in the market. When both endpoints are privatized, the average price rises by about 21 BRL, or 3 percent, in Phase I, and by about 25 BRL, or 7 percent, after the mandatory investment deadline.[49] When only one endpoint is privatized the effect is roughly 16 BRL, about two-thirds as large. The sample average fare is 379.88 BRL.[50] Because the set of airlines serving a route can change after privatization, the specification without airline fixed effects reflects both changes in fares within airlines and changes in the set of airlines that serve the route. I also include airline fixed effects in the specification. The effects are still positive, about 5 percent when both endpoints are privatized in Phase II, suggesting the price each airline charges is also higher. Additionally, estimating the same specification on the market-level sample, which captures the average price a consumer faces in the market, gives an increase of about 7 percent. Appendix Section E.2 presents all the airfare results.

To examine the change in airfares further, I turn to the fare distribution. Figure 6 reports the effects on the 90th percentile, the median fare, and the 10th percentile. Each point is a coefficient from equation (1) and the horizontal lines are 95 percent confidence intervals, measured in log points. After the mandatory investment deadline, and when both endpoints are privatized, the 90th percentile rises by about 12 log points, the median by about 4, and the 10th percentile presents a non-statistically significant reduction. When only one endpoint is privatized, the 10th percentile falls by about 2 log points. In Phase I the three move together, each rising by about 2 to 4 log points when both endpoints are privatized. Price dispersion, measured by the Gini coefficient, rises by about 0.03 points relative to a sample average of 0.218.[51]

Both airfares and airfare dispersion show a positive effect after the mandatory investment deadline, consistent with fares on privatized routes becoming more dispersed around a higher average. The airport capacity improvements described in Section 2 could allow airlines to choose different scheduling and different connecting routes, and to serve a wider range of passengers, which could support more price variation. Higher fares could also reflect the increase in market concentration, which I discuss in Section 5.2. I do not, however, provide evidence of an increase in market power.

[49] Brito et al. (2021) finds an increase of about 3 percent in airfares on routes served by at least one privatized airport, consistent with the Phase I estimate here.

[50] Appendix Table 26 reports the results for fares in levels, instead of the logarithm of airfares.

[51] Appendix Table 26 reports the estimates for the Gini coefficient, and Appendix Table 27 the fare distribution with airline fixed effects.

Table 5: Effect of Airport Privatization on the Average Fare

	Phase I			Phase II		
	Both	Origin	Destination	Both	Origin	Destination
	(1)	(2)	(3)	(4)	(5)	(6)
log(Average Price)	0.0336***	0.0017	0.0010	0.0703***	0.0238***	0.0225***
	(0.0074)	(0.0048)	(0.0048)	(0.0128)	(0.0078)	(0.0077)
Market and month–year fixed effects. Observations: 1,317,165. R^2: 0.47879. Within R^2: 0.00059.						

Notes: Airline–market–month observations. The outcome is the logarithm of the average fare. The specification is equation (1). Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Standard errors clustered by market in parentheses. */**/***: 10/5/1%.

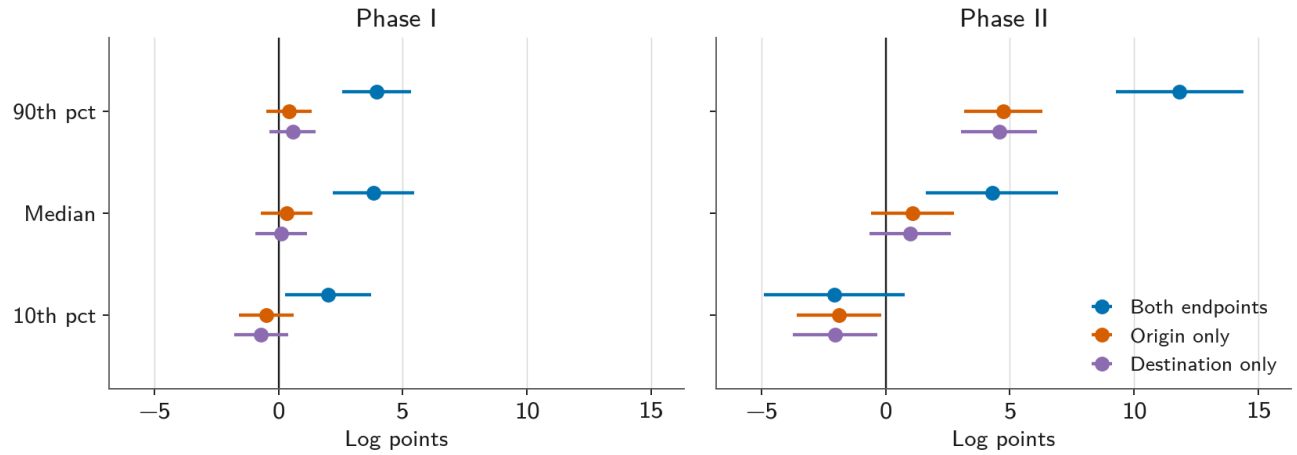


Figure 6: Effect of Airport Privatization on the Fare Distribution

Notes: Each point is the coefficient on the indicated contract phase and route privatization status from equation (1), estimated on the logarithms of the 90th percentile, the median and the 10th percentile of the fare distribution. Horizontal lines are 95 percent confidence intervals from standard errors clustered by market. The omitted category is markets with two public endpoints.

5.2 Market Concentration

Table 6 reports estimates of (1) for the logarithm of the HHI, the two-firm concentration ratio (CR2), the number of airlines serving the market, and the maximum market share. Because concentration is defined at the market level, the outcome is measured at the market-month level rather than the airline-market-month level, and (1) is estimated on a market-month panel with market and month-year fixed effects.

Privatization increases market concentration, and the effect strengthens across contract phases. The estimates for the logarithm of HHI are positive and statistically significant, and increase in magnitude across phases. When both origin and destination airports are privatized, HHI rises by about 9 percent in Phase I and about 25 percent after the mandatory-investment deadline, or about 1,250 points on the 0–10,000 HHI scale. When only one endpoint is privatized, the effect is roughly one-quarter of this magnitude, 6 percent, or 340 to 350 points after the deadline. The results are consistent when using logs or levels, and when HHI is based on the share of seats sold, or the share

of revenue in the market.[52]

The other concentration measures move in line with the increase in HHI. The average number of airlines operating in a market falls, and both the CR2 and the maximum market share rise. The pattern across contract phases is the same as for HHI, with the largest effects after the mandatory-investment deadline. The rise in the maximum market share suggests that some airlines may have become more dominant on some routes following privatization, which I explore further in Section 6.

The results suggest that concentration has, on average, increased within each route. Because a single airline does not dominate every route, rising concentration across routes reflects different carriers holding strong positions in different markets. This raises the question of whether privatization shifts activity toward particular airlines on some routes, and how an airport operator would affect concentration on a route.

The next subsection describes a series of robustness exercises showing that the results are not likely to be driven by other shocks to the industry or by particular types of markets, and that they are robust to the concerns that arise when treatment is adopted at different times. Then, I further explore explanations for the increase in market concentration in Section 6.

Table 6: Market Concentration

	Log(HHI)	CR2	Number of Airlines	Maximum Market Share
Model:	(1)	(2)	(3)	(4)
Variables				
Fully Privatized (Phase I)	0.0822***	0.0223***	-0.2832***	0.0401***
	(0.0068)	(0.0019)	(0.0183)	(0.0037)
Destination Only Privatized (Phase I)	0.0324***	0.0102***	-0.1170***	0.0152***
	(0.0046)	(0.0013)	(0.0121)	(0.0025)
Origin Only Privatized (Phase I)	0.0309***	0.0100***	-0.1101***	0.0142***
	(0.0046)	(0.0013)	(0.0120)	(0.0025)
Fully Privatized (Phase II)	0.2217***	0.0657***	-0.7898***	0.1077***
	(0.0112)	(0.0038)	(0.0334)	(0.0060)
Destination Only Privatized (Phase II)	0.0599***	0.0167***	-0.2326***	0.0287***
	(0.0072)	(0.0019)	(0.0194)	(0.0039)
Origin Only Privatized (Phase II)	0.0592***	0.0169***	-0.2193***	0.0283***
	(0.0071)	(0.0019)	(0.0192)	(0.0039)
Fixed-effects				
Route	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	616,346	616,346	616,346	616,346
R^2	0.66212	0.54815	0.74616	0.62104
Within R^2	0.00901	0.01185	0.02187	0.00624

Notes: Market–month observations. The outcomes are log HHI, CR2, the number of airlines and the maximum market share, in columns 1 to 4. An airline's market share is the number of seats it sold in a market–month divided by total seats sold in that market–month, and HHI is the sum of squared percentage shares.Equation (1) is estimated on a market–month panel. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Market and month–year fixed effects. Standard errors clustered by market in parentheses. */**/***: 10/5/1%.

[52] Appendix Table 24 reports the results for HHI in levels and for the revenue-based HHI.

5.3 Robustness and Heterogeneity

This section describes the robustness exercises for market concentration and airfares. The tables are reported in Appendix Sections E.3 and E.3, respectively.

Avianca. Avianca Brasil (Avianca) operated domestic flights until 2019 and competed with the main airlines on some of the major routes.[53] On 10 December 2018, Avianca filed for bankruptcy protection, and in June 2019 it suspended activities and exited the industry.

A large carrier's exit mechanically raises concentration on the routes it served and can also affect the fares charged there, so I test whether the effects of privatization on concentration and on fares are driven by Avianca's exit. First, I drop all routes ever served by Avianca; the effect remains, so it is not an artifact of the exit. The fare effects are similar in direction and magnitude for the average fare, and smaller for fare dispersion. Because Avianca's markets were larger, this also removes many of the largest routes. As an alternative that keeps the full sample, I interact the treatment variables with an indicator for markets ever served by Avianca. The treatment effects in markets Avianca never served remain significant, though smaller in magnitude.

Market Structure. I split the sample by the number of firms serving a route before treatment, to check whether the effects on concentration and on fares hold in all markets or are confined to markets that were already concentrated. I re-estimate the main specification excluding routes that were monopolies at some point before treatment.

The increase in concentration appears broad and not restricted to already less competitive routes. It survives dropping ever-monopoly routes, and even routes that ever had two or fewer firms, and in those competitive subsamples it is often larger than in the full sample. The fare effects are also robust to dropping these routes, so they are not driven by very concentrated routes. I repeat this test using the modal and mean number of airlines over the pre-treatment window to define competition, rather than whether a route was a monopoly or had two or fewer firms at some point before treatment. The effects are robust across definitions.

Staggered Timing. As with the operational outcomes, I re-estimate the main specification using stacked DiD to address the concern that fixed-effects estimates in staggered settings can be affected by comparisons with already-treated units.[54] The design restricts each cohort's comparison group to routes that are never or not-yet privatized, so already-treated routes do not serve as controls, and I estimate the same specification within the stacked sample. The effects on concentration and on fares are robust.

Market Size. Privatization may affect routes of different market size differently. I examine whether the effects on concentration and on fares appear across routes of different market size or are concentrated in particular ones. To measure market size, I use data on the populations of the cities of both endpoints of a route.[55] For a given origin–destination market, I then define market size as the simple average of the resident populations of its two endpoint airport cities.

[53] Avianca did not disproportionately serve privatized airports: its pre-exit seat share was 10.4% at ever-privatized origin airports and 8.0% at never-privatized ones, a small difference. Its markets were concentrated in the top size tercile.

[54] The construction of the cohort-specific stacked samples is described in Section 4.1.2.

[55] For each airport I take the resident population of its home municipality (IBGE municipal population estimates) and average it over the sample period 2011–2025, yielding a single, time-invariant population for each airport.

I sort markets into terciles of this population measure (small, medium, and large) and re-estimate the baseline specification separately within each group, so that treated markets are compared to controls of similar size.[56] The concentration effect of privatization is not confined to any particular market size: it is large and significant in all three groups, and, as in the baseline, strongest when both the origin and destination airports are privatized. The fare effects also hold across the three groups.

I also estimate a continuous specification in which each privatization-phase indicator is interacted with the natural logarithm of market population, centered at its sample mean. The interactions with log population are positive and statistically significant, so the concentration effect tends to be stronger in larger markets. The fare effects are also somewhat stronger in larger markets.

COVID. To check whether the results are driven by COVID disruptions, I restrict the sample to before 2020. The concentration effects remain robust. The fare effects are also robust and, if anything, stronger in the pre-COVID sample.

6 Mechanism: Heterogeneous Effects Across Airlines

This section connects the findings on operational outcomes in Section 4 with the findings on market outcomes in Section 5. I examine whether the changes in airport conditions affected airlines differently depending on how much each airline operates at the airport, which would offer an explanation for the increase in market concentration.

Airport conditions are shaped by both the airport's infrastructure and its managerial decisions. Capacity, such as runways, gates, and terminals, together with the reliability of ground services, affects terminal congestion and how much an airline can expand and schedule its operations at the airport. These conditions, along with aeronautical fees, enter an airline's costs and affect how many flights it decides to operate there.

Airlines operate at different levels across airports, running more flights at some airports than at others. Hubs are one example: an airline runs a large share of its flights through its hub, operating there on a larger scale than the other carriers. Scale and a stronger position at an airport can allow an airline to serve the routes through it more efficiently, improving aircraft utilization and coordinating connections. Because airlines are stronger at some airports than others, a change at an airport affects a different set of routes depending on which airline is strong there. Therefore airlines are affected asymmetrically, by how much activity each has at a given airport: a change in passenger or terminal operations affects an airline running a few flights a day less than one processing many passengers. This asymmetry can shift how demand is allocated across airlines, and in turn the concentration of individual routes.

The direction of the asymmetry is therefore of interest. Improved operating conditions and infrastructure could benefit firms already established at the airport more, leading them to gain activity on the routes serving it relative to their competitors. These same changes could instead benefit smaller-presence carriers more, lowering the barrier for them to grow there and reducing concentration on those routes. Capacity is limited, so gains by one airline come partly at the expense of another's room to grow, given the demand for flights at the airport. New airport conditions may affect demand at the airport. Overall demand for flights still depends on the cities served, their

[56] The tercile cut-offs correspond to average endpoint populations of roughly 294,000 and 768,000 residents.

size, and economic activity, and can grow only so far. Which airlines benefit more therefore determines whether concentration rises or falls.

To formalize this possibility, I consider a simple framework in which two airlines compete for passengers at an airport, and airport conditions affect their costs differently depending on their activity there. The framework shows that the effect on concentration depends on how the airport change affects each airline's costs, which is an empirical question, and it defines the object I estimate.

An Illustrative Framework

Consider two airlines that choose the fares for flights serving a route. Products are differentiated. Let p_i denote the fare charged by airline i, and q_i the number of passengers it carries. Inverse demand is linear, $p_i = a_i - bq_i - cq_j$, with $a_i > 0$ and $b > c > 0$. The condition $b > c > 0$ ensures that an airline's own quantity affects its fare more than its rival's, which is natural in this setting given the role of schedules, frequency, and connections.

Privatization. Let θ denote airport conditions, such as infrastructure, operational efficiency, or the pricing and incentive schemes the airport operator sets for airlines. Privatization is modeled as a change in these conditions, θ, that affects airlines' fare and quantity decisions. I do not model the change of the airport from public to private operation. Section 2 discusses how the private airport operator may affect airlines' decisions, and Section 4 provides evidence that operational outcomes were affected by private operation.

Changes in airport conditions may affect airlines differently. Airlines with a larger presence or a more established position at a given airport may respond differently to these changes. Let z_i denote airline-specific characteristics, such as initial scale, network density, or the ability to expand operations.

These airport characteristics enter airlines' costs, determining their effective marginal cost.

$$\widetilde{c}_i(z_i, \theta) \equiv c_i - \Delta(z_i, \theta) \tag{2}$$

Here c_i is the baseline marginal cost and $\Delta(z_i, \theta)$ reflects the amount by which airport conditions reduce airline i's marginal cost of carrying a passenger. This effect may differ across airlines, since it depends on z_i, airline i's operations at that airport.

Airlines choose fares, so the relevant demand system gives each quantity as a function of both fares. Inverting the pair of inverse demand functions provides:

$$q_i = \alpha_i - \beta p_i + \gamma p_j, \qquad \text{where} \qquad \alpha_i = \frac{ba_i - ca_j}{b^2 - c^2}, \quad \beta = \frac{b}{b^2 - c^2}, \quad \gamma = \frac{c}{b^2 - c^2}, \tag{3}$$

and analogously for q_j. Airline j's expressions are obtained throughout by interchanging the subscripts i and j.[57] Under $b > c > 0$ both β and γ are positive, so an airline's quantity declines as its own fare rises and increases as its rival's fare rises.

Equilibrium. Airline i chooses p_i to maximize profits given by $\pi_i = [p_i - \widetilde{c}_i(z_i, \theta)] \left(\alpha_i - \beta p_i + \gamma p_j\right)$, taking p_j as given. The first-order condition is

[57] The system $p_i = a_i - bq_i - cq_j$ and $p_j = a_j - bq_j - cq_i$ is invertible for $b \neq \pm c$, and solving it for the quantities gives (3).

$$\alpha_i - 2\beta p_i + \gamma p_j + \beta \widetilde{c}_i(z_i, \theta) = 0, \tag{4}$$

and the same condition holds for airline j.[58] Substituting the equilibrium fares into (3) gives the equilibrium quantities,

$$q_i = \beta \frac{2\beta\alpha_i + \gamma\alpha_j - \left(2\beta^2 - \gamma^2\right)\widetilde{c}_i + \beta\gamma\,\widetilde{c}_j}{4\beta^2 - \gamma^2} \tag{5}$$

and analogously for airline j.

Asymmetry. The object of interest is the asymmetry in equilibrium quantities across airlines. Relative quantities determine each airline's market share, and the distribution of shares determines market concentration, so the asymmetry is the object that links airport conditions to the concentration measures examined above. Since privatization is modeled as a change in θ, the objective is to determine how such a change affects this asymmetry.

Let $G(\theta; z_i, z_j) \equiv q_i - q_j$ denote the difference between the equilibrium outputs of airline i and airline j. Substituting from (5) gives[59]

$$G(\theta; z_i, z_j) = \frac{b}{(b-c)(2b+c)}\left[(a_i - a_j) - (c_i - c_j) + \Delta(z_i, \theta) - \Delta(z_j, \theta)\right] \tag{6}$$

The output asymmetry depends on the difference in demand intercepts, the initial cost difference and on how airport conditions change each airline's costs. To examine how the changes in airport conditions caused by privatization affect this asymmetry, differentiate $G(\theta; z_i, z_j)$ with respect to θ,

$$\frac{\partial G}{\partial \theta} = \frac{b}{(b-c)(2b+c)}\left[\frac{\partial \Delta(z_i, \theta)}{\partial \theta} - \frac{\partial \Delta(z_j, \theta)}{\partial \theta}\right] \tag{7}$$

The factor multiplying the bracket is positive because $b > c > 0$. Consequently, (7) implies that the effect of privatization on asymmetry depends on the difference in how each airline's costs respond to changes in airport conditions, where $\partial\Delta(z, \theta)/\partial\theta$ captures the effect of a change in airport conditions on the cost of carrying a passenger for an airline with characteristics z. Differences in demand intercepts shift the level of the output gap but not its response to θ.

Suppose $z_i > z_j$. Then the sign of $\partial G/\partial\theta$ depends on whether $\partial\Delta(z, \theta)/\partial\theta$ is increasing or decreasing in z. To characterize it, consider:

$$\frac{\partial}{\partial z}\left(\frac{\partial \Delta(z, \theta)}{\partial \theta}\right) = \frac{\partial^2 \Delta(z, \theta)}{\partial z \partial \theta} \tag{8}$$

The cross-partial in (8) is the object that determines the direction of the effect. It determines whether the cost effect of a change in airport conditions is larger for airlines with more activity at the airport, or for those with less.

[58] The second derivative is $-2\beta < 0$, so the first-order condition characterizes a maximum. Rearranging (4) gives airline i's best response to its rival's fare, $p_i = \left[\alpha_i + \gamma p_j + \beta\widetilde{c}_i(z_i, \theta)\right]/2\beta$, which is increasing in p_j. Solving the two conditions simultaneously gives the equilibrium fares, $p_i = \frac{2\beta\alpha_i + \gamma\alpha_j + 2\beta^2\widetilde{c}_i + \beta\gamma\widetilde{c}_j}{4\beta^2 - \gamma^2}$, and analogously for airline j, where $\widetilde{c}_i$ and $\widetilde{c}_j$ are evaluated at (z_i, θ) and (z_j, θ).

[59] Subtracting q_j from q_i in (5) provides $G(\theta; z_i, z_j) = \frac{\beta}{2\beta+\gamma}\left(\alpha_i - \alpha_j\right) - \frac{\beta(\beta+\gamma)}{2\beta+\gamma}\left(\widetilde{c}_i - \widetilde{c}_j\right)$. Using $\alpha_i - \alpha_j = (a_i - a_j)/(b-c)$ and $\widetilde{c}_i - \widetilde{c}_j = (c_i - c_j) - \left[\Delta(z_i, \theta) - \Delta(z_j, \theta)\right]$, the two terms share the factor $\beta(\beta+\gamma)/(2\beta+\gamma) = b/[(b-c)(2b+c)]$, which provides (6).

If the cross-partial is positive, the cost effect of a change in airport conditions is increasing in z: airlines that are more established at the airport benefit more and expand relative to their competitors. Since relative quantities determine market shares, concentration increases on the routes serving the airport. If the cross-partial is negative, the cost effect is decreasing in z: airlines that are less established benefit more and expand relative to their competitors, so concentration decreases on those routes. If the cross-partial is zero, the response to airport conditions does not vary with z, asymmetry is unchanged, and concentration does not change.

The same basic conclusions hold when airlines compete in quantities rather than in fares. Appendix Section F.1 presents the case of differentiated products, and Appendix Section F.2 presents the case of homogeneous products with airlines choosing capacity before fares.

Empirical approach. The direction of the effect depends on how the impact of airport conditions on costs varies with airline characteristics. The model does not determine which case holds: the sign of the cross-partial is an empirical question. Since airlines have different levels of z across airports, the direction may differ from one airport to another, and an airline's shares in routes serving one airport could increase while its shares in routes serving another decrease, depending on their activity at each.

I test whether airlines with greater airport presence gain relatively more market share in routes served by that airport when it becomes privately operated. I estimate the following specification, allowing the effect of privatization to vary with an airline's presence at the airport:

$$\log s_{irt} = \alpha_i + \mu_r + \tau_t + \lambda\theta_{rt} + \rho\left(\theta_{rt} \times z_{ia}\right) + \varepsilon_{irt}. \tag{9}$$

The dependent variable s_{irt} is the market share of airline i in route r at time t, measured as the share of seats sold. The variable θ_{rt} is the route-level privatization indicator. The term z_{ia} is a measure of airline i's presence and activity at airport a; I also consider a version specific to the route, z_{ir}. The terms α_i, μ_r, and τ_t denote airline, route, and time fixed effects, respectively, and ε_{irt} captures residual demand factors not included in the regression, such as service quality, and other airline-specific attributes. The estimation is on airline-route-months with positive share, so the effect is on the allocation of shares among airlines serving the route, not on entry or exit.

The variable z_{ia} measures an airline's presence at an airport before privatization. Because privatization can itself change how much an airline operates at an airport, contemporaneous activity is affected by treatment, so all exposure measures are computed only from months before the route's first exposure and held fixed over time. A route's first exposure is the contract signing date and the window is the 24 months immediately preceding it, applied to both endpoints. For routes where neither endpoint is ever privatized, exposure is computed over a common baseline window; these values do not affect the estimates, since the privatization indicator is zero for these routes in every period.

The main measure is the logarithm of the airline's average monthly departures from the origin airport before privatization. This captures the scale and intensity of the airline's operations there, and reflects entry, exit, and changes in service across the routes it serves from that airport. This measure is constructed from flight-level operational data, while market shares are measured from route-level price data, which include both direct and connecting itineraries. I also consider the analogous measure at the destination, the airline's share of departures from the origin airport, the average of the origin and destination measures, and, from the fare data, the airline's seats

sold on the route and its share of seats sold at the origin airport. Results for the alternative measures are reported in Table 37.

Parameter of Interest. The interaction term $\theta_{rt} \times z_{ia}$ is the empirical counterpart of the cross-partial in (8): it captures whether the effect of privatization differs depending on an airline's activity at the airport. A positive coefficient ($\rho > 0$) corresponds to the case in which airlines with a stronger presence benefit relatively more from changes in airport conditions and gain market share following privatization; a negative coefficient corresponds to the case in which less-established airlines gain.

Table 7 reports estimates of equation (9) using the log of the airline's pre-treatment departures from the origin airport as the exposure measure. The three columns differ only in how privatization is defined: the origin airport privatized, both endpoints privatized, or either endpoint privatized.

The interaction coefficient ρ is positive and statistically significant in all three columns. Airlines with greater pre-treatment activity at the origin airport gain relatively more market share after privatization. In column (1), a 10 percent increase in an airline's pre-treatment departures from the origin airport raises the effect of privatization on its route market share by about 2 percent. The estimates are similar when privatization is defined by both endpoints or either endpoint.

Table 7: Market Shares

Dependent variable:	log(market share)		
Privatized airports:	Origin airport	Origin and destination	Either origin or destination
	(1)	(2)	(3)
Variables			
Privatized (λ)	-0.963***	-0.573***	-0.957***
	(0.068)	(0.061)	(0.048)
Privatized × log pre-treatment flights at origin (ρ)	0.198***	0.147***	0.199***
	(0.012)	(0.011)	(0.009)
Fixed-effects			
Airline	Yes	Yes	Yes
Route	Yes	Yes	Yes
Month	Yes	Yes	Yes
Fit statistics			
Observations	1,271,947	1,271,947	1,271,947
R^2	0.202	0.194	0.210
Within R^2	0.017	0.007	0.026

Notes: The dependent variable is the log of an airline's market share on a route in a given month. Each column reports a separate regression that differs only in how privatization is defined: column (1) treats a route as privatized when its origin airport is privatized, column (2) when both the origin and destination airports are privatized, and column (3) when either endpoint is privatized. The exposure measure z is the same in all three columns: the log of the airline's average monthly flights at the origin airport, measured over the 24 months before the route's first exposure to privatization, so that it is not affected by treatment. λ is the coefficient on the privatization indicator and ρ is the coefficient on its interaction with z. The marginal effect of privatization for an airline with exposure z is $\lambda + \rho z$. All specifications include airline, route, and month fixed effects, with standard errors clustered by route.

To illustrate the effects, Figure 7 presents the marginal effect of origin-airport privatization on log market share, $\hat{\lambda} + \hat{\rho} z$, where z is the airline's pre-treatment presence at the origin airport, evaluated over the 15th–85th percentile of its range. It is based on column (1) of Table 7. Since λ is negative and ρ positive, the effect is negative for airlines with little presence at the airport and positive for those with more, crossing zero at about 130 flights per month. The pattern corresponds to the case in which the cost effect of airport conditions is increasing in an airline's activity at the airport, so that the difference between the equilibrium outputs of the larger and the smaller airline at the airport increases. The figure shows how the effect varies with presence rather than at a single value, and the short black vertical lines along the horizontal axis shows where the observations lie.[60]

The figure shows that airlines with little presence at the origin airport lose market share on its routes following privatization, while those with greater presence gain. The effect changes most across the lower range of presence and flattens among the largest operations: airlines with the most flights at the airport gain the most, but the gain rises

[60]The 95 percent confidence band is obtained by the delta method from the market-clustered variance–covariance matrix. The standard error at each point is $\sqrt{\mathrm{Var}(\hat{\lambda}) + z^2\,\mathrm{Var}(\hat{\rho}) + 2z \cdot \mathrm{Cov}(\hat{\lambda}, \hat{\rho})}$, where $z = \log(1 + f)$ and f is the airline's average monthly flights at the origin airport.

at a decreasing rate, so the difference between a small and a mid-sized operation matters more than the difference between a large and a very large one. The losses for the smallest operations and the gains for the largest are of comparable magnitude, which is consistent with privatization reallocating share across airlines serving the same routes rather than raising or lowering all of them.

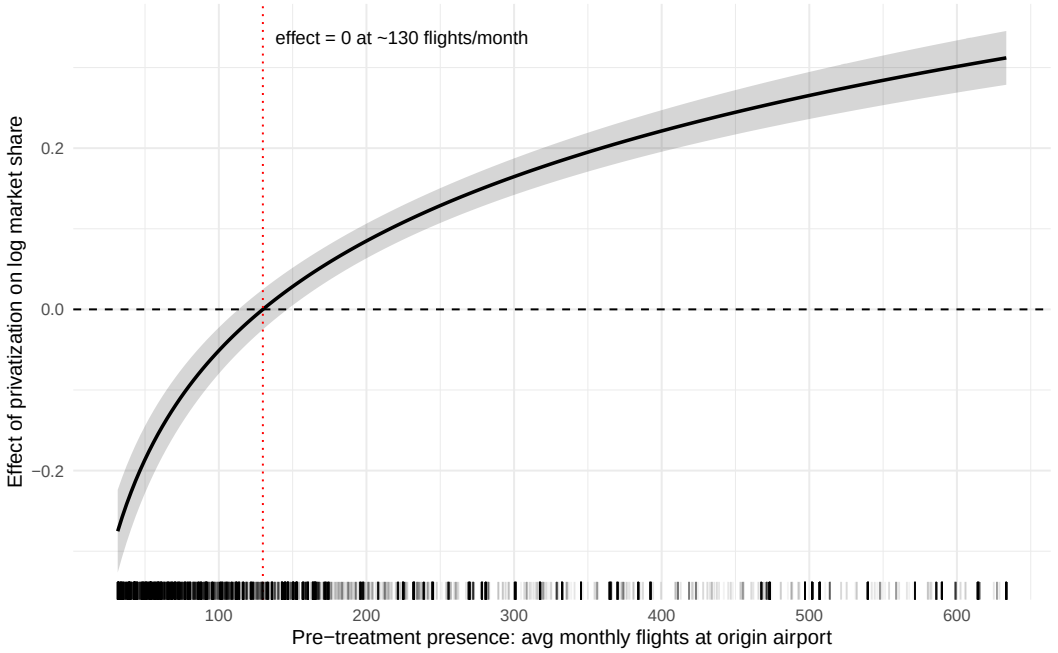


Figure 7: Marginal effect of privatization on log market share, by pre-treatment airport presence

Notes: Marginal effect of origin-airport privatization on an airline's log market share, $\hat{\lambda} + \hat{\rho} z$, where z is the airline's pre-treatment presence at the origin airport (log average monthly flights over the 24 months before the route's first exposure). Based on column (1) of Table 7. Evaluated over the 15th–85th percentile of the presence range; the effect is negative for airlines with little presence and positive for those with more, crossing zero at about 130 flights per month. The shaded band is the 95 percent confidence interval from the delta method, with standard errors clustered by route. The rug shows the distribution of observations.

Discussion. The estimates show that privatization raises the market share of airlines with a larger presence at the airport and reduces the share of airlines with a smaller presence. I describe two examples of how privatization could produce that pattern.

First, privatization requires investments in airport capacity, including expansions in the number of gates and aircraft parking spaces. These investments may not affect each airline in the same way. An airline operating a few flights a day at an airport, with few connecting passengers, may have slack between arrival and departure, so congestion and short delays may not affect that airline much. For an airline operating more flights a day at the airport, with more connecting passengers, the same conditions can be more disruptive, since delays propagate through its schedule and passengers miss connections. Because delays are more costly for an airline the more flights and connecting passengers it has at the airport, investments that reduce congestion could make schedules more reliable and lower costs by more for those airlines.

Second, the private airport can use aeronautical fees to attract activity. AENA Brasil, for example, offers a seasonal incentive program for domestic passenger flights: airlines receive a rebate on passenger fees for traffic

above a baseline defined by their operations in the same season of the previous year. To be eligible, an airline must increase total passenger boardings across AENA's network of airports to at least 103 percent of the level in the previous season, and the rebate is granted on the additional traffic above that threshold, calculated route by route.[61] This is a case of an operator creating an incentive for airlines to expand operations on routes they already serve, which could increase concentration on those routes.[62]

AENA also offers an incentive for new direct routes involving at least one of its airports that the airline did not operate in the same season of the previous year, granting an amount equal to 50 percent of the passenger boarding fee for passengers boarding or arriving at the AENA airport. At first, this incentive could reduce concentration, since a new direct flight brings an additional competitor into that origin–destination market. The effect need not go that way, however. Because a market here is an origin–destination pair that pools direct and connecting service, an airline may already serve a market through a connection at another airport. A new direct flight on that pair then adds a second path for an airline already present, raising its share. The same conclusion holds if the new route opens a connection to markets the airline already serves indirectly. Which case applies depends on the airline's existing network, so even an incentive aimed at new routes does not have a clear effect on concentration.

Revenue from aeronautical fees and from commercial activities rises with the number of passengers, so the operator's revenue is increasing in traffic. Because fees are regulated, the operator cannot raise revenue by charging more per passenger. The operator therefore has an incentive to attract traffic, especially after financing the investments and the cost of operating improved services.

Overall, the private operator has an incentive to affect the conditions under which airlines operate. Airlines with different levels of activity at an airport may be affected differently. The model shows that when this is the case, the direction of the effect on concentration depends on which airlines benefit more. The regression finds that airlines with a larger presence at the airport gain market share on its routes following privatization, which is consistent with the increase in concentration documented above.

7 Conclusion

This research has examined how the privatization of airport operations affects airline operations and the markets those airports serve. I document improvements in the conditions airlines and passengers face at the airport, while market concentration and airfares rose in those markets. Improvements in airport conditions need not affect all airlines symmetrically. An airline with more pronounced operations at the airport has more activity exposed to that change, so a given improvement has a more pronounced impact on that airline. Specifically, I find that airlines with a larger presence at an airport gained market share on the routes that airport serves, while airlines with little presence there lost share. Because the airline with the larger presence differs across airports, and many airports were privatized, some airlines gained share on the routes serving one airport while others gained on the routes serving another, contributing to the broad increase in concentration.

Two institutional patterns recur across the outcomes I analyze. The effects of privatization on operational and

[61] The program's details are available at `https://www.aenabrasil.com.br/en/corporative/incentiveprogram.html`.

[62] Such incentive programs are not unique to AENA. Another example: BH Airport, in Belo Horizonte, is run by a different operator and offers a comparable program with fare incentives for new destinations, increased frequencies, and new airlines. See `https://www.bh-airport.com.br/en/business/incentive-program`.

market outcomes are most pronounced after the investment deadline. This suggests that the realized effects of privatization depend not only on the change to private operation, but also on how the investment requirements and incentives are designed in the contracts. These effects are stronger on routes for which both endpoints are privatized, suggesting that in network industries, what a privatization program achieves depends on how much of the network is privatized.

I document how privatizing an input can affect downstream operations and markets. Firms that rely more on the input are affected more, so the same change need not affect competitors symmetrically. The relationship between airports and airlines is common across countries, so improvements at an airport could produce similar responses from airlines elsewhere, even if features of the Brazilian setting shape the magnitudes. The findings may also be informative for other industries in which downstream firms use a shared input to serve final consumers.

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A Additional Data Description

This appendix reports the construction details for the datasets described in Section 3.1.

Privatization data. I also collected the contract length, the winning bidder, and the type of bid, either individual airport or regional block.

Flight operations data. The Voo Regular Ativo (VRA) dataset provides flight-level status and timing information, including scheduled and actual arrival and departure times, and identifies canceled flights. The *Microdados* flight dataset provides realized characteristics of operated flights, such as passengers, seats, aircraft, distance, and other operational variables.

I construct delay and cancellation outcomes from VRA. Delay is measured in minutes as the difference between actual arrival time and scheduled arrival time. The flight-count outcome is the number of scheduled flights in a route-airline-month cell. Delay shares are defined as the number of flights with delays above each threshold divided by the total number of scheduled flights in the cell. Cancellation shares are defined as canceled flights divided by total scheduled flights. I also construct delay interval shares, which measure the share of scheduled flights falling within different delay ranges, such as 15–30 minutes.

Prices and market outcomes. Most price and airline-level outcomes are constructed at the route-airline-month level. These include price levels, such as average, median, minimum, and maximum fares, and price dispersion measures based on the distribution of tickets sold by an airline in a route-month. I also construct airline market shares, defined as the number of seats sold by an airline in a route-month divided by the total number of seats sold in that route-month.

For each market-month I explore several measures of concentration: the Herfindahl–Hirschman Index (HHI), computed as the sum of squared airline market share percentages; the concentration ratio of the two largest airlines (CR2); the number of airlines operating in the market; and the market share of the largest airline. I also compute a revenue-based HHI, using each airline's share of route-month revenue in place of its seat share.

Additional datasets. I use the IPCA, Brazil's broad consumer price index, to deflate fares. I use municipal population estimates from IBGE to measure market size in the heterogeneity analysis, taking the average population of the cities served by the two endpoint airports.

Table 8: Summary Statistics

Variable	Observations	Mean	Standard Deviation	25th Percentile	Median	75th Percentile
Total Flights	209456	58.742	66.850	24.000	34.000	76.000
Total Passengers	209456	5556.965	7391.003	1003.000	3128.000	7230.000
Average Occupancy Rate	209456	0.742	0.164	0.673	0.779	0.854
Average Distance (km)	209453	931.245	650.023	420.000	732.000	1299.000
Cancellation Rate	209456	0.061	0.119	0.000	0.014	0.067
Median Delay (min)	205443	0.930	14.777	-5.000	0.000	0.000
Average Delay (min)	205443	6.557	16.788	-1.543	3.747	11.286
Share of On-Time Flights	209456	0.603	0.287	0.452	0.675	0.818
Share of Flights Delayed over 1 Minute	209456	0.231	0.190	0.091	0.192	0.333
Share of Flights Delayed over 15 Minutes	209456	0.150	0.147	0.046	0.113	0.208
Share of Flights Delayed over 30 Minutes	209456	0.076	0.098	0.000	0.048	0.101
Share of Flights Delayed over 60 Minutes	209456	0.030	0.058	0.000	0.011	0.037
Share of Flights Delayed over 90 Minutes	209456	0.016	0.042	0.000	0.000	0.017
Share of Flights Delayed over 120 Minutes	209456	0.009	0.032	0.000	0.000	0.005

Notes: An observation is at the airline–route–month-year level. Observations reports the number of nonmissing observations; Mean and Standard Deviation. report the sample mean and standard deviation; and the remaining columns report the 25th percentile, median, and 75th percentile.

Table 9: Timeline of Airport Privatization Auction Notice Documents and Private Operation

Round	Auction notice publication date	Start of private operation
1st Round	May 12, 2011	November 28, 2011
2nd Round	December 15, 2011	June 14, 2012
3rd Round	October 3, 2013	April 2, 2014
4th Round	December 1, 2016	July 28, 2017
5th Round	November 30, 2018	September 3 and 5, 2019
6th Round	January 14, 2021	September 20, October 18, and October 20, 2021
7th Round	June 22, 2022	March 28 and April 4, 2023

Source: Information hand-collected from the Auction notice documents of each privatization round, available at `https://www.gov.br/anac/pt-br/assuntos/concessoes/processos-licitatorios`.

B Additional Pre-trends Analysis

Appendix figures report results for the main delay and frequency outcomes.

B.1 Selection Event Studies (Airport Level Sample)

The following subsections provide additional event-study evidence at the airport level, complementing the pre-trend analysis discussed in the empirical strategy section. The goal is to assess whether airports selected for privatization were already following different trends than non-privatized airports before treatment.

B.1.1 Callaway and Sant'Anna (2021) selection event-study (Airport level)

The following figure reports the same airport-level event-study estimates using the Callaway and Sant'Anna (2021) estimator over the full sample window, without restricting to the 24-month period used in the main text.

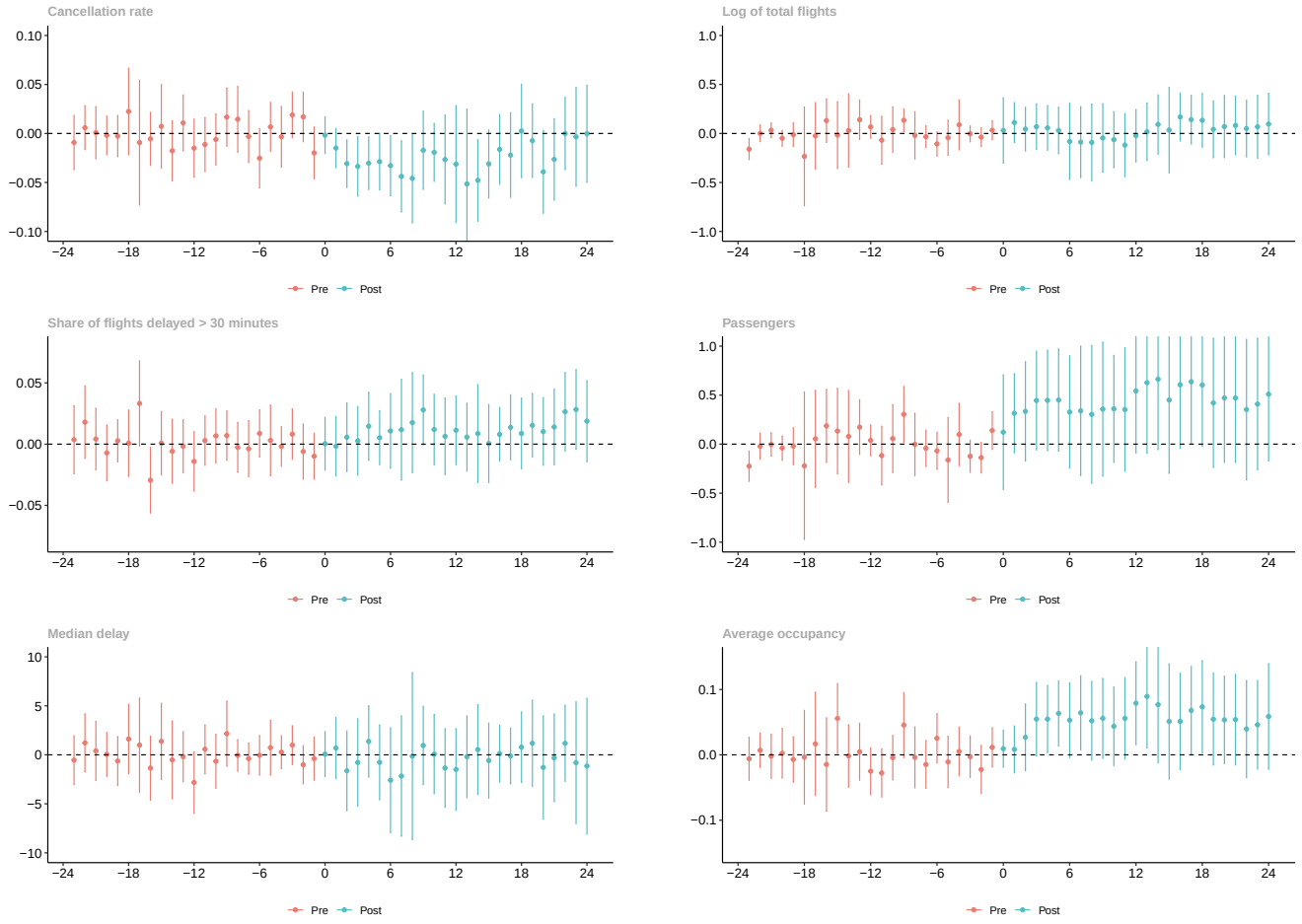


Figure 8: Airport-Level Pre-Trend Estimates: 24-Month Window.

Notes: Event-study estimates of airport-level outcomes using the Callaway and Sant'Anna (2021) estimator, with outcomes aggregated by airport of origin. Treatment is defined as the date of contract signing, when the airport enters the privatization process. For each cohort of airports privatized in a given period, outcomes are compared to airports that are either never privatized or not yet privatized at that point in time. The window covers 24 months before and after contract signing. The focus is on the coefficients before privatization, which do not show a clear systematic pattern of differential pre-trends. Red coefficients are periods before treatment. Blue coefficients are periods after treatment.

The online appendix reports the same estimates over all periods, rather than the 24-month window, together with the remaining pre-trend figures.

B.1.2 Stacked DiD

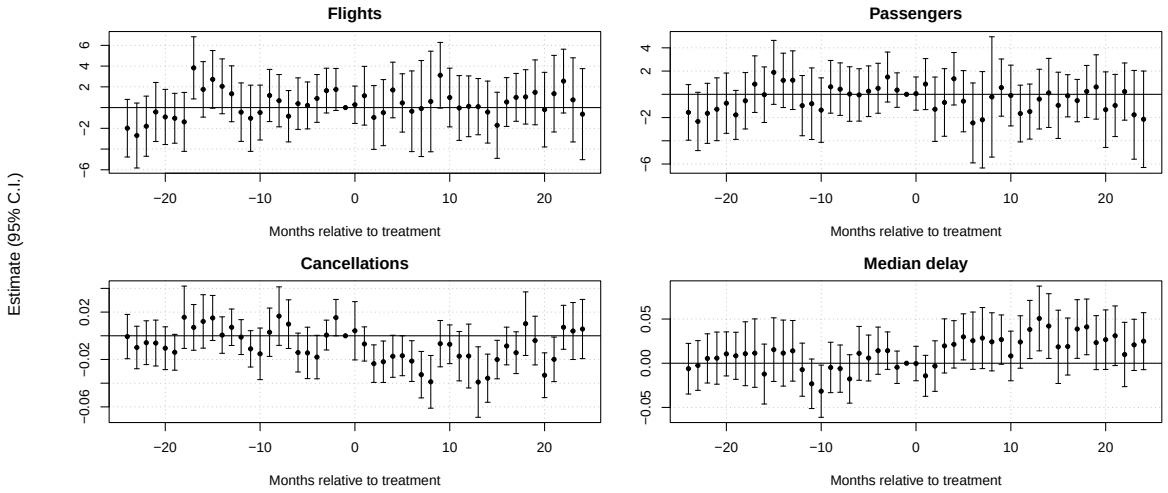
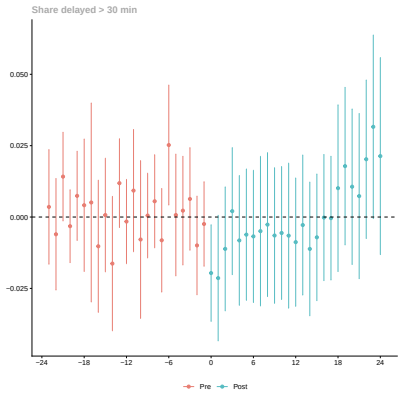


Figure 9: Stacked Event-Study Pre-Trend Estimates: Operational Outcomes.

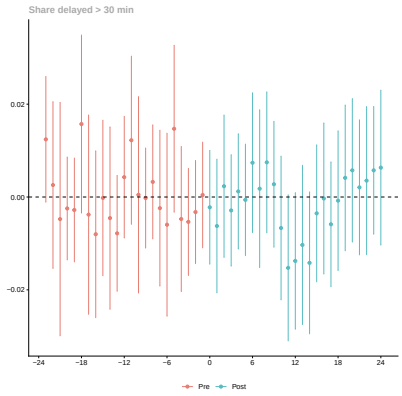
Notes: Stacked event-study estimates based on Wing et al. (2024). For each privatization cohort, treated airports are compared to airports that are never privatized or not yet privatized over the same event window. Cohort-specific airport and time fixed effects are included. No flight-count weighting. Red coefficients are periods before treatment. Blue coefficients are periods after treatment.

B.2 Route-level Callaway and Sant'Anna (2021) pre-trends

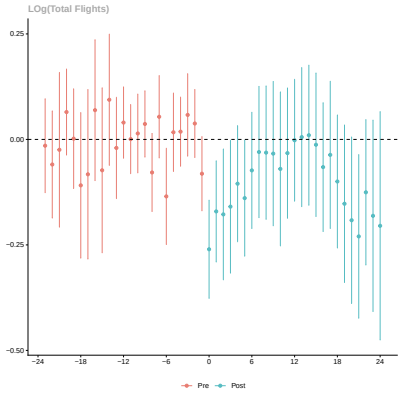
The above figures address the airport selection concern. The following event studies use the route-level sample, which matches the level of the main regressions. Pre-treatment coefficients show no evidence of differential trends. Post-treatment estimates should be interpreted cautiously: the 24-month window does not allow routes to reach later privatization phases, and extending the window would produce noisier estimates. These figures are included as pre-trend diagnostics only.



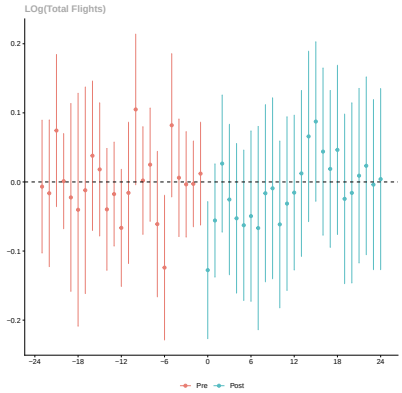
(a) Share Delayed 30+ min, Either Endpoint Signed



(b) Share Delayed 30+ min, Both Endpoints Signed



(c) Log Total Flights, Either Endpoint Signed



(d) Log Total Flights, Both Endpoints Signed

Figure 10: Route-Level Pre-Trend Estimates: 24-Month Window.

Notes: Event-study estimates using the Callaway and Sant'Anna (2021) estimator. Treatment is defined at the route level based on the signing status of the two endpoint airports. Left column uses first signing at either endpoint airport as the treatment date. Right column uses signing at both endpoint airports. Red coefficients are periods before treatment. Blue coefficients are periods after treatment.

B.2.1 Longer Event Window

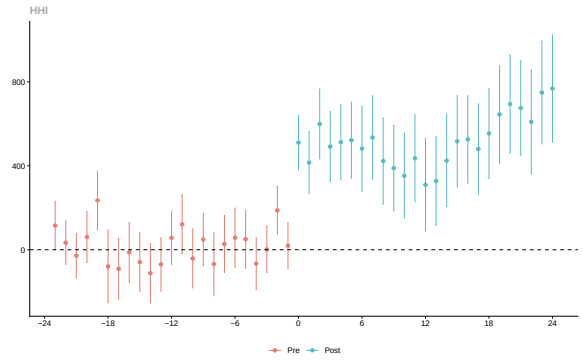
As a robustness check on the window length, the online appendix reports route-level event studies over longer horizons. No clear pre-treatment trends are observed.

Route-level event studies use the date at which both endpoint airports have signed contracts as the treatment date, which allows for a cleaner pre-period by avoiding partial exposure contaminating the pre-treatment window.

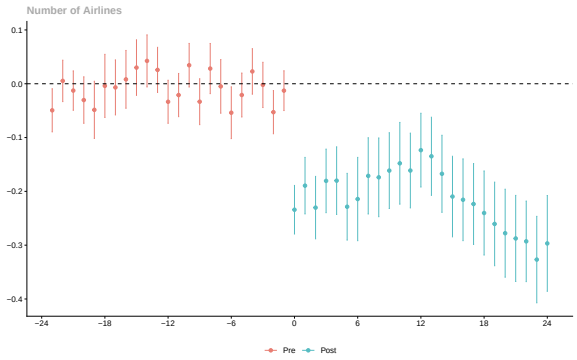
B.3 Market-Level Callaway and Sant'Anna (2021) pre-trends

In this specification, treatment is defined as markets in which either the origin or the destination airport is privatized.

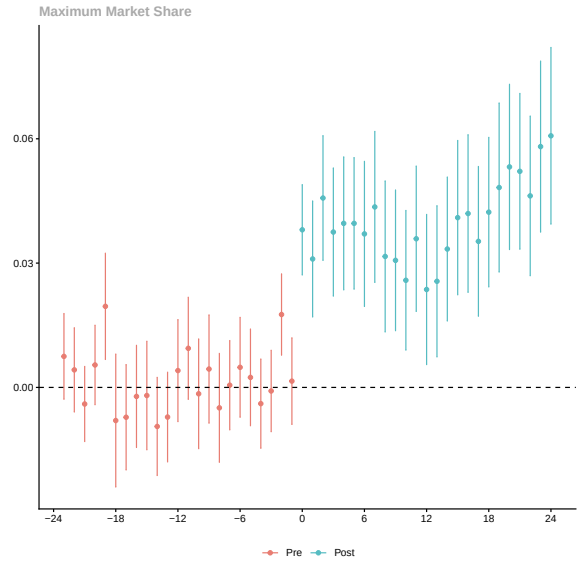
Figure 11 reports market-level event-study estimates for the market outcomes examined in the paper: the Herfindahl–Hirschman index, the number of firms serving the market, the maximum market share, and the average fare. The coefficients before privatization are the object of interest.



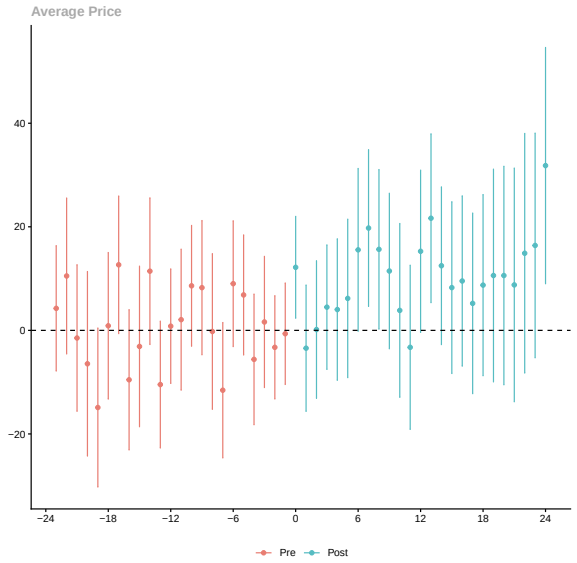
(a) HHI



(b) Number of Firms



(c) Maximum Market Share



(d) Average Fare

Figure 11: Market-Level Pre-Trend Estimates: 24-Month Window.

Notes: Event-study estimates using the Callaway and Sant'Anna (2021) estimator, with outcomes measured at the market level, where a market is a directional origin–destination pair. Treatment is defined as markets in which either the origin or the destination airport is privatized. For each cohort of markets treated in a given period, outcomes are compared to markets that are either never treated or not yet treated at that point in time. The window covers 24 months before and after treatment. Red coefficients are periods before treatment. Blue coefficients are periods after treatment.

C Delays

This appendix reports additional plots and tables for the delay results. The figures report the estimated effects across delay thresholds and across delay intervals, and the table reports the estimates for each interval. Subsection C.1 reports the tables for the analysis of the reported causes of delays, and Subsection C.2 presents the robustness exercises.

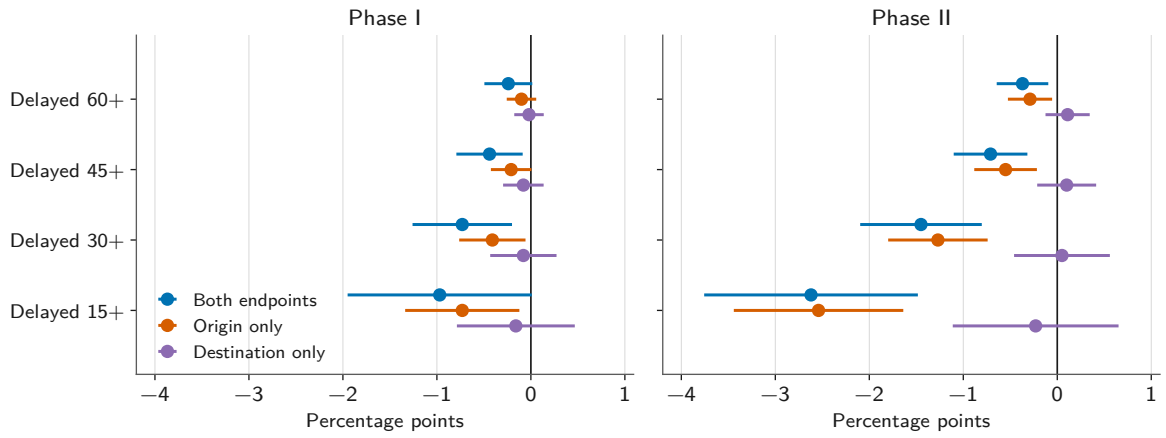


Figure 12: Effect of Privatization on the Share of Flights Delayed Above Each Threshold

Notes: Route–airline–month observations. Each point is the estimated effect of privatization on the share of flights delayed beyond the threshold indicated on the vertical axis, in percentage points, from equation (1). The left panel reports Phase I and the right panel Phase II. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. Colours distinguish routes with both endpoints privatized, the origin airport only and the destination airport only; the omitted category is routes with two public endpoints. Horizontal bars are 95 percent confidence intervals, constructed from standard errors clustered by route. The underlying estimates are reported in Table 3.

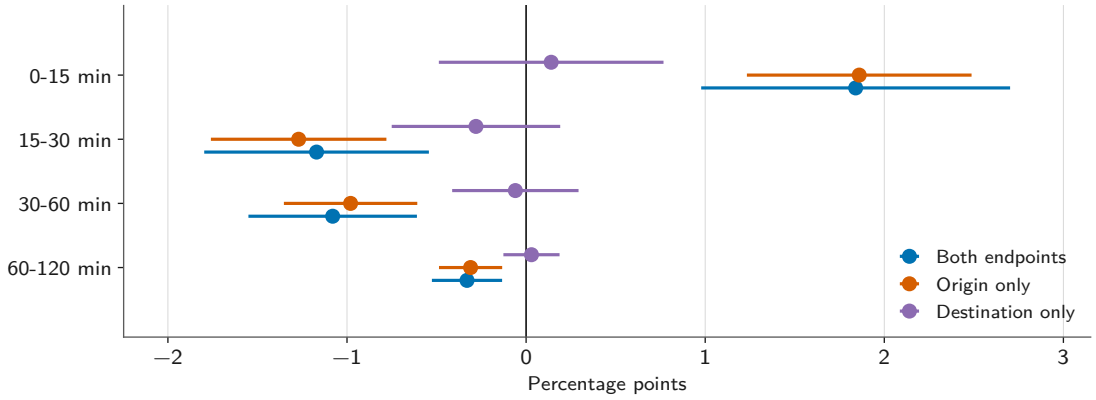


Figure 13: Effect of Privatization on the Share of Flights in Each Delay Interval, Phase II

Notes: Route–airline–month observations. Each point is the estimated effect of privatization on the share of flights whose delay falls in the interval indicated on the vertical axis, in percentage points, from equation (1). Only Phase II coefficients are shown, where Phase II is the period after the deadline for the mandated investments. Colours distinguish routes with both endpoints privatized, the origin airport only and the destination airport only; the omitted category is routes with two public endpoints. Horizontal bars are 95 percent confidence intervals, constructed from standard errors clustered by route. The underlying estimates are reported in Table 10.

Table 10: Effects of Airport Privatization on Delay Intervals

	0-15 min	15-30 min	30-60 min	60-120 min	120-180 min	180-240 min	240-300 min	300+ min
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Fully Privatized (Phase I)	0.0099**	-0.0024	-0.0048**	-0.0022**	-0.0006	0.0008***	-0.0002*	-0.0002
	(0.0043)	(0.0027)	(0.0019)	(0.0009)	(0.0004)	(0.0003)	(0.0001)	(0.0002)
Destination Only Privatized (Phase I)	0.0041*	-0.0008	-0.0006	0.0001	-6.35×10^{-5}	-3.35×10^{-5}	-9.13×10^{-5}	-0.0002
	(0.0022)	(0.0017)	(0.0013)	(0.0006)	(0.0002)	(0.0001)	(8.3×10^{-5})	(0.0001)
Origin Only Privatized (Phase I)	0.0017	-0.0032**	-0.0031**	-0.0007	-0.0003	2.3×10^{-5}	-5.15×10^{-5}	2.98×10^{-5}
	(0.0022)	(0.0016)	(0.0012)	(0.0006)	(0.0002)	(0.0001)	(7.08×10^{-5})	(0.0001)
Fully Privatized (Phase II)	0.0184***	-0.0117***	-0.0108***	-0.0033***	-0.0001	0.0003	-0.0003*	-0.0003
	(0.0044)	(0.0032)	(0.0024)	(0.0010)	(0.0005)	(0.0003)	(0.0002)	(0.0002)
Destination Only Privatized (Phase II)	0.0014	-0.0028	-0.0006	0.0003	0.0005	0.0004**	-0.0001	-4.16×10^{-5}
	(0.0032)	(0.0024)	(0.0018)	(0.0008)	(0.0004)	(0.0002)	(0.0001)	(0.0001)
Origin Only Privatized (Phase II)	0.0186***	-0.0127***	-0.0098***	-0.0031***	-8.15×10^{-5}	0.0002	-4.28×10^{-6}	0.0001
	(0.0032)	(0.0025)	(0.0019)	(0.0009)	(0.0004)	(0.0002)	(0.0001)	(0.0002)
Fixed-effects								
Route	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics								
Observations	209,456	209,456	209,456	209,456	209,456	209,456	209,456	209,456
R^2	0.47223	0.18279	0.16198	0.13919	0.07490	0.05716	0.05083	0.06976
Within R^2	0.00218	0.00093	0.00102	0.00030	5.74×10^{-5}	0.00012	3.16×10^{-5}	4.27×10^{-5}

Clustered (Route) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Route–airline–month observations. The outcome in each column is the share of flights whose delay falls in the indicated interval. The specification is equation (1). Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is routes with two public endpoints. Route, month–year and airline fixed effects. Standard errors clustered by route in parentheses. */**/***: 10/5/1%.

C.1 Reported Causes of Delays

C.1.1 Tables underlying the causes figures

Table 11: Composition of delays by reported cause and delay length

	Delay interval (minutes)			
Reported cause	15–30	30–60	60–120	120+
Airport operator	30.3	25.5	15.9	8.3
Airport closed (interdiction)	23.5	19.8	11.2	5.5
Airline	16.1	25.5	36.0	37.3
Air navigation / ATC	12.2	6.2	3.9	4.3
Other	9.2	7.7	6.7	7.2
Weather	8.0	14.8	26.0	37.0
Not reported	0.7	0.5	0.3	0.4

Note: Each column corresponds to a delay-length interval and reports the share of delayed flights in that interval attributed to each reported cause, so each column sums to 100%. Delay causes are airline-reported and cover the pre-2020 period.

Table 11 reports, within each delay-length interval, the share of delayed flights attributed to each reported cause. Among flights delayed 15 to 30 minutes, airport-related reasons are the largest group: airport-operator causes account for 30% and temporary airport closures for a further 24%, followed by air navigation and ATC clearances at 12%. Airline-related causes account for 16% and weather for only 8%. The composition reverses for longer delays. Among flights delayed more than 120 minutes, weather and airline-related causes each account for 37%, while airport-operator causes fall to 8%.

Table 12: Effect of airport privatization on delay shares by reported cause

Dependent Variables:	Airport operator	Airport closed (interdiction)	Airline	Air navigation / ATC	Weather
Model:	(1)	(2)	(3)	(4)	(5)
Variables					
Fully Privatized (Phase I)	-0.0157***	-0.0081*	-0.0086***	-0.0017	0.0001
	(0.0043)	(0.0044)	(0.0025)	(0.0022)	(0.0013)
Destination Only Privatized (Phase I)	-0.0002	-0.0031	-0.0054***	8.16×10^{-5}	-0.0008
	(0.0019)	(0.0028)	(0.0013)	(0.0014)	(0.0008)
Origin Only Privatized (Phase I)	-0.0103***	-0.0023	-0.0037***	-0.0011	0.0011
	(0.0021)	(0.0025)	(0.0014)	(0.0014)	(0.0008)
Fully Privatized (Phase II)	-0.0303***	-0.0140**	-0.0103***	-0.0026	-0.0023
	(0.0053)	(0.0066)	(0.0030)	(0.0027)	(0.0014)
Destination Only Privatized (Phase II)	-0.0032	-0.0035	-0.0065***	0.0032	7.34×10^{-5}
	(0.0024)	(0.0037)	(0.0025)	(0.0021)	(0.0011)
Origin Only Privatized (Phase II)	-0.0268***	-0.0076**	-0.0029	-0.0012	-0.0003
	(0.0032)	(0.0036)	(0.0024)	(0.0023)	(0.0010)
Fixed-effects					
Route	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes
Airline	Yes	Yes	Yes	Yes	Yes
Fit statistics					
Observations	139,378	139,378	139,378	139,378	139,378
R^2	0.32925	0.30529	0.25511	0.22400	0.20386
Within R^2	0.00707	0.00070	0.00059	0.00027	0.00018

Clustered (Route) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Route–airline–month observations. The outcome in each column is the share of delayed flights attributed to the reported cause named in the column heading. The specification is equation (1). Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is routes with two public endpoints. Route, month–year and airline fixed effects. Standard errors clustered by route in parentheses. $^{*}/^{**}/^{***}$: 10/5/1%.

Table 12 shows that privatization reduces the share of delays attributed to airport-operator causes, in column 1. This reduction is strongest in Phase II, after the mandatory investments are in place, consistent with improvements that operate through the infrastructure and managerial channels. In that phase the airport-operator share falls by 3.03 percentage points for fully privatized routes and by 2.68 points for origin-privatized routes, both statistically significant, while the effect for destination-only routes is near zero and insignificant. This is the same pattern found in the main delays results in Tables 3 and 10.

Temporary airport closures, in column 2, decline modestly, by 1.40 percentage points for fully privatized routes in Phase II, which is consistent with an airport channel where the private operator may be better able to manage such disruptions. This may reflect both its financial incentive to maintain reliable operation, on which its traffic and revenue depend, and its control over staffing, equipment, and operational procedures. This pattern holds when airport closures are grouped together with airport-operator causes, as a robustness check on the airport category definition.

Airline-related causes, in column 3, also decline, but by substantially less than airport-operator causes. For fully privatized routes in Phase II the reduction is 1.03 points, compared with 3.03 points for airport-operator causes. This smaller decline is consistent with airline operations being shaped by airport operations. A better-run airport may, for example, speed aircraft turnaround and reduce the consequent delays from a late-arriving aircraft that are attributed to the airline.

Columns 4 and 5, which cover ATC and weather, serve as placebo tests. Weather disruptions are outside the airport operator's control, and ATC remains the responsibility of the public authority. Their effects are small throughout, and none is statistically significant in Phase II.

C.1.2 Over-representation of reported causes

Table 13 compares each cause's frequency at a given delay length to its frequency across all delays. The comparison addresses the possibility that the composition within an interval reflects some causes being more common overall rather than being concentrated at particular delay lengths.

Table 13: Over-Representation of Reported Causes by Delay Duration

	Delay interval (minutes)			
Reported cause	15–30	30–60	60–120	120+
Air navigation / ATC	1.40	0.71	0.45	0.49
Airport closed (interdiction)	1.19	1.00	0.57	0.28
Airport operator	1.18	0.99	0.62	0.32
Not reported	1.18	0.94	0.56	0.80
Other	1.11	0.93	0.81	0.86
Airline	0.70	1.12	1.58	1.63
Weather	0.57	1.06	1.86	2.64

Note: Each cell reports a cause's share of delays within an interval divided by its share across all delays. Values above one indicate over-representation at that delay length; values below one indicate under-representation.

C.1.3 Mapping of reported reasons to categories

Table 14: Mapping of reported reasons to categories

Category	Reported Causes
Airport operator	Airport under operational restrictions; Airport facilities, support-service restrictions; Ground equipment and passenger-service failure; Security, passenger, cargo, alarm.
Airport closed (interdiction)	Aircraft connection, inbound leg not penalized: airport closed; Destination airport closed; Origin airport closed; Due to origin airport closed; Due to destination airport closed; Cancellation, inbound leg cancelled: airport closed; Flight over four hours late: airport closed.
Air navigation / ATC	Air traffic control clearance or schedule change; Flight-plan approval.
Weather	Aircraft connection, inbound leg not penalized: weather; Origin airport below weather minima; Destination airport below weather minima; Aircraft connection, inbound leg not penalized: weather, code 12 A2-1; Alternate airport below weather minima; Delay due to return: weather; Removal of ice, water, mud, sand at airport; Delay at alternate airport: weather; De-icing and snow or mud removal on aircraft; Cancellation: destination below weather minima; Cancellation: origin below weather minima; Cancellation, inbound leg cancelled: weather.
Airline	Aircraft connection, late inbound aircraft; Aircraft defects; Aircraft swap; Fuelling or defuelling; Malfunction during in-flight operations; Delay at alternate airport: technical; Malfunction during ground operations; Cancellation for technical-operational reasons; Delay due to return: technical; Flight over four hours late: aircraft breakdown.
Other	Unspecified delays, other; Unspecified delays, other; Authorized schedule advancement; Authorized; Immigration, customs, health; Authorized; Special return flight to origin airport; Authorized schedule advancement, international flights; Added leg at alternate airport for a special return flight; Added leg due to cancelled scheduled stops, supplementary routes.

Delay causes have been translated from the original Portuguese.

Note: This table lists each reported delay reason and the category to which it is assigned. Causes have been translated from the original Portuguese. Some reported reasons share the same translated description but correspond to distinct codes in the original system.

C.1.4 Closures grouped into airport-operator causes

Table 15: Robustness: Effect of airport privatization on delay shares by reported cause (Closures grouped into airport-operator causes)

Dependent Variables:	Airport (operator only)	Airport (incl. closures)
Model:	(1)	(2)
Variables		
Fully Privatized (Phase I)	-0.0157***	-0.0238***
	(0.0043)	(0.0066)
Destination Only Privatized (Phase I)	-0.0002	-0.0033
	(0.0019)	(0.0036)
Origin Only Privatized (Phase I)	-0.0103***	-0.0125***
	(0.0021)	(0.0032)
Fully Privatized (Phase II)	-0.0303***	-0.0443***
	(0.0053)	(0.0083)
Destination Only Privatized (Phase II)	-0.0032	-0.0067
	(0.0024)	(0.0045)
Origin Only Privatized (Phase II)	-0.0268***	-0.0344***
	(0.0032)	(0.0051)
Fixed-effects		
Route	Yes	Yes
Month-Year	Yes	Yes
Airline	Yes	Yes
Fit statistics		
Observations	139,378	139,378
R^2	0.32925	0.34686
Within R^2	0.00707	0.00594

Clustered (Route) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Note: This table re-estimates the main decomposition with temporary airport closures grouped into the airport-operator category, to check that the result does not depend on how the closure category is defined.

C.2 Robustness

This appendix reports the tables for the robustness exercises described in Section 4.1.2. Each subsection covers one exercise. Staggered timing re-estimates the main specification with a stacked design, so that treated routes are compared to routes that are not yet treated. COVID re-estimates the baseline specification excluding observations from 2020 onward. Frequency heterogeneity estimates the effects separately for routes grouped by the number of flights they operate. Alternative fixed effects re-estimates the main regressions with structures that absorb more variation, including airline-by-month fixed effects.

The COVID, frequency heterogeneity and alternative fixed effects tables report the four contractual phases

rather than the two used in the main text. Reporting the four phases is also a check on the phase definition, since the period before the deadline is split into three rather than pooled. Phase I in the main text pools the signature, transition and management phases, and Phase II corresponds to the period after the mandatory investments.

C.2.1 Stacked DiD

Within this stacked sample, I estimate equation (1). Table 16 reports the Phase II coefficients alongside the baseline estimates. The online appendix reports all contract phases.

Table 16: Robustness: Stacked DiD, Phase II Coefficients

	Delayed 15+	Delayed 30+	Delayed 45+	Delayed 60+	Delayed 120+	Median delay	Mean delay	Cancellation
Panel A: Baseline (TWFE)								
Fully Privatized (II After Mandatory Investments)	-0.0252***	-0.0138***	-0.0067***	-0.0035**	-0.0003	0.2559	-0.7204	-0.0060
	(0.0059)	(0.0034)	(0.0020)	(0.0014)	(0.0008)	(0.4521)	(0.5246)	(0.0038)
Destination Only Privatized (II After Mandatory Investments)	-0.0021	0.0007	0.0010	0.0011	0.0008	-0.1044	-0.0638	-0.0085***
	(0.0045)	(0.0026)	(0.0016)	(0.0012)	(0.0006)	(0.3828)	(0.4157)	(0.0026)
Origin Only Privatized (II After Mandatory Investments)	-0.0252***	-0.0125***	-0.0053***	-0.0028**	0.0003	0.6609*	0.1236	-0.0089***
	(0.0047)	(0.0027)	(0.0017)	(0.0012)	(0.0006)	(0.3744)	(0.4050)	(0.0026)
Route Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	209,456	209,456	209,456	209,456	209,456	205,443	205,443	209,456
Routes (clusters)	2,217	2,217	2,217	2,217	2,217	2,217	2,217	2,217
Panel B: Stacked, clean controls								
Fully Privatized (II After Mandatory Investments)	-0.0310***	-0.0160***	-0.0085***	-0.0037	-0.0005	-0.1448	-1.1213	-0.0226***
	(0.0079)	(0.0044)	(0.0031)	(0.0025)	(0.0014)	(0.7921)	(0.8012)	(0.0057)
Destination Only Privatized (II After Mandatory Investments)	0.0017	0.0019	0.0009	0.0009	0.0000	-0.7699	-0.6928	-0.0165***
	(0.0056)	(0.0031)	(0.0020)	(0.0015)	(0.0008)	(0.5114)	(0.5443)	(0.0032)
Origin Only Privatized (II After Mandatory Investments)	-0.0272***	-0.0140***	-0.0069***	-0.0037**	-0.0006	0.1747	-0.5458	-0.0151***
	(0.0059)	(0.0032)	(0.0021)	(0.0015)	(0.0008)	(0.5149)	(0.5330)	(0.0033)
Route × cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year × cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Routes (clusters)	2,217	2,217	2,217	2,217	2,217	2,217	2,217	2,217
Cohorts	126	126	126	126	126	126	126	126
Stacked obs.	3,038,871	3,038,871	3,038,871	3,038,871	3,038,871	2,959,752	2,959,752	3,038,871

Notes: Route–airline–month observations. Columns 1 to 5 report the share of flights delayed beyond the indicated threshold, columns 6 and 7 report median and mean delay in minutes, and column 8 reports the cancellation rate. Panel A reports the baseline estimates of equation (1) and Panel B the stacked estimates. A cohort is defined by the first month in which either endpoint of a route is privatized, and each cohort's comparison group is restricted to routes that are never or not-yet privatized. Panel A includes route, month–year and airline fixed effects; Panel B includes route-by-cohort, month–year-by-cohort and airline fixed effects. Only Phase II coefficients are reported, where Phase II is the period after the deadline for the mandated investments. The omitted category is routes with two public endpoints. Standard errors clustered by route in parentheses. */**/***: 10/5/1%.

Fully privatized routes and origin-only routes continue to show negative and statistically significant effects on the share of flights delayed more than 15, 30, and 45 minutes. For delays above 60 minutes, the estimates remain negative, but the evidence is weaker for fully privatized routes and stronger for origin-only routes. Destination-only routes continue to show little evidence of reductions in delay-threshold outcomes.

The stacked estimates are close to the baseline estimates and, in some cases, slightly larger in magnitude. For example, the effect on delays above 30 minutes for fully privatized routes changes from about -1.4 percentage points in the baseline specification to about -1.6 percentage points in the stacked specification. Mean and median delay remain less systematic. The cancellation results should be interpreted cautiously and are discussed in Section 4.1.3.

C.2.2 COVID

Table 17 reports the baseline estimates with observations from 2020 onward excluded.

Table 17: Robustness: Pre-COVID Sample

Model:	Delayed 15+ (1)	Delayed 30+ (2)	Delayed 45+ (3)	Delayed 60+ (4)	Delayed 120+ (5)	Median Delay (6)	Mean Delay (7)	Cancellation (8)
Variables								
Fully Privatized (Signed Only)	-0.0140	-0.0084	-0.0096	-0.0029	-0.0021	0.3528	-1.257	0.0068
	(0.0170)	(0.0090)	(0.0061)	(0.0042)	(0.0019)	(1.624)	(1.934)	(0.0192)
Destination Only Privatized (Signed Only)	-0.0162**	-0.0079*	-0.0014	-0.0011	-0.0012	-0.6024	-0.8511	0.0183***
	(0.0071)	(0.0048)	(0.0036)	(0.0026)	(0.0012)	(0.5549)	(0.7069)	(0.0067)
Origin Only Privatized (Signed Only)	-0.0140**	-0.0081*	-0.0029	-0.0003	-7.72×10^{-5}	0.1427	0.4081	0.0187***
	(0.0067)	(0.0046)	(0.0032)	(0.0025)	(0.0014)	(0.7178)	(0.8235)	(0.0066)
Fully Privatized (I-A Transition Phase)	-0.0141	-0.0115	-0.0049	-0.0033	0.0009	0.6246	0.3487	0.0002
	(0.0134)	(0.0077)	(0.0056)	(0.0037)	(0.0014)	(1.004)	(1.255)	(0.0112)
Destination Only Privatized (I-A Transition Phase)	-0.0188***	-0.0112***	-0.0066***	-0.0039***	-0.0014***	-0.4283	-1.480***	0.0003
	(0.0051)	(0.0028)	(0.0017)	(0.0011)	(0.0005)	(0.3062)	(0.3714)	(0.0036)
Origin Only Privatized (I-A Transition Phase)	-0.0298***	-0.0196***	-0.0119***	-0.0072***	-0.0022***	-1.263***	-2.153***	-0.0011
	(0.0053)	(0.0030)	(0.0018)	(0.0012)	(0.0005)	(0.3306)	(0.3697)	(0.0036)
Fully Privatized (I-B Management Phase)	-0.0353***	-0.0170***	-0.0095**	-0.0047*	-0.0011	-0.2306	-1.396*	0.0141
	(0.0123)	(0.0065)	(0.0039)	(0.0025)	(0.0009)	(0.6641)	(0.7952)	(0.0096)
Destination Only Privatized (I-B Management Phase)	-0.0031	-0.0021	-0.0017	-0.0009	-0.0005	-0.5410	-0.8572**	-0.0022
	(0.0055)	(0.0030)	(0.0018)	(0.0011)	(0.0004)	(0.3519)	(0.4184)	(0.0032)
Origin Only Privatized (I-B Management Phase)	-0.0120**	-0.0076**	-0.0038**	-0.0021*	-0.0007	-0.7651**	-0.8230**	-0.0032
	(0.0052)	(0.0030)	(0.0018)	(0.0013)	(0.0005)	(0.3303)	(0.3750)	(0.0032)
Fully Privatized (II After Mandatory Investments)	-0.0510***	-0.0224***	-0.0101***	-0.0046**	-0.0005	0.0663	-1.810***	-0.0107
	(0.0092)	(0.0052)	(0.0029)	(0.0020)	(0.0010)	(0.6112)	(0.6738)	(0.0069)
Destination Only Privatized (II After Mandatory Investments)	-0.0056	-0.0012	0.0002	0.0004	0.0003	-0.8457	-0.7721	-0.0092***
	(0.0063)	(0.0036)	(0.0022)	(0.0015)	(0.0007)	(0.5214)	(0.5355)	(0.0034)
Origin Only Privatized (II After Mandatory Investments)	-0.0377***	-0.0194***	-0.0088***	-0.0046***	-0.0006	0.3481	-0.6781	-0.0087**
	(0.0068)	(0.0037)	(0.0021)	(0.0014)	(0.0006)	(0.5166)	(0.5315)	(0.0035)
Fixed-effects								
Route	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics								
Observations	142,912	142,912	142,912	142,912	142,912	139,284	139,284	142,912
R^2	0.26162	0.24043	0.21949	0.20792	0.13338	0.27344	0.31140	0.19313
Within R^2	0.00336	0.00220	0.00115	0.00062	0.00022	0.00067	0.00074	0.00059

Clustered (Route) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Route–airline–month observations. Columns 1 to 5 report the share of flights delayed beyond the indicated threshold, columns 6 and 7 report median and mean delay in minutes, and column 8 reports the cancellation rate. The specification is equation (1), estimated excluding observations from 2020 onward. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is routes with two public endpoints. Route, month–year and airline fixed effects. Standard errors clustered by route in parentheses. */**/***: 10/5/1%.

C.2.3 Flight Frequency Heterogeneity

The delay reductions are not driven by low-frequency routes. In fact, the estimates are weaker and less consistent for low-frequency routes, where delay shares may be noisier because fewer flights are operated. The pattern is clearest for medium-frequency routes, where fully privatized and origin-only routes show significant reductions in delay-threshold outcomes in Phase II. High-frequency routes also show negative effects, especially for fully privatized routes, although the pattern is less uniform across thresholds. Across the frequency groups, destination-only routes continue to show little evidence of delay reductions. Overall, this exercise suggests that the main results are concentrated in routes with more frequent service and are not an artifact of small or irregular route markets. The results are present across both medium and high frequency routes, suggesting they are not driven by the dynamics of large hub routes specifically.

Table 18 reports the estimates for the share of flights delayed more than 30 minutes, separately for each frequency

group. The full tables for each group, with all outcomes, are reported in the online appendix.

Table 18: Flight Frequency Heterogeneity: Share of Flights Delayed More Than 30 Minutes

	Signed only	I-A Transition	I-B Management	II After investments
	(1)	(2)	(3)	(4)
Panel A. Low frequency routes (up to 30 flights per month)				
Fully privatized	0.0174	0.0289*	-0.0025	-0.0113
	(0.0207)	(0.0151)	(0.0057)	(0.0072)
Origin only	0.0058	-0.0089	0.0006	-0.0114*
	(0.0088)	(0.0064)	(0.0043)	(0.0064)
Destination only	-0.0048	-0.0012	0.0067	-0.0034
	(0.0090)	(0.0065)	(0.0045)	(0.0063)
Observations	61,851			
Panel B. Medium frequency routes (31 to 90 flights per month)				
Fully privatized	-0.0028	-0.0129***	-0.0071*	-0.0125***
	(0.0066)	(0.0050)	(0.0038)	(0.0048)
Origin only	-0.0037	-0.0126***	-0.0017	-0.0134***
	(0.0042)	(0.0031)	(0.0025)	(0.0035)
Destination only	0.0007	-0.0060**	0.0018	0.0035
	(0.0055)	(0.0028)	(0.0025)	(0.0036)
Observations	112,654			
Panel C. High frequency routes (more than 90 flights per month)				
Fully privatized	0.0107	-0.0002	-0.0011	-0.0157**
	(0.0150)	(0.0118)	(0.0073)	(0.0061)
Origin only	-0.0015	-0.0086**	-0.0005	-0.0089*
	(0.0053)	(0.0042)	(0.0035)	(0.0045)
Destination only	-0.0011	-0.0049	-0.0035	-0.0009
	(0.0048)	(0.0035)	(0.0033)	(0.0048)
Observations	34,951			

Clustered (route) standard errors in parentheses

*Signif. codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Route–airline–month observations. The outcome is the share of flights delayed more than 30 minutes. Each panel re-estimates the baseline specification on routes grouped by their average monthly flights in pre-treatment public months. Columns report the four contractual phases. Rows report the privatization status of the route's endpoints. Route, month–year and airline fixed effects. Standard errors clustered by route in parentheses.

C.2.4 Alternative Fixed Effects

For each of the main delay outcomes, column 1 reports the main specification, column 2 adds airline-by-month fixed effects, column 3 adds airline-by-route fixed effects, and column 4 includes both sets of fixed effects. I show a selection of outcomes here; the pattern is similar across the others. The remaining outcomes are reported in the

online appendix.

Table 19: Alternative Fixed Effects: Flights Delayed at Least 30 Minutes

Model:	Baseline (1)	Route + Airline x Month (2)	Airline x Route + Month (3)	Airline x Route + Airline x Month (4)
Variables				
Fully Privatized (Signed Only)	0.0033	9.42×10^{-5}	-0.0029	-0.0052
	(0.0066)	(0.0068)	(0.0082)	(0.0081)
Destination Only Privatized (Signed Only)	-0.0015	-0.0015	-0.0048	-0.0039
	(0.0038)	(0.0037)	(0.0036)	(0.0036)
Origin Only Privatized (Signed Only)	-0.0017	-0.0020	-0.0022	-0.0016
	(0.0033)	(0.0031)	(0.0031)	(0.0030)
Fully Privatized (I-A Transition Phase)	-0.0055	-0.0054	-0.0141**	-0.0121**
	(0.0050)	(0.0049)	(0.0059)	(0.0059)
Destination Only Privatized (I-A Transition Phase)	-0.0065***	-0.0042*	-0.0082***	-0.0056***
	(0.0023)	(0.0022)	(0.0023)	(0.0022)
Origin Only Privatized (I-A Transition Phase)	-0.0127***	-0.0103***	-0.0137***	-0.0109***
	(0.0024)	(0.0023)	(0.0023)	(0.0022)
Fully Privatized (I-B Management Phase)	-0.0077***	-0.0024	-0.0079***	-0.0021
	(0.0030)	(0.0028)	(0.0030)	(0.0028)
Destination Only Privatized (I-B Management Phase)	0.0009	0.0019	0.0002	0.0017
	(0.0019)	(0.0018)	(0.0019)	(0.0017)
Origin Only Privatized (I-B Management Phase)	-0.0019	-0.0010	-0.0026	-0.0010
	(0.0019)	(0.0018)	(0.0019)	(0.0018)
Fully Privatized (II After Mandatory Investments)	-0.0138***	-0.0090***	-0.0121***	-0.0075**
	(0.0034)	(0.0033)	(0.0034)	(0.0033)
Destination Only Privatized (II After Mandatory Investments)	0.0007	0.0015	0.0007	0.0013
	(0.0026)	(0.0026)	(0.0027)	(0.0026)
Origin Only Privatized (II After Mandatory Investments)	-0.0124***	-0.0117***	-0.0106***	-0.0098***
	(0.0027)	(0.0026)	(0.0026)	(0.0025)
Fixed-effects				
Route	Yes	Yes		
Airline	Yes			
Month-Year	Yes		Yes	
Airline x Month		Yes		Yes
Airline x Route			Yes	Yes
Fit statistics				
Observations	209,456	209,456	209,456	209,456
R^2	0.21727	0.30633	0.29230	0.37703
Within R^2	0.00128	0.00108	0.00110	0.00090

Clustered (Route) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Route–airline–month observations. The outcome is the share of flights delayed at least 30 minutes. Column 1 reports the baseline specification, equation (1), with route, airline and month–year fixed effects. Column 2 uses route and airline-by-month fixed effects, column 3 airline-by-route and month–year fixed effects, and column 4 airline-by-route and airline-by-month fixed effects. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is routes with two public endpoints. Standard errors clustered by route in parentheses. */**/***: 10/5/1%.

D Flights Operated

This section reports the flights regression tables discussed in Section 4.2. Table 20 reports the results for the route-level sample, in levels and in logarithms, for the full sample and by route size. Routes are split into terciles by their average number of flights before privatization, so that the grouping is chosen ahead of treatment. I refer to these terciles as small, medium, and large routes.

Table 20: Flights, route-level sample

Sample	Full		Low		Medium		High	
Outcome	Log	Total	Log	Total	Log	Total	Log	Total
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Fully Privatized (Phase I)	0.0617	8.517***	-0.1387	-3.395**	0.0293	-1.280	0.2448***	29.22***
	(0.0438)	(2.580)	(0.0992)	(1.672)	(0.0590)	(2.372)	(0.0639)	(8.601)
Destination Only Privatized (Phase I)	0.0237	4.225***	-0.1181***	-1.862**	0.0416	1.662	0.1279***	21.23***
	(0.0205)	(1.264)	(0.0454)	(0.7933)	(0.0266)	(1.314)	(0.0403)	(4.941)
Origin Only Privatized (Phase I)	0.0285	4.576***	-0.1143**	-1.805**	0.0264	0.9315	0.1829***	23.34***
	(0.0204)	(1.262)	(0.0447)	(0.7932)	(0.0259)	(1.301)	(0.0408)	(4.681)
Fully Privatized (Phase II)	0.1668***	6.711	0.0455	0.1972	0.1297**	0.2350	0.1889	44.18***
	(0.0545)	(4.122)	(0.1185)	(2.126)	(0.0650)	(3.473)	(0.1282)	(14.80)
Destination Only Privatized (Phase II)	0.0880**	4.092*	-0.0811	-2.317	0.0925*	1.170	0.1150	26.06***
	(0.0388)	(2.100)	(0.0842)	(1.410)	(0.0480)	(2.252)	(0.0982)	(9.557)
Origin Only Privatized (Phase II)	0.1091***	4.835**	-0.0669	-2.127	0.0999**	1.166	0.1491	27.04***
	(0.0381)	(2.121)	(0.0814)	(1.379)	(0.0462)	(2.250)	(0.1028)	(9.363)
Fixed-effects								
Route	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics								
Observations	209,456	209,456	61,851	61,851	112,654	112,654	34,951	34,951
R^2	0.61872	0.68269	0.52797	0.48047	0.25475	0.36490	0.36979	0.58897
Within R^2	0.00113	0.00171	0.00389	0.00615	0.00104	0.00058	0.00592	0.01110

Clustered (Route) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Route–airline–month observations. The outcome is the number of flights operated on a route, in logarithms in the odd columns and in levels in the even columns. Columns 1 and 2 use the full sample, and the remaining columns the low, medium and high route- size terciles. Routes are split into terciles by their average number of flights before privatization, so the grouping is fixed ahead of treatment. The specification is equation (1). Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is routes with two public endpoints. Route, month–year and airline fixed effects. Standard errors clustered by route in parentheses. */**/***: 10/5/1%.

Table 21 reports the results for the airport-airline sample, where the outcome is the number of flights operated by a given airline at an airport, and its logarithm. Treatment is the airport's privatization phase relative to public operation. The specification includes airport, airline, and month-year fixed effects. Estimates are reported for the full sample and by size tercile.

Table 21: Flights, airport-airline sample

Sample	Full		Tercile 1		Tercile 2		Tercile 3	
Outcome	Log	Total	Log	Total	Log	Total	Log	Total
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Phase I (Signed, before Phase II)	0.1704***	41.90**	-0.1267	0.3402	0.2602***	12.58***	0.0624	34.41
	(0.0523)	(17.03)	(0.1521)	(2.874)	(0.0853)	(3.320)	(0.0451)	(23.17)
Phase II (After Mandatory Investments)	0.3774***	78.47*	0.0712	2.495	0.4691***	20.14***	0.0765	24.66
	(0.0890)	(47.32)	(0.2204)	(4.174)	(0.0988)	(4.064)	(0.0793)	(70.89)
Fixed-effects								
Airport (Origin)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics								
Observations	50,270	50,270	7,295	7,295	14,580	14,580	28,395	28,395
R^2	0.71886	0.50320	0.47821	0.47520	0.35185	0.34806	0.61640	0.50373
Within R^2	0.00751	0.00145	0.00199	0.00090	0.01875	0.02436	0.00058	0.00037

Clustered (Airport (Origin)) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Airport–airline–month observations. The outcome is the number of flights an airline operates at an airport, in logarithms in the odd columns and in levels in the even columns. Columns 1 and 2 use the full sample, and the remaining columns the airport-size terciles. Treatment is the privatization phase of the airport relative to public operation. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is public operation of the airport. Origin airport, month–year and airline fixed effects. Standard errors clustered by origin airport in parentheses. */**/***: 10/5/1%.

Table 22 reports the route-level results excluding the COVID period.

Table 22: Flights, route-level sample (excluding COVID period)

Sample	Full		Low		Medium		High	
Outcome	Log	Total	Log	Total	Log	Total	Log	Total
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables								
Fully Privatized (Phase I)	0.2863***	16.94***	-0.0940	2.281	0.3913***	6.380**	0.1934**	16.81
	(0.0569)	(5.923)	(0.2142)	(2.752)	(0.0635)	(2.468)	(0.0856)	(10.70)
Destination Only Privatized (Phase I)	0.0640**	3.308**	-0.1266*	-2.017*	0.0899***	2.416	0.0674	8.522*
	(0.0263)	(1.605)	(0.0679)	(1.155)	(0.0329)	(1.536)	(0.0476)	(4.682)
Origin Only Privatized (Phase I)	0.0630**	3.586**	-0.0725	-1.553	0.0472	1.226	0.1184**	10.42**
	(0.0262)	(1.583)	(0.0629)	(1.122)	(0.0323)	(1.495)	(0.0506)	(4.406)
Fully Privatized (Phase II)	0.2778***	5.194	-0.1916	5.217	0.2729***	-8.969***	0.0148	6.890
	(0.0829)	(9.257)	(0.6252)	(3.654)	(0.1015)	(3.088)	(0.1390)	(16.18)
Destination Only Privatized (Phase II)	0.0978**	1.123	-0.0712	-1.169	0.1114*	-0.5340	-0.0379	0.9010
	(0.0488)	(2.896)	(0.1284)	(1.991)	(0.0601)	(2.578)	(0.1128)	(10.69)
Origin Only Privatized (Phase II)	0.1362***	2.201	-0.0112	-0.6597	0.1245**	-0.4424	0.0189	2.513
	(0.0470)	(2.963)	(0.1182)	(1.886)	(0.0552)	(2.540)	(0.1164)	(10.52)
Fixed-effects								
Route	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics								
Observations	142,912	142,912	37,116	37,116	80,980	80,980	24,816	24,816
R^2	0.61891	0.69318	0.60087	0.56401	0.26741	0.41301	0.37075	0.60847
Within R^2	0.00254	0.00186	0.00148	0.00248	0.00322	0.00193	0.00247	0.00166

Clustered (Route) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Route–airline–month observations, excluding observations from 2020 onward. The outcome is the number of flights operated on a route, in logarithms in the odd columns and in levels in the even columns. Columns 1 and 2 use the full sample, and the remaining columns the low, medium and high route-size terciles. Routes are split into terciles by their average number of flights before privatization, so the grouping is fixed ahead of treatment. The specification is equation (1). Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is routes with two public endpoints. Route, month–year and airline fixed effects. Standard errors clustered by route in parentheses. */**/***: 10/5/1%.

Table 23 reports the results for the airport-level sample, where the outcome is the total number of flights operated at an airport, and its logarithm.

Table 23: Flights, airport-level sample

Model:	Log Total Flights (1)	Total Flights (2)
Variables		
Phase I (Signed, before Phase II)	0.0191	1.533
	(0.0527)	(61.61)
Phase II (After Mandatory Investments)	0.1158	-540.2***
	(0.0854)	(167.6)
Fixed-effects		
Airport (Origin)	Yes	Yes
Month-Year	Yes	Yes
Fit statistics		
Observations	21,796	21,796
R^2	0.93662	0.93490
Within R^2	0.00131	0.06080

Clustered (Airport (Origin)) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Airport–month observations. The outcome is the total number of flights operated at an airport, in logarithms in column 1 and in levels in column 2. Treatment is the privatization phase of the airport relative to public operation. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is public operation of the airport. Origin airport and month–year fixed effects. Standard errors clustered by origin airport in parentheses. */**/***: 10/5/1%.

E Market Outcomes

This section reports additional tables and robustness exercises for the market outcomes, market concentration and fares.

Table 24: Market Concentration: All Outcomes

Model:	Log(HHI) (1)	HHI (2)	HHI (Revenue) (3)	Log(HHI Revenue) (4)	CR2 (5)	Number of Airlines (6)	Maximum Market Share (7)
Variables							
Fully Privatized (Phase I)	0.0822***	489.4***	509.0***	0.0878***	0.0223***	-0.2832***	0.0401***
	(0.0068)	(43.77)	(44.39)	(0.0070)	(0.0019)	(0.0183)	(0.0037)
Destination Only Privatized (Phase I)	0.0324***	176.2***	183.2***	0.0350***	0.0102***	-0.1170***	0.0152***
	(0.0046)	(29.36)	(29.34)	(0.0046)	(0.0013)	(0.0121)	(0.0025)
Origin Only Privatized (Phase I)	0.0309***	165.7***	170.3***	0.0331***	0.0100***	-0.1101***	0.0142***
	(0.0046)	(29.37)	(29.34)	(0.0046)	(0.0013)	(0.0120)	(0.0025)
Fully Privatized (Phase II)	0.2217***	1,249.9***	1,263.1***	0.2289***	0.0657***	-0.7898***	0.1077***
	(0.0112)	(68.15)	(66.69)	(0.0112)	(0.0038)	(0.0334)	(0.0060)
Destination Only Privatized (Phase II)	0.0599***	348.2***	352.2***	0.0621***	0.0167***	-0.2326***	0.0287***
	(0.0072)	(46.21)	(46.15)	(0.0073)	(0.0019)	(0.0194)	(0.0039)
Origin Only Privatized (Phase II)	0.0592***	340.1***	346.2***	0.0617***	0.0169***	-0.2193***	0.0283***
	(0.0071)	(45.78)	(45.80)	(0.0072)	(0.0019)	(0.0192)	(0.0039)
Fixed-effects							
Route	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Observations	616,346	616,346	616,346	616,346	616,346	616,346	616,346
R^2	0.66212	0.67661	0.69503	0.68508	0.54815	0.74616	0.62104
Within R^2	0.00901	0.00714	0.00757	0.00994	0.01185	0.02187	0.00624

Notes: Market–month observations. The outcomes are log HHI, HHI, revenue-based HHI, log revenue-based HHI, CR2, the number of airlines and the maximum market share, in columns 1 to 7. An airline's market share is the number of seats it sold in a market–month divided by total seats sold in that market–month, HHI is the sum of squared percentage shares, and the revenue-based HHI replaces seat shares with revenue shares. Because concentration is defined at the market level, equation (1) is estimated on a market–month panel. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Market and month–year fixed effects. Standard errors clustered by market in parentheses. */**/***: 10/5/1%.

E.1 Market Concentration: Summary Statistics

Table 25 reports summary statistics at the market–month level for the number of airlines serving the market, the Herfindahl–Hirschman index, the same index computed from revenue, the two-firm concentration ratio, the maximum market share, total seats in the market, and the average fare.

Table 25: Summary Statistics: Market-Month Level

Variable	Mean	Standard Deviation	25th Percentile	Median	75th Percentile	Minimum	Maximum	Observations
Number of Airlines	2.137	0.999	1	2	3	1	7	616346
HHI	7204.508	2497.839	5000.889	7024.793	10000	1970.248	10000	616346
HHI (Revenue)	7118.788	2534.429	4903.849	6803.747	10000	1895.062	10000	616346
CR2	0.952	0.084	0.931	1	1	0.449	1	616346
Maximum Market Share	0.784	0.210	0.590	0.821	1	0.227	1	616346
Total Seats in Market	886.207	3171.288	28	86	406	11	115364	616346
Average Price	414.544	180.891	288.902	387.122	507.270	25.372	2347.169	616346

Notes: Market–month observations. The table reports the mean, standard deviation, 25th percentile, median, 75th percentile, minimum, maximum and number of observations for each variable.

E.2 Additional Airfare Tables

Table 27 reports the fare results with airline fixed effects, so the coefficients compare fares within a carrier, while Table 5 in the main text reports them without airline fixed effects. Table 28 reports the fare results at the market level, where an observation is a market in a month rather than an airline on a route in a month.

Table 26: Effect of Airport Privatization on Fares: All Outcomes (Airline–Route Level)

	Average Price	log(Average Price)	Median Price	log(Median Price)	log(P10 Percentile)	log(P90 Percentile)	Gini Coefficient (Price)
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
Fully Privatized (Phase I)	21.47***	0.0336***	22.88***	0.0383***	0.0199**	0.0396***	0.0019
	(3.411)	(0.0074)	(3.487)	(0.0083)	(0.0088)	(0.0071)	(0.0013)
Destination Only Privatized (Phase I)	2.280	0.0010	2.567	0.0010	-0.0070	0.0057	0.0019**
	(2.027)	(0.0048)	(2.025)	(0.0053)	(0.0055)	(0.0047)	(0.0008)
Origin Only Privatized (Phase I)	2.953	0.0017	3.561*	0.0032	-0.0050	0.0043	0.0013
	(2.038)	(0.0048)	(2.041)	(0.0053)	(0.0056)	(0.0047)	(0.0009)
Fully Privatized (Phase II)	25.58***	0.0703***	19.04***	0.0428***	-0.0207	0.1182***	0.0273***
	(4.829)	(0.0128)	(4.693)	(0.0136)	(0.0144)	(0.0131)	(0.0024)
Destination Only Privatized (Phase II)	15.65***	0.0225***	13.80***	0.0099	-0.0204**	0.0457***	0.0130***
	(3.182)	(0.0077)	(3.125)	(0.0083)	(0.0087)	(0.0078)	(0.0015)
Origin Only Privatized (Phase II)	16.21***	0.0238***	14.26***	0.0109	-0.0188**	0.0473***	0.0135***
	(3.242)	(0.0078)	(3.200)	(0.0085)	(0.0087)	(0.0080)	(0.0015)
Fixed-effects							
Market	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Observations	1,317,165	1,317,165	1,317,165	1,317,165	1,317,165	1,317,165	1,317,165
R^2	0.37197	0.47879	0.32801	0.45380	0.47230	0.38668	0.24018
Within R^2	0.00067	0.00059	0.00051	0.00027	0.00024	0.00132	0.00181

Clustered (Market) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 27: Effect of Airport Privatization on Fares — Within-Carrier (Airline FE)

Model:	Average Price (1)	log(Average Price) (2)	Median Price (3)	log(Median Price) (4)	log(P10 Percentile) (5)	log(P90 Percentile) (6)	Gini Coefficient (Price) (7)
Variables							
Fully Privatized (Phase I)	17.91***	0.0232***	19.43***	0.0277***	0.0107	0.0289***	0.0017
	(3.384)	(0.0073)	(3.458)	(0.0081)	(0.0086)	(0.0070)	(0.0012)
Destination Only Privatized (Phase I)	0.7688	-0.0031	1.133	-0.0027	-0.0099*	0.0011	0.0016*
	(1.999)	(0.0047)	(1.997)	(0.0052)	(0.0054)	(0.0046)	(0.0008)
Origin Only Privatized (Phase I)	1.382	-0.0025	2.052	-0.0007	-0.0081	-0.0003	0.0010
	(2.012)	(0.0047)	(2.016)	(0.0052)	(0.0054)	(0.0046)	(0.0008)
Fully Privatized (Phase II)	18.78***	0.0511***	13.12***	0.0273**	-0.0301**	0.0941***	0.0242***
	(4.760)	(0.0126)	(4.609)	(0.0133)	(0.0139)	(0.0130)	(0.0023)
Destination Only Privatized (Phase II)	13.75***	0.0173**	12.22***	0.0063	-0.0216**	0.0387***	0.0118***
	(3.162)	(0.0076)	(3.099)	(0.0083)	(0.0085)	(0.0077)	(0.0014)
Origin Only Privatized (Phase II)	14.25***	0.0187**	12.58***	0.0072	-0.0202**	0.0404***	0.0123***
	(3.222)	(0.0078)	(3.173)	(0.0084)	(0.0085)	(0.0079)	(0.0014)
Fixed-effects							
Market	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Airline	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Observations	1,317,165	1,317,165	1,317,165	1,317,165	1,317,165	1,317,165	1,317,165
R^2	0.38352	0.49843	0.33962	0.47378	0.49182	0.40824	0.26758
Within R^2	0.00054	0.00040	0.00041	0.00017	0.00021	0.00100	0.00153

Clustered (Market) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: As in Table 5 but adding airline fixed effects (within-carrier variation). Market, airline, and year–month FE; SE clustered by market. */**/***: 10/5/1%.

Table 28: Effect of Airport Privatization on Fares (Market Level)

Model:	Average Price (1)	log(Average Price) (2)
Variables		
Fully Privatized (Phase I)	21.64***	0.0389***
	(3.529)	(0.0080)
Destination Only Privatized (Phase I)	1.201	-0.0005
	(1.979)	(0.0049)
Origin Only Privatized (Phase I)	0.9012	-0.0014
	(1.983)	(0.0049)
Fully Privatized (Phase II)	23.73***	0.0773***
	(4.673)	(0.0129)
Destination Only Privatized (Phase II)	13.22***	0.0244***
	(3.177)	(0.0082)
Origin Only Privatized (Phase II)	14.23***	0.0273***
	(3.178)	(0.0083)
Fixed-effects		
Market	Yes	Yes
Month-Year	Yes	Yes
Fit statistics		
Observations	616,346	616,346
R^2	0.55369	0.63099
Within R^2	0.00129	0.00125

Clustered (Market) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Market–month observations; average fare is the seat-weighted mean across airlines. Two-phase spec; market and year–month FE; SE clustered by market.

E.3 Robustness for Market Outcomes

This section reports the tables for the robustness exercises described in Section 5.3. Each subsection covers one exercise and reports it for both outcomes, market concentration and fares. The main results are presented in Section 5.2 for concentration and Section 5.1 for fares.

E.3.1 Avianca

Table 29 reports the concentration estimates dropping every market ever served by Avianca, and Table 30 repeats the exercise for fares. The online appendix reports a specification that keeps the full sample and interacts the treatment indicators with an indicator for markets Avianca ever served.

Table 29: Concentration effects excluding markets ever served by Avianca Brasil

	Log(HHI)	HHI	HHI (Revenue)	Log(HHI Revenue)	CR2	Number of Airlines	Maximum Market Share
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
Fully Privatized (Phase I)	0.0838***	523.6***	544.9***	0.0889***	0.0211***	-0.2222***	0.0433***
	(0.0076)	(51.17)	(52.09)	(0.0077)	(0.0017)	(0.0177)	(0.0042)
Destination Only Privatized (Phase I)	0.0214***	126.7***	136.3***	0.0237***	0.0062***	-0.0523***	0.0111***
	(0.0051)	(34.39)	(34.51)	(0.0051)	(0.0011)	(0.0125)	(0.0028)
Origin Only Privatized (Phase I)	0.0208***	121.6***	129.2***	0.0227***	0.0060***	-0.0459***	0.0108***
	(0.0050)	(34.14)	(34.25)	(0.0051)	(0.0011)	(0.0126)	(0.0028)
Fully Privatized (Phase II)	0.1587***	1,068.6***	1,092.2***	0.1651***	0.0313***	-0.4275***	0.0823***
	(0.0146)	(100.9)	(93.56)	(0.0136)	(0.0036)	(0.0377)	(0.0078)
Destination Only Privatized (Phase II)	0.0473***	309.2***	314.6***	0.0491***	0.0100***	-0.1376***	0.0247***
	(0.0082)	(55.38)	(55.50)	(0.0082)	(0.0018)	(0.0209)	(0.0045)
Origin Only Privatized (Phase II)	0.0474***	305.0***	315.3***	0.0500***	0.0103***	-0.1230***	0.0250***
	(0.0081)	(55.01)	(55.21)	(0.0081)	(0.0018)	(0.0207)	(0.0045)
Fixed-effects							
Route	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Observations	495,307	495,307	495,307	495,307	495,307	495,307	495,307
R^2	0.61906	0.63737	0.65579	0.64225	0.46593	0.70245	0.58028
Within R^2	0.00471	0.00454	0.00488	0.00526	0.00487	0.00701	0.00363

Clustered (Route) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Market–month observations. The outcomes are log HHI, HHI, revenue-based HHI, log revenue-based HHI, CR2, the number of airlines and the maximum market share, in columns 1 to 7. The specification is equation (1), estimated after dropping every market ever served by Avianca Brasil. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Market and month–year fixed effects. Standard errors clustered by market in parentheses. $^{*}/^{**}/^{***}$: 10/5/1%.

Table 30: Effect of Airport Privatization on Fares — Excluding Avianca routes

Model:	Average Price (1)	log(Average Price) (2)	Median Price (3)	log(Median Price) (4)	log(P10 Percentile) (5)	log(P90 Percentile) (6)	Gini Coefficient (Price) (7)
Variables							
Fully Privatized (Phase I)	21.76***	0.0428***	23.59***	0.0552***	0.0430***	0.0424***	-0.0034**
	(4.559)	(0.0091)	(4.686)	(0.0102)	(0.0109)	(0.0085)	(0.0016)
Destination Only Privatized (Phase I)	0.0489	-0.0006	0.6763	0.0033	0.0025	-0.0010	-0.0015
	(2.497)	(0.0056)	(2.491)	(0.0061)	(0.0065)	(0.0055)	(0.0010)
Origin Only Privatized (Phase I)	1.052	0.0012	1.758	0.0057	0.0041	-0.0008	-0.0018*
	(2.513)	(0.0056)	(2.523)	(0.0062)	(0.0065)	(0.0055)	(0.0010)
Fully Privatized (Phase II)	24.66***	0.0695***	20.70***	0.0625***	0.0409**	0.0891***	0.0065**
	(7.511)	(0.0203)	(7.083)	(0.0203)	(0.0199)	(0.0215)	(0.0028)
Destination Only Privatized (Phase II)	13.39***	0.0299***	11.71***	0.0231**	-0.0011	0.0479***	0.0089***
	(4.103)	(0.0096)	(4.022)	(0.0102)	(0.0104)	(0.0097)	(0.0017)
Origin Only Privatized (Phase II)	13.99***	0.0314***	12.12***	0.0240**	0.0002	0.0499***	0.0093***
	(4.218)	(0.0098)	(4.148)	(0.0105)	(0.0105)	(0.0100)	(0.0017)
Fixed-effects							
Market	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Observations	940,158	940,158	940,158	940,158	940,158	940,158	940,158
R^2	0.35415	0.45645	0.30980	0.42480	0.43319	0.38043	0.20552
Within R^2	0.00057	0.00065	0.00045	0.00046	0.00027	0.00105	0.00091

Clustered (Market) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: As in Table 5 but adding airline fixed effects (within-carrier variation). Market, airline, and year–month FE; SE clustered by market. */**/***: 10/5/1%.

E.3.2 Market Structure

Table 31 checks whether the increase in concentration holds in more competitive markets, or is confined to markets that were already concentrated. It re-estimates the concentration specification on markets that had more than one airline before privatization. The three panels define that restriction using the minimum, the mean and the modal number of airlines over the pre-treatment window. The increase in concentration holds in all three panels, and the online appendix reports the same exercise for markets that had more than two airlines.

Table 31: Concentration Effects Excluding Less Competitive Routes: Excluding Monopolies

	Log(HHI)	HHI	HHI (Revenue)	Log(HHI Revenue)	CR2	Number of Airlines	Maximum Market Share
Panel A: Never a Monopoly (pre-treatment min firms > 1)							
Fully Privatized (Phase I)	0.0921***	529.4128***	579.9930***	0.1033***	0.0275***	-0.3145***	0.0433***
	(0.0088)	(53.1497)	(53.2390)	(0.0090)	(0.0028)	(0.0227)	(0.0048)
Destination Only Privatized (Phase I)	0.0481***	261.6828***	280.9564***	0.0533***	0.0148***	-0.1624***	0.0227***
	(0.0064)	(38.5545)	(37.4869)	(0.0064)	(0.0021)	(0.0168)	(0.0035)
Origin Only Privatized (Phase I)	0.0441***	237.4008***	251.6782***	0.0485***	0.0141***	-0.1501***	0.0202***
	(0.0065)	(38.8036)	(37.9298)	(0.0065)	(0.0021)	(0.0167)	(0.0035)
Fully Privatized (Phase II)	0.2557***	1409.5776***	1412.9760***	0.2624***	0.0809***	-0.9274***	0.1217***
	(0.0136)	(81.7806)	(80.0438)	(0.0136)	(0.0047)	(0.0384)	(0.0074)
Destination Only Privatized (Phase II)	0.1070***	649.6494***	659.8562***	0.1106***	0.0263***	-0.3691***	0.0529***
	(0.0099)	(60.0707)	(59.0696)	(0.0099)	(0.0030)	(0.0264)	(0.0053)
Origin Only Privatized (Phase II)	0.1050***	637.4875***	651.1551***	0.1092***	0.0261***	-0.3540***	0.0516***
	(0.0097)	(59.0486)	(58.2903)	(0.0098)	(0.0030)	(0.0260)	(0.0052)
Route Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	337,321	337,321	337,321	337,321	337,321	337,321	337,321
Routes (clusters)	4,879	4,879	4,879	4,879	4,879	4,879	4,879
Panel B: Pre-treatment Mean Firms > 1							
Fully Privatized (Phase I)	0.0946***	566.9173***	591.2785***	0.1014***	0.0254***	-0.3355***	0.0459***
	(0.0077)	(48.6767)	(49.3110)	(0.0079)	(0.0022)	(0.0207)	(0.0042)
Destination Only Privatized (Phase I)	0.0359***	191.7464***	201.3281***	0.0392***	0.0117***	-0.1320***	0.0167***
	(0.0054)	(33.8638)	(33.6780)	(0.0054)	(0.0015)	(0.0141)	(0.0029)
Origin Only Privatized (Phase I)	0.0328***	170.0463***	176.1850***	0.0355***	0.0113***	-0.1230***	0.0147***
	(0.0054)	(34.1954)	(34.0364)	(0.0055)	(0.0016)	(0.0141)	(0.0029)
Fully Privatized (Phase II)	0.2402***	1349.3283***	1362.3373***	0.2479***	0.0725***	-0.8848***	0.1157***
	(0.0123)	(74.6766)	(73.3176)	(0.0123)	(0.0041)	(0.0357)	(0.0066)
Destination Only Privatized (Phase II)	0.0829***	508.0504***	515.8843***	0.0857***	0.0197***	-0.3108***	0.0409***
	(0.0084)	(53.2510)	(53.0175)	(0.0085)	(0.0023)	(0.0225)	(0.0046)
Origin Only Privatized (Phase II)	0.0827***	502.9109***	510.6410***	0.0856***	0.0201***	-0.2982***	0.0407***
	(0.0083)	(52.9673)	(52.8251)	(0.0084)	(0.0023)	(0.0224)	(0.0045)
Route Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	479,295	479,295	479,295	479,295	479,295	479,295	479,295
Routes (clusters)	6,097	6,097	6,097	6,097	6,097	6,097	6,097
Panel C: Pre-treatment Modal Firms > 1							
Fully Privatized (Phase I)	0.1015***	615.5451***	645.2672***	0.1092***	0.0262***	-0.3510***	0.0496***
	(0.0082)	(51.0543)	(51.5210)	(0.0083)	(0.0024)	(0.0219)	(0.0044)
Destination Only Privatized (Phase I)	0.0438***	245.3790***	257.1150***	0.0476***	0.0125***	-0.1475***	0.0211***
	(0.0058)	(35.7354)	(35.2770)	(0.0058)	(0.0017)	(0.0152)	(0.0031)
Origin Only Privatized (Phase I)	0.0400***	219.8782***	227.9937***	0.0432***	0.0121***	-0.1382***	0.0186***
	(0.0058)	(36.1177)	(35.7501)	(0.0058)	(0.0017)	(0.0151)	(0.0031)
Fully Privatized (Phase II)	0.2538***	1433.7706***	1438.5170***	0.2605***	0.0754***	-0.9181***	0.1227***
	(0.0129)	(78.0948)	(76.9542)	(0.0129)	(0.0043)	(0.0372)	(0.0069)
Destination Only Privatized (Phase II)	0.0971***	604.2723***	610.8927***	0.0999***	0.0217***	-0.3501***	0.0486***
	(0.0090)	(56.5730)	(56.0720)	(0.0091)	(0.0025)	(0.0242)	(0.0049)
Origin Only Privatized (Phase II)	0.0947***	584.8128***	593.5706***	0.0979***	0.0219***	-0.3327***	0.0470***
	(0.0089)	(55.9451)	(55.5978)	(0.0090)	(0.0025)	(0.0241)	(0.0048)
Route Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	426,406	426,406	426,406	426,406	426,406	426,406	426,406
Routes (clusters)	5,596	5,596	5,596	5,596	5,596	5,596	5,596

Notes: Market–month observations. The outcomes are log HHI, HHI, revenue-based HHI, log revenue-based HHI, CR2, the number of airlines and the maximum market share, in columns 1 to 7. The specification is equation (1), estimated separately on three subsamples that exclude less competitive markets. Panel A keeps markets that were never a monopoly before treatment, Panel B markets whose pre-treatment mean number of airlines exceeds one, and Panel C markets whose pre-treatment modal number of airlines exceeds one. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Market and month–year fixed effects. Standard errors clustered by market in parentheses. */**/***: 10/5/1%.

E.3.3 Staggered Timing

Table 32 compares the baseline and stacked Phase II estimates for concentration. The concentration effects are robust to the stacked design. The online appendix reports the stacked estimates for all contract phases.

Table 32: Stacked regression versus main specification: concentration effects, Phase II

	Log(HHI)	HHI	HHI Revenue	Log (HHI Revenue)	CR2	Number of Airlines	Maximum Market Share
Panel A: Baseline (TWFE)							
Fully Privatized (II After Mandatory Investments)	0.2246***	1266.7472***	1279.3027***	0.2317***	0.0666***	-0.8019***	0.1091***
	(0.0114)	(69.1794)	(67.7703)	(0.0113)	(0.0038)	(0.0338)	(0.0061)
Destination Only Privatized (II After Mandatory Investments)	0.0606***	352.6974***	356.4262***	0.0628***	0.0169***	-0.2356***	0.0290***
	(0.0072)	(46.5913)	(46.5413)	(0.0073)	(0.0019)	(0.0195)	(0.0039)
Origin Only Privatized (II After Mandatory Investments)	0.0600***	345.3042***	351.2738***	0.0626***	0.0171***	-0.2222***	0.0287***
	(0.0072)	(46.1740)	(46.1931)	(0.0072)	(0.0019)	(0.0194)	(0.0039)
Route Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	616,346	616,346	616,346	616,346	616,346	616,346	616,346
Routes (clusters)	9,584	9,584	9,584	9,584	9,584	9,584	9,584
Panel B: Stacked, clean controls							
Fully Privatized (II After Mandatory Investments)	0.1690***	999.0128***	1057.8062***	0.1833***	0.0448***	-0.5884***	0.0819***
	(0.0145)	(93.3322)	(90.7411)	(0.0143)	(0.0039)	(0.0364)	(0.0080)
Destination Only Privatized (II After Mandatory Investments)	0.0570***	340.0138***	343.7061***	0.0587***	0.0146***	-0.1971***	0.0279***
	(0.0079)	(52.1882)	(52.2598)	(0.0080)	(0.0020)	(0.0210)	(0.0044)
Origin Only Privatized (II After Mandatory Investments)	0.0567***	334.9046***	339.4895***	0.0587***	0.0148***	-0.1868***	0.0278***
	(0.0078)	(51.8065)	(51.9349)	(0.0079)	(0.0020)	(0.0209)	(0.0043)
Route × cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date × cohort Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Routes (clusters)	9,584	9,584	9,584	9,584	9,584	9,584	9,584
Cohorts	144	144	144	144	144	144	144
Stacked obs.	22,023,545	22,023,545	22,023,545	22,023,545	22,023,545	22,023,545	22,023,545

Notes: Market–month observations. The outcomes are log HHI, HHI, revenue-based HHI, log revenue-based HHI, CR2, the number of airlines and the maximum market share, in columns 1 to 7. Panel A reports the baseline estimates of equation (1) and Panel B the stacked estimates. A cohort is defined by the first month in which either endpoint of a market is privatized, and each cohort's comparison group is restricted to markets that are never or not-yet privatized. Panel A includes market and month–year fixed effects; Panel B includes market-by-cohort and month–year-by-cohort fixed effects. Only Phase II coefficients are reported, where Phase II is the period after the deadline for the mandated investments. The omitted category is markets with two public endpoints. Standard errors clustered by market in parentheses. */**/***: 10/5/1%.

E.3.4 Market Size

Table 33 reports the concentration estimates separately for small, medium and large markets, defined by terciles of average endpoint population, and Table 34 repeats the exercise for fares. The online appendix reports the concentration specification interacting each phase indicator with centred log market population, and the fare results with airline fixed effects.

Table 33: Heterogeneity: Market Size Terciles (Population)

	Log(HHI)	HHI	HHI (Revenue)	Log(HHI Revenue)	CR2	Maximum Market Share
Panel A: Small Markets (bottom population tercile)						
Fully Privatized (Phase I)	0.0686***	413.0921***	435.8343***	0.0744***	0.0224***	0.0293***
	(0.0141)	(89.4762)	(91.2330)	(0.0147)	(0.0042)	(0.0076)
Destination Only Privatized (Phase I)	0.0296***	164.0718**	176.2695***	0.0326***	0.0108***	0.0125**
	(0.0101)	(68.0608)	(68.2004)	(0.0103)	(0.0026)	(0.0056)
Origin Only Privatized (Phase I)	0.0275***	153.6537**	163.5490**	0.0303***	0.0100***	0.0112**
	(0.0101)	(67.9543)	(67.9430)	(0.0102)	(0.0025)	(0.0056)
Fully Privatized (Phase II)	0.2204***	1331.1811***	1439.8735***	0.2451***	0.0573***	0.1080***
	(0.0268)	(159.5377)	(161.4371)	(0.0275)	(0.0077)	(0.0150)
Destination Only Privatized (Phase II)	0.0705***	432.5873***	464.6926***	0.0769***	0.0175***	0.0349***
	(0.0164)	(108.7039)	(108.7417)	(0.0166)	(0.0040)	(0.0090)
Origin Only Privatized (Phase II)	0.0662***	409.4562***	441.1419***	0.0728***	0.0160***	0.0327***
	(0.0163)	(108.8951)	(109.0617)	(0.0164)	(0.0039)	(0.0090)
Market Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	118,724	118,724	118,724	118,724	118,724	118,724
Routes (clusters)	2,491	2,491	2,491	2,491	2,491	2,491
Panel B: Medium Markets (middle population tercile)						
Fully Privatized (Phase I)	0.0743***	441.0594***	471.6493***	0.0806***	0.0221***	0.0361***
	(0.0113)	(75.5040)	(76.7507)	(0.0117)	(0.0027)	(0.0063)
Destination Only Privatized (Phase I)	0.0157*	75.2566	100.9782*	0.0214***	0.0075***	0.0063
	(0.0081)	(52.3661)	(52.1531)	(0.0082)	(0.0021)	(0.0044)
Origin Only Privatized (Phase I)	0.0127	53.2526	73.9157	0.0174**	0.0068***	0.0044
	(0.0081)	(52.4962)	(52.3184)	(0.0082)	(0.0021)	(0.0044)
Fully Privatized (Phase II)	0.1557***	992.7673***	993.0453***	0.1610***	0.0373***	0.0749***
	(0.0200)	(134.6654)	(125.5934)	(0.0193)	(0.0047)	(0.0108)
Destination Only Privatized (Phase II)	0.0535***	321.0916***	305.7009***	0.0533***	0.0141***	0.0261***
	(0.0137)	(89.1341)	(89.2029)	(0.0138)	(0.0033)	(0.0075)
Origin Only Privatized (Phase II)	0.0518***	301.2278***	289.9032***	0.0523***	0.0144***	0.0249***
	(0.0135)	(87.7176)	(87.7431)	(0.0137)	(0.0033)	(0.0074)
Market Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	186,973	186,973	186,973	186,973	186,973	186,973
Routes (clusters)	2,492	2,492	2,492	2,492	2,492	2,492
Panel C: Large Markets (top population tercile)						
Fully Privatized (Phase I)	0.0882***	508.0428***	523.9693***	0.0940***	0.0239***	0.0437***
	(0.0109)	(68.8799)	(69.7670)	(0.0112)	(0.0031)	(0.0059)
Destination Only Privatized (Phase I)	0.0403***	208.3409***	206.5067***	0.0416***	0.0129***	0.0194***
	(0.0071)	(44.4722)	(44.4276)	(0.0072)	(0.0021)	(0.0038)
Origin Only Privatized (Phase I)	0.0399***	204.3446***	201.9707***	0.0411***	0.0132***	0.0189***
	(0.0071)	(44.4074)	(44.3672)	(0.0072)	(0.0021)	(0.0038)
Fully Privatized (Phase II)	0.2308***	1201.3820***	1194.6931***	0.2339***	0.0783***	0.1107***
	(0.0162)	(98.2973)	(97.4031)	(0.0163)	(0.0055)	(0.0086)
Destination Only Privatized (Phase II)	0.0534***	286.8650***	294.0879***	0.0556***	0.0177***	0.0243***
	(0.0108)	(67.3827)	(67.0895)	(0.0109)	(0.0030)	(0.0058)
Origin Only Privatized (Phase II)	0.0537***	283.7036***	292.6247***	0.0561***	0.0184***	0.0245***
	(0.0106)	(66.6343)	(66.5713)	(0.0108)	(0.0030)	(0.0057)
Market Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	262,588	262,588	262,588	262,588	262,588	262,588
Routes (clusters)	2,490	2,490	2,490	2,490	2,490	2,490

Notes: Market–month observations. The outcomes are log HHI, HHI, revenue-based HHI, log revenue-based HHI, CR2 and the maximum market share, in columns 1 to 6. The specification is equation (1). Each panel estimates the specification on one tercile of the market population distribution: small markets in Panel A, medium markets in Panel B and large markets in Panel C. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Market and month–year fixed effects. Standard errors clustered by market in parentheses. */**/***: 10/5/1%.

Table 34: Effect of Airport Privatization on Fares by Market Size (Population)

	Average Price	log(Average Price)	Median Price	log(Median Price)	log(P10 Percentile)	log(P90 Percentile)	Gini Coefficient (Price)
Panel A: Small Markets (bottom population tercile)							
Fully Privatized (Phase I)	29.3017***	0.0571***	28.9731***	0.0605***	0.0431**	0.0681***	0.0039
	(8.4479)	(0.0173)	(8.6380)	(0.0192)	(0.0202)	(0.0164)	(0.0028)
Destination Only Privatized (Phase I)	4.3822	0.0026	4.0797	0.0016	-0.0014	0.0065	0.0018
	(4.9908)	(0.0112)	(5.0427)	(0.0123)	(0.0130)	(0.0109)	(0.0019)
Origin Only Privatized (Phase I)	5.2034	0.0028	4.9843	0.0041	0.0022	0.0035	0.0003
	(5.0673)	(0.0112)	(5.1209)	(0.0123)	(0.0133)	(0.0109)	(0.0019)
Fully Privatized (Phase II)	13.2861	0.0554*	6.5973	0.0374	-0.0053	0.1004***	0.0223***
	(10.1649)	(0.0312)	(10.2262)	(0.0310)	(0.0328)	(0.0326)	(0.0046)
Destination Only Privatized (Phase II)	19.0901**	0.0393**	16.1027**	0.0291*	0.0168	0.0567***	0.0085***
	(7.4231)	(0.0161)	(7.3108)	(0.0168)	(0.0180)	(0.0167)	(0.0030)
Origin Only Privatized (Phase II)	16.6624**	0.0318*	14.1612*	0.0226	0.0137	0.0477***	0.0082***
	(7.7279)	(0.0164)	(7.8035)	(0.0175)	(0.0181)	(0.0169)	(0.0030)
Market Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	217,114	217,114	217,114	217,114	217,114	217,114	217,114
Routes (clusters)	2,491	2,491	2,491	2,491	2,491	2,491	2,491
Panel B: Medium Markets (middle population tercile)							
Fully Privatized (Phase I)	25.7430***	0.0513***	28.3338***	0.0663***	0.0468***	0.0521***	-0.0022
	(6.1570)	(0.0116)	(6.4079)	(0.0130)	(0.0141)	(0.0110)	(0.0022)
Destination Only Privatized (Phase I)	6.8764*	0.0153*	7.7909**	0.0201**	0.0083	0.0180**	0.0006
	(3.7837)	(0.0086)	(3.8014)	(0.0093)	(0.0097)	(0.0086)	(0.0015)
Origin Only Privatized (Phase I)	7.1411*	0.0156*	8.0968**	0.0208**	0.0079	0.0170**	0.0006
	(3.8382)	(0.0086)	(3.8747)	(0.0094)	(0.0098)	(0.0085)	(0.0015)
Fully Privatized (Phase II)	8.1159	0.0481*	1.4458	0.0265	-0.0276	0.0963***	0.0229***
	(10.8359)	(0.0280)	(10.3940)	(0.0277)	(0.0303)	(0.0280)	(0.0042)
Destination Only Privatized (Phase II)	8.8106	0.0243	5.9976	0.0124	-0.0172	0.0518***	0.0136***
	(6.5732)	(0.0162)	(6.4599)	(0.0170)	(0.0171)	(0.0162)	(0.0024)
Origin Only Privatized (Phase II)	9.7580	0.0276*	6.7930	0.0146	-0.0187	0.0572***	0.0149***
	(6.7405)	(0.0168)	(6.6292)	(0.0175)	(0.0174)	(0.0169)	(0.0024)
Market Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	386,960	386,960	386,960	386,960	386,960	386,960	386,960
Routes (clusters)	2,492	2,492	2,492	2,492	2,492	2,492	2,492
Panel C: Large Markets (top population tercile)							
Fully Privatized (Phase I)	15.4634***	0.0204*	16.5515***	0.0212*	0.0058	0.0257**	0.0025
	(4.5637)	(0.0110)	(4.5955)	(0.0123)	(0.0127)	(0.0108)	(0.0019)
Destination Only Privatized (Phase I)	1.8137	0.0008	2.1436	0.0009	-0.0047	0.0036	0.0012
	(2.8404)	(0.0070)	(2.8098)	(0.0077)	(0.0079)	(0.0069)	(0.0012)
Origin Only Privatized (Phase I)	2.8249	0.0022	3.6679	0.0040	-0.0014	0.0027	0.0003
	(2.8324)	(0.0069)	(2.8082)	(0.0077)	(0.0079)	(0.0069)	(0.0012)
Fully Privatized (Phase II)	41.2883***	0.0994***	34.6619***	0.0710***	0.0063	0.1416***	0.0259***
	(6.3843)	(0.0172)	(6.1984)	(0.0188)	(0.0197)	(0.0176)	(0.0034)
Destination Only Privatized (Phase II)	21.2967***	0.0296***	19.5398***	0.0168	-0.0149	0.0504***	0.0125***
	(4.3757)	(0.0107)	(4.2772)	(0.0118)	(0.0122)	(0.0109)	(0.0021)
Origin Only Privatized (Phase II)	22.6998***	0.0326***	20.7826***	0.0196*	-0.0099	0.0529***	0.0125***
	(4.4450)	(0.0108)	(4.3542)	(0.0118)	(0.0121)	(0.0110)	(0.0021)
Market Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	642,792	642,792	642,792	642,792	642,792	642,792	642,792
Routes (clusters)	2,490	2,490	2,490	2,490	2,490	2,490	2,490

Notes: Airline–market–month observations. The outcomes are the average fare, its logarithm, the median fare, its logarithm, the logarithms of the 10th and 90th percentiles of the fare distribution, and the Gini coefficient of fares, in columns 1 to 7. Each panel estimates equation (1) on one tercile of the market population distribution: small markets in Panel A, medium markets in Panel B and large markets in Panel C. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Market and month–year fixed effects. Standard errors clustered by market in parentheses. $^{*}/^{**}/^{***}$: 10/5/1%.

E.3.5 COVID

Table 35 reports the concentration estimates excluding observations from 2020 onward, and Table 36 the corresponding fare estimates. Both are robust, and the fare effects are if anything stronger in the pre-COVID sample.

Table 35: Robustness, Market Concentration: Pre-COVID Sample

	Log(HHI)	HHI	HHI (Revenue)	Log(HHI Revenue)	CR2	Number of Airlines	Maximum Market Share
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
Fully Privatized (Phase I)	0.1435***	855.7***	898.2***	0.1549***	0.0278***	-0.5226***	0.0736***
	(0.0180)	(114.6)	(117.4)	(0.0183)	(0.0056)	(0.0493)	(0.0097)
Destination Only Privatized (Phase I)	0.0300***	179.1***	187.0***	0.0321***	0.0065***	-0.1384***	0.0150***
	(0.0064)	(39.80)	(39.30)	(0.0064)	(0.0019)	(0.0179)	(0.0035)
Origin Only Privatized (Phase I)	0.0304***	177.9***	182.1***	0.0319***	0.0069***	-0.1316***	0.0152***
	(0.0064)	(39.99)	(39.60)	(0.0064)	(0.0019)	(0.0176)	(0.0035)
Fully Privatized (Phase II)	0.1730***	989.2***	955.1***	0.1685***	0.0520***	-0.7372***	0.0780***
	(0.0285)	(187.2)	(167.0)	(0.0259)	(0.0106)	(0.0729)	(0.0157)
Destination Only Privatized (Phase II)	0.0517***	336.5***	326.7***	0.0501***	0.0095***	-0.2468***	0.0259***
	(0.0104)	(66.07)	(65.90)	(0.0106)	(0.0029)	(0.0277)	(0.0058)
Origin Only Privatized (Phase II)	0.0519***	332.1***	328.9***	0.0516***	0.0104***	-0.2309***	0.0261***
	(0.0103)	(65.53)	(65.71)	(0.0105)	(0.0029)	(0.0276)	(0.0057)
Fixed-effects							
Route	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Observations	398,085	398,085	398,085	398,085	398,085	398,085	398,085
R^2	0.72303	0.73388	0.75385	0.74779	0.63846	0.80607	0.68069
Within R^2	0.00286	0.00265	0.00279	0.00310	0.00212	0.01011	0.00204

Clustered (Route) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Market–month observations. The outcomes are log HHI, HHI, revenue-based HHI, log revenue-based HHI, CR2, the number of airlines and the maximum market share, in columns 1 to 7. The specification is equation (1), estimated excluding observations from 2020 onward. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Market and month–year fixed effects. Standard errors clustered by market in parentheses. $^{*}/^{**}/^{***}$: 10/5/1%.

Table 36: Effect of Airport Privatization on Fares — Pre-COVID Sample

	Average Price	log(Average Price)	Median Price	log(Median Price)	log(P10 Percentile)	log(P90 Percentile)	Gini Coefficient (Price)
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables							
Fully Privatized (Phase I)	29.28***	0.0466**	27.69***	0.0159	-0.0356*	0.0852***	0.0241***
	(6.727)	(0.0224)	(6.264)	(0.0214)	(0.0214)	(0.0280)	(0.0039)
Destination Only Privatized (Phase I)	2.833	-0.0048	1.680	-0.0153*	-0.0355***	0.0099	0.0089***
	(2.875)	(0.0073)	(2.838)	(0.0079)	(0.0081)	(0.0075)	(0.0014)
Origin Only Privatized (Phase I)	0.9375	-0.0072	0.5525	-0.0143*	-0.0336***	0.0049	0.0079***
	(2.955)	(0.0074)	(2.946)	(0.0081)	(0.0083)	(0.0076)	(0.0014)
Fully Privatized (Phase II)	73.63***	0.1255***	60.78***	0.0284	-0.1211**	0.2461***	0.0688***
	(8.698)	(0.0397)	(8.166)	(0.0435)	(0.0516)	(0.0381)	(0.0066)
Destination Only Privatized (Phase II)	33.04***	0.0468***	29.78***	0.0258**	-0.0161	0.0764***	0.0184***
	(4.223)	(0.0113)	(4.123)	(0.0123)	(0.0126)	(0.0122)	(0.0025)
Origin Only Privatized (Phase II)	32.12***	0.0484***	28.62***	0.0272**	-0.0181	0.0804***	0.0203***
	(4.442)	(0.0117)	(4.373)	(0.0128)	(0.0128)	(0.0128)	(0.0025)
Fixed-effects							
Market	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics							
Observations	849,314	849,314	849,314	849,314	849,314	849,314	849,314
R^2	0.40431	0.50314	0.35384	0.46386	0.46485	0.42145	0.22478
Within R^2	0.00189	0.00113	0.00128	0.00041	0.00044	0.00227	0.00249

Clustered (Market) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Airline–market–month observations. The outcomes are the average fare, its logarithm, the median fare, its logarithm, the logarithms of the 10th and 90th percentiles of the fare distribution, and the Gini coefficient of fares, in columns 1 to 7. The specification is equation (1), estimated excluding observations from 2020 onward. Phase I covers the period between contract signature and the deadline for the mandated investments, and Phase II the period after that deadline. The omitted category is markets with two public endpoints. Market and month–year fixed effects. Standard errors clustered by market in parentheses. $^{*}/^{**}/^{***}$: 10/5/1%.

F Mechanism

F.1 Differentiated Products Framework

Section 6 develops the framework with price competition and differentiated products. This subsection and Subsection F.2 present the versions in which airlines compete in quantities, the first with differentiated products and the second with a homogeneous good, which simplifies the presentation.

The same qualitative conclusions hold when airlines choose quantities instead, with the same differentiated inverse demand used in the text, $p_i = a_i - bq_i - cq_j$, provided that $2b - c > 0$.

Airline i chooses q_i to maximize profits given by $\pi_i = \left[a_i - bq_i - cq_j - \widetilde{c}_i(z_i, \theta)\right] q_i$, with effective marginal cost $\widetilde{c}_i(z_i, \theta) \equiv c_i - \Delta(z_i, \theta)$ as defined in (2), where c_i is the baseline marginal cost of carrying a passenger and $\Delta(z_i, \theta)$ is the amount by which airport conditions reduce airline i's marginal cost. The first-order conditions are $a_i - 2bq_i - cq_j - \widetilde{c}_i(z_i, \theta) = 0$ and the same condition for airline j with the indices exchanged. Subtracting one from the other gives the equilibrium output gap,

$$G(\theta; z_i, z_j) = \frac{(a_i - a_j) - (c_i - c_j) + \Delta(z_i, \theta) - \Delta(z_j, \theta)}{2b - c}, \tag{10}$$

so that

$$\frac{\partial G}{\partial \theta} = \frac{1}{2b - c}\left[\frac{\partial \Delta(z_i, \theta)}{\partial \theta} - \frac{\partial \Delta(z_j, \theta)}{\partial \theta}\right], \tag{11}$$

and the sign of $\partial G/\partial\theta$ is again determined by whether $\partial\Delta(z, \theta)/\partial\theta$ is increasing or decreasing in z, that is, by the sign of the cross-partial in (8). Differences in demand intercepts shift the level of the output gap but not its response to θ. The condition $2b - c > 0$ requires that an airline's own frequency affects its demand more than its rival's, which is natural in this setting given the role of schedules, frequency, and connections.

F.2 Cournot Framework

This subsection shows that the conclusions of the model in Section 6 that are relevant for the results also hold in a simplified version in which airlines choose the number of flights and the product is homogeneous, which simplifies the presentation.

Consider two airlines that choose the number of flights serving a route. Let q_i denote the number of flights operated by airline i, and let total flights be $Q = q_i + q_j$. Inverse demand is linear, $P(Q) = a - bQ$, with $a > 0$ and $b > 0$.

In this version of the framework airlines compete in quantities. Of course, airlines also compete in setting prices. Airlines choose flight schedules in advance and compete on fares closer to departure, once capacity, the number of flights and seats, is committed and observable. This is the two-stage structure studied by Kreps and Scheinkman (1983), in which capacity is chosen before prices and the equilibrium outcome coincides with Cournot competition. Modeling airlines as choosing flights therefore captures the outcome of the two-stage game while simplifying the presentation. Basso (2008) also uses Cournot competition to study airline competition in an airport.

Airline i chooses q_i to maximize profits given by $\pi_i = [P(Q) - \widetilde{c}_i(z_i, \theta)]\, q_i$, with effective marginal cost $\widetilde{c}_i(z_i, \theta) \equiv c_i - \Delta(z_i, \theta)$ as defined in (2), where c_i is the baseline marginal cost of carrying a passenger and $\Delta(z_i, \theta)$ is the amount by which airport conditions reduce airline i's marginal cost. The Cournot equilibrium quantities are therefore:

$$q_i = \frac{a - 2\big(c_i - \Delta(z_i, \theta)\big) + \big(c_j - \Delta(z_j, \theta)\big)}{3b}, \qquad q_j = \frac{a - 2\big(c_j - \Delta(z_j, \theta)\big) + \big(c_i - \Delta(z_i, \theta)\big)}{3b}. \tag{12}$$

Let $G(\theta; z_i, z_j) \equiv q_i - q_j$ denote the difference between the equilibrium outputs of airline i and airline j. Substituting from (12) gives

$$G(\theta; z_i, z_j) = \frac{c_j - c_i + \Delta(z_i, \theta) - \Delta(z_j, \theta)}{b} \tag{13}$$

The output asymmetry depends on the initial cost difference and on how airport conditions change each airline's costs. To examine how the changes in airport conditions caused by privatization affect this asymmetry, differentiate $G(\theta; z_i, z_j)$ with respect to θ,

$$\frac{\partial G}{\partial \theta} = \frac{1}{b}\left[\frac{\partial \Delta(z_i, \theta)}{\partial \theta} - \frac{\partial \Delta(z_j, \theta)}{\partial \theta}\right] \tag{14}$$

The effect of privatization on asymmetry again depends on the difference in how each airline's costs respond to changes in airport conditions, where $\partial\Delta(z, \theta)/\partial\theta$ captures the effect of a change in airport conditions on the cost of operating flights for an airline with characteristics z. The sign of $\partial G/\partial\theta$ is determined by whether $\partial\Delta(z, \theta)/\partial\theta$ is increasing or decreasing in z, that is, by the sign of the cross-partial in (8).

F.3 Alternative Exposure Measures

Table 37 re-estimates equation (9) using alternative measures of an airline's pre-treatment exposure z, and, within each measure, alternative definitions of when a route is treated as privatized.

Table 37: Market Shares: Alternative Exposure Measures

Dependent variable:	log(market share)		
Privatized airports:	Origin airport	Origin and destination	Either origin or destination
	(1)	(2)	(3)
Panel A: Pre-treatment share at origin airport			
Privatized (λ)	-0.536***	-0.307***	-0.525***
	(0.037)	(0.040)	(0.028)
Privatized × exposure (ρ)	2.112***	1.680***	1.784***
	(0.118)	(0.131)	(0.084)
Within R^2	0.023	0.009	0.029
Panel B: Log pre-treatment flights, destination airport			
Privatized (λ)	-0.787***	-0.591***	-0.978***
	(0.045)	(0.060)	(0.048)
Privatized × exposure (ρ)	0.183***	0.151***	0.203***
	(0.009)	(0.011)	(0.009)
Within R^2	0.017	0.007	0.028
Panel C: Log pre-treatment flights, route average (origin & destination)			
Privatized (λ)	-1.693***	-1.554***	-1.782***
	(0.102)	(0.102)	(0.091)
Privatized × exposure (ρ)	0.321***	0.307***	0.334***
	(0.018)	(0.018)	(0.016)
Within R^2	0.025	0.012	0.038
Panel D: Log pre-treatment seats, route (price data)			
Privatized (λ)	-1.023***	-0.705***	-1.162***
	(0.038)	(0.044)	(0.032)
Privatized × exposure (ρ)	0.263***	0.201***	0.291***
	(0.008)	(0.009)	(0.007)
Within R^2	0.051	0.019	0.085
Panel E: Pre-treatment seat share at origin airport (price data)			
Privatized (λ)	-0.505***	-0.278***	-0.489***
	(0.041)	(0.044)	(0.028)
Privatized × exposure (ρ)	1.976***	1.546***	1.617***
	(0.137)	(0.140)	(0.084)
Within R^2	0.017	0.007	0.023
Fixed-effects (all panels)			
Airline	Yes	Yes	Yes
Route	Yes	Yes	Yes
Month	Yes	Yes	Yes
Observations (all panels)	1,271,947	1,271,947	1,271,947

Clustered (route) standard-errors in parentheses
*Signif. codes: ***: 0.001, **: 0.01, *: 0.05, .: 0.1*

Notes: The dependent variable is the log of an airline's market share on a route in a given month. Each panel uses a different measure of an airline's pre-treatment exposure z, and within each panel the columns differ only in how privatization is defined: column (1) treats a route as privatized when its origin airport is privatized, column (2) when both endpoints are privatized, and column (3) when either endpoint is privatized. Panel A uses the airline's share of flights at the origin airport; Panel B its flights at the destination airport, in logs; Panel C the average of its flights at the origin and destination airports, in logs; Panel D its seats sold on the route, in logs, from the price data; and Panel E its share of seats sold at the origin airport, from the price data. All exposure measures are constructed over the 24 months before the route's first exposure to privatization, so that they are not affected by treatment. λ is the coefficient on the privatization indicator and ρ is the coefficient on its interaction with z; the marginal effect of privatization for an airline with exposure z is $\lambda + \rho z$. All specifications include airline, route, and month fixed effects, with standard errors clustered by route. Results are robust to two-way clustering by endpoint airports.