The effects of International Airline's Groups acquisition of Aer Lingus on the Irish air transportation market

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Abstract

In this study, I employ a Differences-in-Differences methodology to estimate the impact of the International Airlines Group's (IAG) acquisition of Aer Lingus, Ireland's former national airline, on flight frequency across various routes. By controlling for multiple route-level characteristics and competition factors. I show that there was a significant increase in annual flight frequencies departing Irish airports after the acquisition while there is also no evidence of anti-competitive effects on routes in which IAG and Aer Lingus competed prior to the acquisition. There is also evidence of a shift in flight frequency from Shannon to Dublin Airport. These findings support the European Commissions decision to approve IAG's acquisition of Aer Lingus and shows the acquisition was beneficial for the Irish air transportation market as a whole.

Keywords: Airline Competition, Merger, Flight Frequency, Differences-in-Differences Estimator.
JEL Classification: L93, D43, L4

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1 Introduction

In recent years several events have influenced the air transportation market in Ireland, none more so that the acquisition of the Irish national airline, Aer Lingus. Having previously rejected a proposal by Ryanair in 2007 to acquire Aer Lingus citing the "anti-competitive effects" that would result (Commission, 2013,Gaggero and Piga, 2010). Considering that 80% of the flights that leave Ireland between 2004 and 2023 are operated by either Aer Lingus or Ryanair and combined with the barriers to entry that would effectively shield this new merged entity from competition, these concerns are undoubtedly justified.

Despite the rejection by the European Commission to allow Ryanair to acquire Aer Lingus, this still did not curb the increasing anti-competitive nature of the Irish Airline market. Aer Lingus had struggled to be competitive since losing it's monopoly status during de-regulation of the airline market in 1986 allowed for new competition from Ryanair. This trend has continued with Ryanair becoming one of the largest airlines in Europe and a champion of the Low-Cost-Carrier business model, while Aer Lingus has filed for bankruptcy three times between 1993 and 2009 (Barrett, 2006, O'Connell and Connolly, 2017). Despite European Commissions concerns about competition in the Irish airline market, it seemed that one of the markets main players was likely to exit.

The proposed acquisition of Aer Lingus by International Airlines Group (IAG), however, presents a different scenario that may have potentially benefited the Irish airline market. By integrating Aer Lingus into a larger airline group, IAG can provide the financial stability and investment necessary for Aer Lingus to enhance its competitive position. This acquisition allows Aer Lingus to leverage IAG's extensive network, offering greater connectivity and efficiency. The European Commission approved the acquisition contingent on several commitments from IAG aimed at preserving competition. These commitments included the release of slots at key London airports to facilitate the entry of new competitors on critical routes, and the establishment of fare combinability agreements, which enable passengers to book tickets that combine segments from different airlines. Additionally, IAG agreed to Special Prorate Agree-

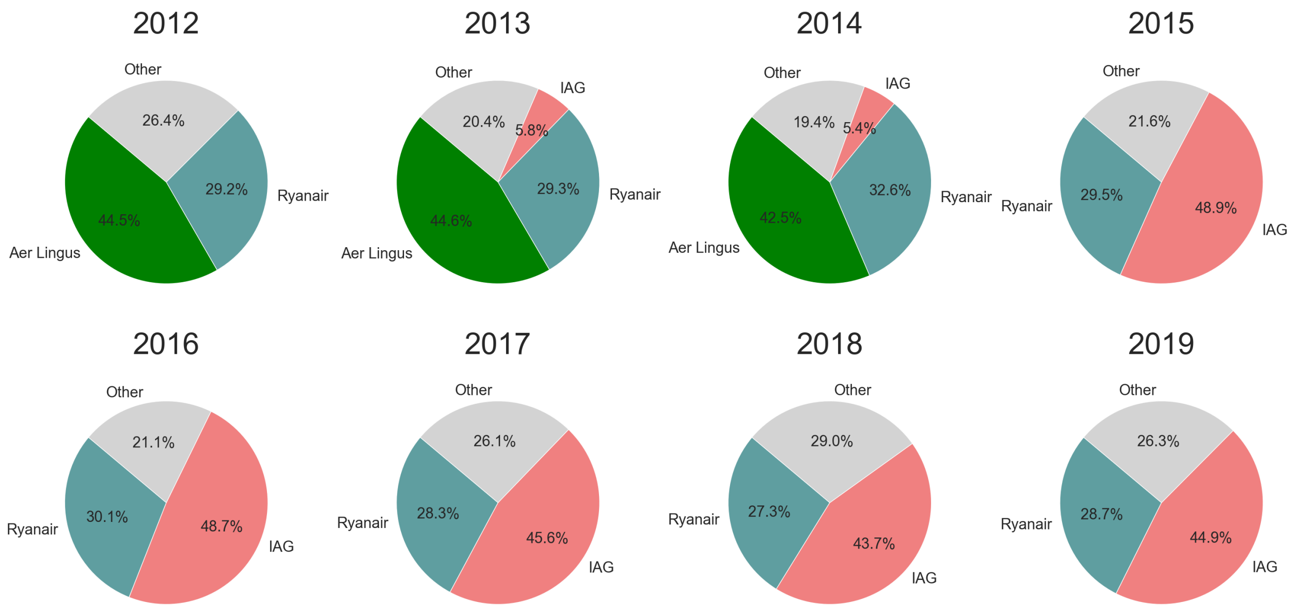


Figure 1: Flight Share by Airline from 2012 to 2019

ments (SPAs), which allow revenue-sharing on connecting flights, ensuring other airlines can offer competitive services using Aer Lingus' short-haul network. These measures aim to ensure that Irish consumers will continue to benefit from competitive pricing and a variety of flight options, thereby maintaining a dynamic market environment. In essence, the IAG acquisition may bolster Aer Lingus' viability and competitiveness while safeguarding consumer interests and market competition.

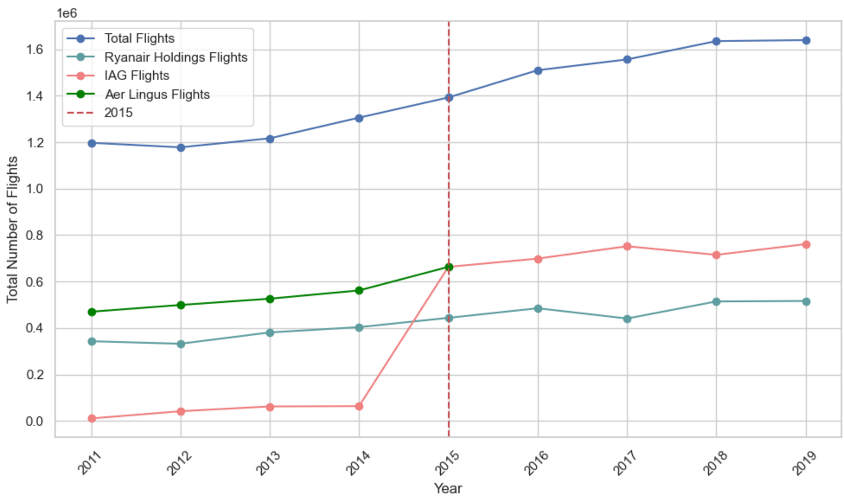


Figure 2: Flight number out of Ireland from 2011 to 2019

The impact of the IAG's acquisition of Aer Lingus deserves more attention in terms of the analysis of their effects on the supply of flights in non-stop routes departing from Irish airports. [1]IAG.

Airline consolidations, be they as a result of mergers or acquisitions, have a detrimental effect on the welfare of passengers in two different but interrelated aspects, prices and flight frequencies. Flight frequency is considered the main attribute of quality in the airline market because it determines the schedule delay cost which is the difference between the actual and desired time of departure Volodymyr Bilotkach and Flores-Fillol, 2008.

In this paper I examine the impact of IAG's acquisition of Aer Lingus on flight frequencies. Similar studies have been carried out for different airline consolidations, namely Bilotkach, 2011 , Borenstein, 1990, Fageda and Perdiguero, 2014 Richard, 2003, Gregory J. Werden and Johnson, 1991 and Fageda, 2014a. I run several regressions controlling for the different indicators of competition taking advantage of a rich dataset which includes both domestic, international and continental flight from Ireland. I apply a differences in differences methodology which is widely used in the evaluation of airline consolidations. The results of my analysis may be useful to assess the effects of the acquisitions on passengers and help guide future decisions in the competition authorities on consolidations in the Irish air transport market. This is also important as this will be the first and only econometric evaluation of the effects of the acquisition on passengers in Ireland to the best of my knowledge. Preferably I would examine both prices and flight frequencies, however I was unable to attain price data prior to the merger.

The results of my study reveal several interesting findings that have significant implications for the Irish air transportation market. I found that the acquisition of Aer Lingus by IAG led to a notable 7.5321% increase in annual flight frequencies from Irish airports, suggesting that the merger enhanced operational capacity and network connectivity. Importantly, I did not find any evidence of anti-competitive behavior on routes where IAG and Aer Lingus previously competed, indicating that the merger did not reduce service levels or lead to collusion. Additionally,

[1]By IAG I am referring all airlines owned by IAG prior to their acquisition of Aer lingus

the redistribution of routes had a mixed impact, with Dublin Airport experiencing increased flight frequencies, while Shannon Airport saw a decline, reflecting a shift in regional service distribution that aligns with broader trends in airline consolidations demonstrated in the literature.

In Section 2 provides context behind the study. In Section 3, I give an overview of the literature on the market and social welfare outcomes of airline consolidation. Section 4 provides a description of the data as well as well as describing how the data was prepared. Section 5 presents my empirical strategy and the reasoning for my model selection. Section 6 outlines my estimations and results. Finally section 7 concludes.

2 Context

2.1 The Irish Air Transportation Market

The Irish airline market is dominated by two major players: Ryanair and Aer Lingus. Ryanair, with its aggressive low-cost business model, has established itself as one of Europe's largest and most successful airlines, offering an extensive network of routes across Europe and beyond. Its competitive pricing and high-frequency services have cemented its dominance in the short-haul market. Aer Lingus, on the other hand, serves as Ireland's national carrier. Historically owned by the Irish state, Aer Lingus has focused on providing both short-haul and long-haul services, with a strong emphasis on transatlantic routes. It has maintained a significant competitive presence in the market, balancing between premium service and competitive pricing.

Ireland's aviation infrastructure comprises several airports, with Dublin Airport being the busiest and most significant. Dublin Airport serves as the primary hub for both Ryanair and Aer Lingus, handling the majority of international and domestic flights. Cork and Shannon airports are also major facilities, providing a mix of international and regional services.

2.2 International Airlines Group (IAG)

IAG was formed in January 2011 through the merger of British Airways and Iberia, creating one of the world's largest airline groups. This strategic move aimed to enhance the competitiveness and operational efficiencies of both airlines. Following the initial merger, IAG pursued an ambitious expansion strategy through a series of acquisitions. In 2012, IAG acquired British Midland International (BMI), significantly boosting its presence at London-Heathrow Airport. The group's next major acquisition came in 2013 with the purchase of Vueling, a low-cost airline, enhancing its footprint in the European short-haul market. In 2015, IAG acquired Aer Lingus, including the Irish state's holdings, integrating the Irish national carrier into its portfolio and strengthening its transatlantic network. This acquisition was met with opposition due to concerns about the impact on competition and national interest. Critics argued that selling the government's stake in Aer Lingus could reduce competition within the Irish airline market, potentially leading to higher fares and fewer choices for consumers. Additionally, there were fears that the sale would compromise national interests, as Aer Lingus played a crucial role in ensuring connectivity for Ireland, particularly in transatlantic routes vital for business, tourism, and diaspora relations.

The acquisition of Air Europa in 2019 was another significant milestone, aimed at bolstering IAG's position in the Spanish and Latin American markets. These strategic acquisitions have enabled IAG to diversify its offerings and maintain a strong competitive edge in the global aviation industry.

2.3 Airlines Competitive Strategies

Airlines adopt various strategies to optimize their operations, enhance profitability, and improve service quality. Two of the most prevalent strategies in the airline industry are the point-to-point and hub-and-spoke models. These strategies are depicted in Figure 3.

The point-to-point strategy involves direct flights between two destinations without requiring a transfer at a central hub. This model is characterized by its direct routes, increased flight

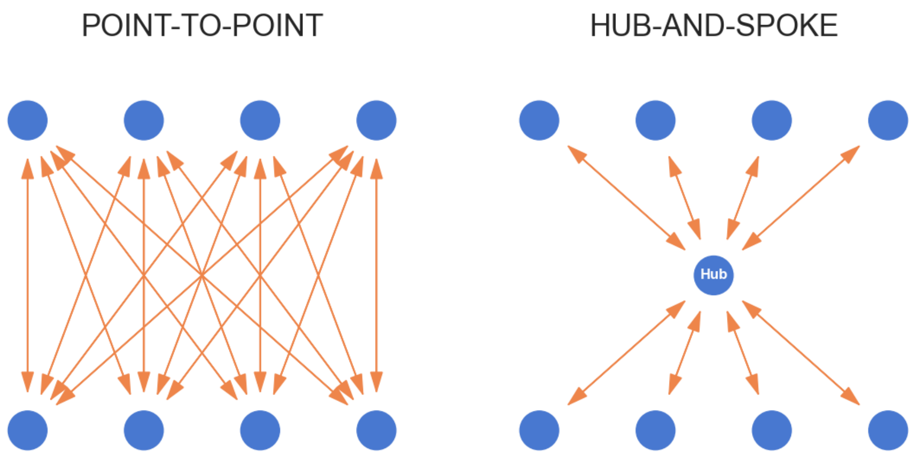


Figure 3: Airline Strategies

frequencies, operational simplicity, and passenger convenience. Airlines operating on a point-to-point model connect cities directly, reducing travel time and avoiding the need for layovers. By connecting multiple cities directly, airlines can offer more frequent flights on popular routes, catering to high-demand destinations. The simplicity of the point-to-point model can lead to lower operational costs as it reduces the complexity associated with managing a central hub. Additionally, this model offers passengers the convenience of fewer stopovers and shorter travel times, which can enhance customer satisfaction. However, the point-to-point model may be less efficient for airlines in terms of aircraft utilization and can result in lower load factors on less popular routes.

In contrast, the hub-and-spoke strategy involves consolidating flights at a central hub airport, where passengers transfer to connecting flights to reach their final destinations. This model centralizes operations at a major hub airport, from which spokes radiate out to various destinations. By funneling passengers through a central hub, airlines can ensure higher load factors on flights, making aircraft utilization more efficient. Additionally, the hub-and-spoke model allows airlines to offer a wider range of destinations by connecting through a hub, increasing network coverage. The concentration of operations at a hub can lead to economies of scale in terms of ground services, maintenance, and other operational activities. However, the hub-and-spoke model can lead to longer travel times for passengers due to layovers and increased potential for delays at the hub. Additionally, it requires more complex scheduling and coordination.

The choice between a point-to-point and a hub-and-spoke strategy depends on various factors, including the airline's business model, target market, and operational capabilities. Low-cost carriers often prefer the point-to-point model for its simplicity and cost-efficiency, while major airlines tend to adopt the hub-and-spoke model to maximize network reach and operational efficiency. The Irish air transport market is an example of competition between the Low Cost Carrier, Ryanair, and a Network Carrier, Aer Lingus, operating a Hub-and-spoke model.

Low-Cost Carriers (LCCs) focus on minimizing operational costs and offering lower fares by using strategies such as point-to-point routing, high aircraft utilization, single-class seating, and charging for additional services. Ryanair is the biggest LCC in Europe, utilizing a point-to-point strategy to connect secondary airports across Europe with minimal operational complexity. Network Carriers - such as Aer Lingus, British Airways and Iberia - provide a wider range of services and amenities, including multiple travel classes, extensive route networks, and hub-and-spoke models to maximize connectivity. They often focus on business and long-haul travel, balancing operational efficiency with passenger comfort. Aer Lingus, under the ownership of IAG, exemplifies a network carrier, integrating its operations within IAG's extensive hub-and-spoke network to offer a broader range of destinations and services.

Ryanair employs a point-to-point strategy, positioning itself as a low-cost carrier. It focuses on direct flights between numerous secondary airports across Europe, emphasizing cost efficiency and frequent services on high-demand routes. In contrast, Aer Lingus operates a hub-and-spoke strategy, and following its acquisition by IAG has been incorporated into a larger European hub-and-spoke network. It offers both short-haul and long-haul services, leveraging IAG's network for greater connectivity, particularly on transatlantic routes, with Dublin Airport serving as a primary hub. IAG airlines, including major carriers like British Airways and Iberia, utilize the hub-and-spoke model extensively. They operate comprehensive global networks with centralized hubs in key cities such as London and Madrid, focusing on providing extensive services across multiple travel classes. Both the point-to-point and hub-and-spoke models offer distinct advantages and challenges. The optimal strategy for an airline depends on its specific goals and market conditions. Figure 3 illustrates the structural differences between these two models, highlighting the direct connections of the point-to-point strategy and the centralized connections of the hub-and-spoke strategy.

3 Literature Review

The existing literature provides a comprehensive overview of the effects of airline mergers and acquisitions on market dynamics, including pricing, flight frequencies, and competition. The impacts of mergers and acquisitions in the airline industry have been widely studied, with a primary focus on their influence on market concentration and competition. According to Fageda and Perdiguero, 2014, mergers often lead to a reduction in flight frequencies on routes where the merging airlines previously competed, primarily due to reduced competition. This reduction can result in higher prices and diminished service levels, particularly on routes where the merged entity becomes dominant. Similarly, the merger between Iberia, Clickair, and Vueling demonstrated a significant reduction in flight frequencies, suggesting a more collusive behavior post-merger, negatively impacting consumer welfare Fageda, 2014a.

In the context of the IAG and Aer Lingus merger, initial concerns were raised about potential increases in market power and reduced competition. However, the European Commission's approval of the acquisition included commitments from IAG to mitigate these risks. These commitments involved the release of slots at key London airports and the establishment of fare combinability agreements to ensure competition and consumer choice Commission, 2013.

Flight frequency is a crucial quality attribute in the airline industry, significantly affecting schedule convenience and delay costs for passengers. According to Volodymyr Bilotkach and Flores-Fillol, 2008, the relationship between mergers and flight frequencies is critical, as frequency influences schedule delay costs, which represent the difference between the actual and desired departure times. Fageda and Flores-Fillol, 2012a found that the merger between Iberia, Clickair, and Vueling led to a decrease in flight frequencies on affected routes, potentially increasing schedule delay costs for passengers. Furthermore, the empirical evidence from the Iberia-Vueling merger showed a modest impact on frequencies but a substantial increase in prices on routes where these airlines previously competed independently Bilotkach et al., 2013; Fageda and Flores-Fillol, 2012b.

In simulations of potential mergers between major U.S. airlines, Kim and Singal, 1993 demonstrated that such mergers would likely result in welfare losses due to reduced producer surplus and increased prices. Morrison, 1996 observed that the merger between Japan Airlines and Japan Air System increased competition, leading to lower equilibrium prices. These findings highlight the complex dynamics of airline mergers, where the effects on pricing and frequency can vary significantly depending on market conditions and the competitive landscape.

The regulatory role is pivotal in overseeing mergers to maintain competitive markets. The European Commission's intervention in the IAG-Aer Lingus merger included several measures to preserve competition, such as the release of take-off and landing slots at congested airports and ensuring fare combinability agreements to facilitate competitive ticket pricing across different airlines Fageda and Perdiguero, 2014; Volodymyr Bilotkach and Flores-Fillol, 2008. Studies by **Clougherty2002a** emphasize that regulatory frameworks must consider both domestic and international competitive dynamics when evaluating airline mergers. The Commission's actions in the IAG case reflect a proactive approach to safeguarding consumer interests while allowing for the operational efficiencies that mergers can bring.

The distribution of airline traffic is significantly impacted by mergers and consolidations, often resulting in a reorganization of flight frequencies between primary and secondary hubs. Studies have shown that consolidations typically lead to an increased number of flights being channeled through primary hubs. For instance, Bilotkach, Fageda, and Flores-Fillol (2013) demonstrate that following airline consolidations, primary hubs tend to see an increase in flight frequency, while secondary hubs may experience a reduction in traffic. This differentiation becomes more pronounced post-consolidation, as airlines focus on maximizing efficiency and profitability at their main hubs.

In their empirical analysis of the Delta-Northwest merger, Bilotkach et al. (2013) found that Delta's primary hubs, such as Atlanta, saw reinforced traffic, whereas smaller secondary hubs like Cincinnati and Memphis were effectively shut down post-merger. This reallocation of traffic is influenced by several factors, including pre-existing congestion levels and the strategic importance of certain hubs. The study highlights that congestion at primary hubs can moderate the extent of traffic concentration, leading airlines to utilize secondary hubs to alleviate congestion-related delays.

Moreover, the presence of congestion can also impact fare structures and flight frequencies. Theoretical models suggest that while consolidation generally leads to increased flight frequencies and fares, congestion can mitigate these increases by creating incentives to use less congested, secondary hubs. This adjustment helps airlines manage operational efficiency and maintain service quality across their network.

4 Data

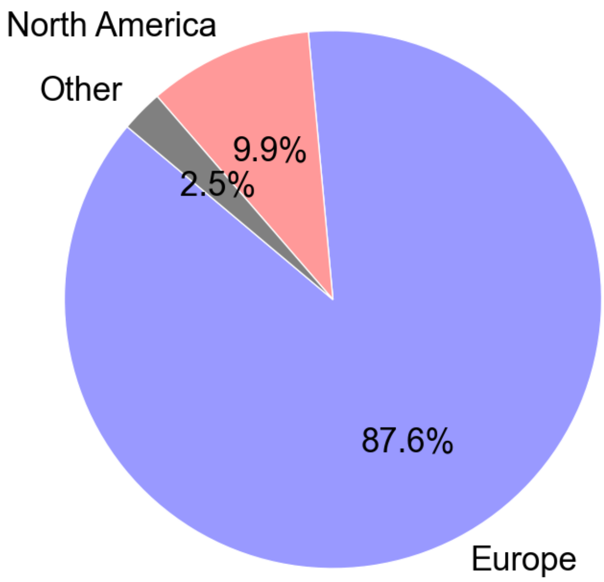
This study utilizes data acquired from RDC Aviation, encompassing 70,330 observations of flights originating from Ireland between January 2002 and March 2024. The subset considered includes 32,225 observations from January 2011, when IAG was formed through the merger of British Airways and Iberia, until December 2019, just before the COVID-19 pandemic severely restricted air travel from Ireland. The dataset provides comprehensive information on each flight, including origin and destination airports, the distance between these airport, the number of seats offered on each flight.

To capture the overall supply of flights on IAG and Aer Lingus routes, I consider every route serviced by either IAG or Aer Lingus over the duration of the dataset as the treatment group. This method enables the evaluation of how the entry and exit of routes by IAG or Aer Lingus influence the total flight frequency from Irish airports. While these are not the only feasible routes for them to service, they are the ones chosen, and thus some dependent variable values will be zero. For example, a route not operated by either IAG or Aer Lingus prior to the merger would have a frequency of zero during that period, but if the route is introduced post-merger, it would increase the overall flight frequency.

To implement this, I compiled a list of every route serviced by either IAG or Aer Lingus over the dataset's duration. Starting from the first time period, I updated these routes to include the IAG airline or Aer Lingus with a frequency of zero if they did not operate the route during that time period. For instance, if Aer Lingus did not operate the Dublin to Seville route before 2015 but started doing so after 2015, I included an observation for Aer Lingus for each year prior to 2015 with a flight frequency of zero.

Each airport is matched to the TL2(OECD, 2024) or NUTS2(European Commission, 2024) region for which they are contained, airports in regions outside the European Union or OECD use national level statistics. The statistics used are annual Gross Domestic Produce (GDP) per-capita and annual population statistics. The reason more localised statistics are used is because they offer a better approximation of demand for flight for specific airport. For example, simply using national level population statistics will not help identify demand for flights to a small regional airport . These localisation are particularly important for European regions, as can be seen in figure 4 that 97.5% of the flights in the data set are to a destination in Europe or North America and more regionalised statistics allow for me to control for travel demand to specific airports.

The Herfindahl-Hirschman Index (HHI) was calculated for each route based on the market



The "Other" category includes destinations in Africa, Asia, The Middle East and the Carribean

Figure 4: Destination Continents of the Data

shares of airlines, which were derived from the total number of departing seats. The HHI provides a measure of market concentration, indicating the level of competition on each route. A higher HHI value signifies a more concentrated market with less competition, while a lower HHI value indicates a more competitive market with a greater number of airlines sharing the market. Within the context of my regressions it is used as a proxy for determining the level of competition on a route at different time periods.

5 The Empirical Model

We examine the full range of route options offered by both IAG member airlines and Aer Lingus throughout the dataset's timeframe. This approach allows for the analysis of new routes within the Differences-in-Differences framework. However, it also introduces computational complexities, as some routes may be non-operational in certain periods, resulting in zero flight frequency. The complexities arise as a result of the lost data that would result from a logarithmic transform of the dependant variable.

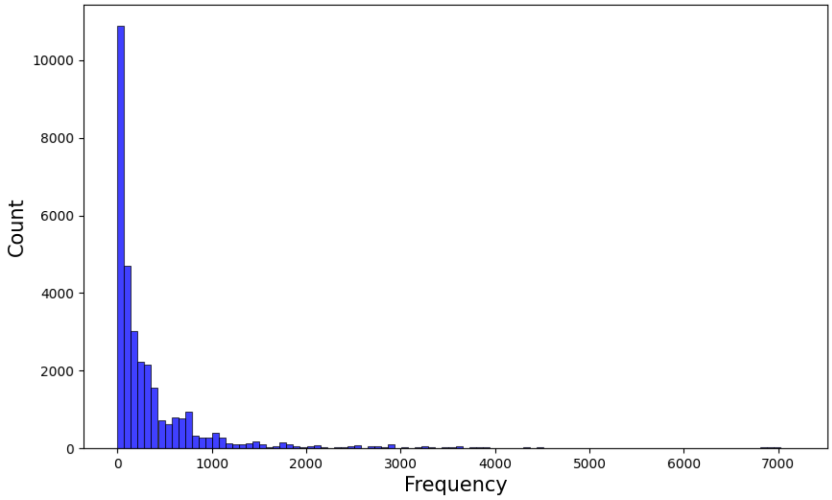


Figure 5: Histogram of Frequency variable

It is for this reason that I have attempted to fit a series of count-data regression models, as they allow for 0 values in the dependant variable, and ultimately settle on a negative-binomial fixed effects models which represents the best fit for my data.The base model specification using Ordinary Least Squares (OLS) regression is as follows:

$$\begin{aligned}\text{Frequency}_{kt} = \beta_0 &+ \beta_1 \text{Distance}_k + \beta_2 \ln(\text{Population})_{kt} + \beta_3 \ln(\text{GDP-pc})_{kt} \\ &+ \beta_4 \ln(\text{Competition})_{kt} + \beta_5 \text{Tourism}_{kt} + \beta_6 \text{Diff-in-Diff}_{kt} + \mu_t \\ &+ \epsilon_{kt}\end{aligned} \tag{1}$$

The dependent variable *Frequency* represents the annual number of flights operated by IAG and Aer Lingus. The *Distance* variable measures the distance between origin and destination airports in nautical miles. To proxy competition, the Herfindahl-Hirschman Index (HHI) is used at the route level. The *Tourism* variable is a dummy indicating tourist locations. The difference-in-differences (DiD) operator, denoted as *Diff-in-Diff*, identifies routes of interest post-merger and is explained further in subsequent sections. Multiple DiD operators are used, each representing different sets of routes to assess the merger's impact. Additionally, μ_t is a vector of annual dummy variables controlling for time-variant heterogeneity, and ϵ_{kt} represents the error term.

Due to the presence of 6084 zero observations in the dependent variable, which indicates non-operational routes in certain periods, I applied a series of count regression models to determine the direct effects.

I began by modeling using a Poisson Pseudo-Maximum Likelihood (PPML) model and a PPML model with route-level fixed effects. The Ramsey RESET test Silva and Tenreyro, 2006, with a chi-squared test statistic of 0.86 and a p-value of 0.3524, suggested no significant evidence of model misspecification or omitted variable bias, indicating that our model was correctly specified. However, a variance-to-mean test indicated a high degree of over-dispersion in the frequency variable, a common result in variables with a substantial number of zero observations. This suggested that a negative binomial model might be more appropriate.

Consequently, I implemented both a negative binomial model and a negative binomial model with route-level fixed effects. Given the high number of zeros in the response variable, I also applied a Zero-Inflated Negative Binomial (ZINB) model to account for the excess zeros. The models were estimated with robust standard errors to correct for any potential heteroskedasticity. The goodness of fit for each model was assessed using the likelihood ratio test. The results of these models are presented in Table 1.

The negative binomial model for flight frequency Frequency_{kt} is specified as:

$$\text{Frequency}_{kt} \sim \text{NegBin}(\mu_{kt}, \alpha) \tag{2}$$

where μ_{kt} is the mean of the distribution and α is the over-dispersion parameter. The mean μ_{kt} is modeled as a function of the covariates:

Table 1: Model Selection

	(1) OLS	(2) PPML	(3) PPML-FE	(4) NB	(5) NB-FE	(6) ZINB
Distance	-0.265***	-0.001***	0.000	-0.001***	-0.000***	-0.001***
	(0.057)	(0.000)	(.)	(0.000)	(0.000)	(0.000)
ln(Population)	126.699***	0.361***	-0.084	0.218***	0.122***	0.218***
	(45.125)	(0.090)	(0.067)	(0.022)	(0.033)	(0.022)
ln(GDP-pc)	327.551***	0.595***	-0.305	0.847***	0.197***	0.847***
	(92.438)	(0.095)	(0.197)	(0.039)	(0.067)	(0.039)
ln(HHI)	-1531.997***	-2.166***	-0.612***	-2.097***	-0.698***	-2.097***
	(202.356)	(0.146)	(0.052)	(0.059)	(0.041)	(0.059)
Tourism	-133.713**	-0.314***	0.000	-0.235***	0.302***	-0.235***
	(58.962)	(0.119)	(.)	(0.042)	(0.082)	(0.042)
Constant	-4686.838***	-5.301***	11.230***	-5.957***	-1.283	-5.957***
	(1172.373)	(1.796)	(2.494)	(0.473)	(0.871)	(0.473)
ln(α)				-0.192***		-0.192***
				(0.030)		(0.030)
inflate						
Distance						-0.000
						(0.000)
ln(Population)						0.000
						(0.024)
ln(GDP-pc)						0.000
						(0.046)
ln(HHI)						0.000
						(0.079)
Tourism						0.000
						(0.049)
Constant						-25.167***
						(0.560)
R-squared	0.417620	0.582383				
Log likelihood	-18100	-338000	-28800	-15700	-10900	-15700
AIC	36300	676000	57600	31400	2.1800	3.1400
BIC	3.6300	676000	57700	31400	2.19e+04	3.1600
Model degrees of freedom	13	13	11	13	14	13

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Year effects controlled for with dummies included but not reported

$$\begin{aligned}\ln(\mu_{kt}) =& \beta_0 + \beta_1 \text{Distance}_k + \beta_2 \ln(\text{Population}_{kt}) + \beta_3 \ln(\text{GDP-pc}_{kt}) + \\ & \beta_4 \text{Competition}_{kt} + \beta_5 \text{Tourism}_{kt} + \beta_6 \text{Diff-in-Diff}_{kt} + \gamma_k\end{aligned} \tag{3}$$

Here, γ_k represents the route-level fixed effects, capturing unobserved heterogeneity across different routes. This model accounts for the over-dispersion, is robust to heteroskedasticity, and is able to evaluate zeros in the flight frequencies.

6 Estimation and Results

In order to capture the full effect of the merger, I make use of seperate estimation strategies. Firstly, I assess the total impact of the merger on flight frequency with Diff-in-Diff$_{fullnetwork}$ operator. This Diff-in-Diff$_{fullnetwork}$ operator captures the change in the total number of flights leaving Irish airports that are operated by any member airline of IAG. This operator will measure the change in these airline operational capacity in Ireland and will determine how the merger affected the Irish . Secondly, I estimate the Diff-in-Diff$_{Anti-Competitive}$. This estimator is similar to those used in other papers examining flight frequency Fageda, 2014b whereby it outlines the effects of frequency changes on routes which IAG and Aer Lingus competed on prior to the merger, the difference between my estimator and Fageda, 2014b is that by including 0 frequencies in my dependant variable, my estimator considers each airlines entry and exit from these routes. Lastly, I interact my Diff-in-Diff$_{fullnetwork}$ with a series of Dummy variables indicating flights to or from specific airports. The airports I examine are Dublin Cork and Shannon as these are the primary and secondary airport hubs in Ireland and indicate regional connectivity. I also examine the change in traffic distribution in flights to IAG's primary hubs, namely; London-Heathrow, Madrid–Barajas and Barcelona-El Prat airports.

The estimation begins by examining the model for routes where Aer Lingus and IAG competed prior to the airline's acquisition. This approach aims to identify any negative effects resulting from the potentially anti-competitive nature of the consolidation.

The table presents the results of three different regression models: OLS, Negative Binomial (NB), and Negative Binomial with Fixed Effects (NB-FE). The focus of our evaluation is on the NB-FE model, as it accounts for both over-dispersion and unobserved heterogeneity across

Table 2: Results

	Full network Flight Frequency			Flight Frequency of Previously Competitve Routes		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	NB	FE NB	OLS	NB	FE NB
Distance	-0.000448***	-0.000497***	-0.000322***	-0.000444***	-0.000495***	-0.000331***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ln(Population)	0.211***	0.210***	0.124***	0.212***	0.215***	0.122***
	(0.026)	(0.022)	(0.033)	(0.025)	(0.022)	(0.033)
ln(GDP-pc)	0.788***	0.802***	0.177***	0.823***	0.835***	0.197***
	(0.045)	(0.039)	(0.067)	(0.043)	(0.039)	(0.067)
ln(HHI)	-2.194***	-2.014***	-0.688***	-2.236***	-2.052***	-0.698***
	(0.073)	(0.057)	(0.041)	(0.071)	(0.060)	(0.041)
Tourism	-0.060	-0.267***	0.301***	-0.013	-0.224***	0.303***
	(0.046)	(0.040)	(0.082)	(0.046)	(0.042)	(0.082)
Diff-in-Diff$_{fullnetwork}$	0.475***	0.365***	0.073**			
	(0.075)	(0.071)	(0.029)			
Diff-in-Diff$_{Anti-Competitive}$				0.717***	0.360***	0.008
				(0.084)	(0.071)	(0.042)
Constant	-6.049***	-5.590***	-1.161	-6.050***	-5.824***	-1.287
	(0.552)	(0.474)	(0.868)	(0.545)	(0.475)	(0.871)
$\ln(\alpha)$		-0.205***			-0.196***	
		(0.031)			(0.030)	
R-squared	0.370			0.365		
Route Fixed Effects	No	No	Yes	No	No	Yes

Standard errors in parentheses

* p<0.10, ** p<0.05, *** p<0.01

Year fixed effects included but not reported

$^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

groups, making it the most appropriate model for the data at hand.

The over-dispersion coefficient $\ln(\alpha)$ in the NB model (Column 2) is -0.205 and is highly significant ($p < 0.01$). This negative value indicates the presence of overdispersion in the data, confirming that the NB model is a better fit than a Poisson model, which assumes equidispersion. However, while the NB model addresses over-dispersion, it does not account for unobserved heterogeneity, which is why the NB-FE model is preferred.

6.0.1 Parallel Trends investigation.

To assess the robustness of the estimates, it is crucial to examine whether the parallel trends assumption is reasonably supported. This assumption is vital for making causal inferences, as it posits that in the absence of the intervention, the treated and control groups would have exhibited similar trends over time. If the pre-treatment trends are indeed parallel, any divergence in post-treatment periods trends may be indicative of the treatment effect (Angrist and Pischke, 2015). A violation of this assumption would undermine the credibility of the estimated treatment effects. To empirically investigate the validity of the parallel trends assumption, I include dummy variables in the regression model to identify each of the merger-affected routes for each year. These dummies capture the difference in average flight frequency between the treated and non-treated routes.

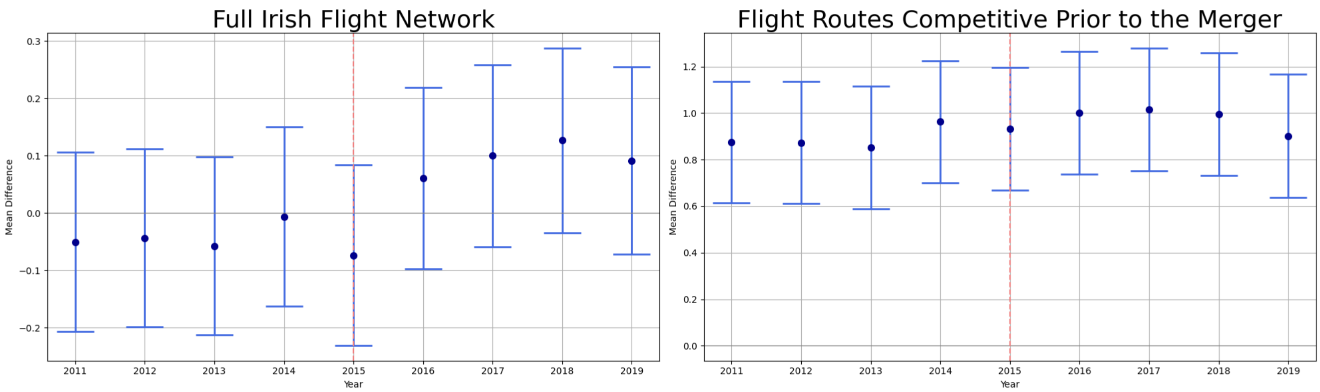


Figure 6: Mean difference in flight frequency. Treated and control groups.

I do this in order to identify pre-treatment trends that could confound the interpretation of the treatment effect. Specifically, I investigate whether any of the pre-treatment years demonstrate a statistically significant influence on flight frequencies, which would suggest a potential deviance from parallel trends (Meyer, 1995; Angrist and Pischke, 2009). As the Parallel trends assumption is not testable, I provide evidence that both treated and control groups follow parallel trend prior to the merger. I perform an equality of means test on both sets of routes. The results are displayed in Figure 6. The equality of means test fails to reject the null hypothesis, which posits that there is no significant difference in average flight frequencies between the treatment and control groups prior to the treatment year. This lack of significant pre-treatment differences suggests that the parallel trends assumption holds, thereby supporting the reliability of the NB-FE model in capturing the causal effects in this context.

6.0.2 Full Network Flight Frequency

The Negative Binomial Fixed Effects regression for the full network flight frequency provides valuable insights into how various factors influence flight frequency across the entire network. The key variables in this model include Distance, Population, GDP per capita, Herfindahl-Hirschman Index (HHI), Tourism, and the Diff-in-Diff$_{fullnetwork}$ indicator.

The coefficient for Distance is negative and highly significant (-0.000322), indicating that longer distances between airports are associated with fewer flights. This result is expected, as longer routes typically incur higher costs and consequently have lower frequencies compared to shorter routes. The logarithm of Population ($\ln$(Population)) shows a positive and significant coefficient (0.124), suggesting that routes serving larger populations tend to have higher flight frequencies due to greater demand. Similarly, the GDP per capita ($\ln$(GDP-pc)) variable has a positive and significant coefficient (0.177), implying that wealthier regions experience higher flight frequencies, likely due to higher disposable incomes and a greater propensity for air travel.

The HHI, ($\ln$(HHI)), has a negative and significant coefficient (-0.688), which suggests that less competitive routes, have lower flight frequencies. This result aligns with the literature that increased competition enhances service frequency as airlines compete. Additionally, the coefficient for Tourism is positive (0.301) and significant, indicating that routes with higher tourism activity see increased flight frequencies, reflecting the high demand generated by tourist traffic.

Finally, the Diff-in-Diff$_{fullnetwork}$ indicator is positive and significant (0.073), suggesting that the merger had a positive impact on flight frequencies across the entire network. This result underscores the beneficial effects of the merger on operational capacity and network connectivity for the involved airlines. It is worth noting that irrespective of the chosen model, the DiD operators is deemed the highest level of significance at the 99% threshold, as outlined in table 1A of the appendix.

6.0.3 Previously Competitive Routes Flight Frequency

The Negative Binomial Fixed Effects regression for previously competitive routes examines the impact on flight frequency for routes where IAG and Aer Lingus competed prior to the merger.

Consistent with the full network model, the coefficient for Distance is negative and significant (-0.000331), indicating that longer routes have fewer flights. The positive and significant coefficient for Population ($\ln$(Population)) (0.122) reinforces the notion that routes serving larger populations have higher flight frequencies, reflecting higher demand. Similarly, the GDP per capita ($\ln$(GDP-pc)) coefficient (0.197) is positive and significant, indicating that wealthier areas enjoy higher flight frequencies, likely due to increased disposable incomes and demand for air travel.

The HHI coefficient is negative and significant (-0.698), consistent with the results for the full network model, suggesting that less competition positively influences flight frequency on these routes. The Tourism variable remains positive (0.303) and significant, highlighting that routes popular with tourists experience increased flight frequencies due to heightened demand.

The Diff-in-Diff$_{Anti-Competitive}$ coefficient, however, is not significant (0.008), indicating that the merger did not significantly impact flight frequencies on previously competitive routes. This result suggests that there was no substantial anti-competitive behavior post-merger, maintaining flight frequencies at levels similar to those observed prior to the acquisition.

6.1 Results

In this section, I present the calculated elasticities and semi-elasticities derived from the estimated NB-FE models. These measures provide precise insights into the effects of various factors on flight frequency.

6.1.1 Total Network Effects

Table 3: Negative Binomial Fixed Effects on Total Network Frequency

Variable	Coefficient	Elasticity	Semi-Elasticity
Distance	-0.0003***		-0.0322***
ln(Population)	0.1244***	0.1244***	
ln(GDP-pc)	0.1765***	0.1765***	
ln(HHI)	-0.6883***	-0.6883***	
Tourism	0.3006***		35.0648***
Diff-in-Diff$_{fullnetwork}$	0.0726**		7.5321**

*** p<0.01, ** p<0.05, * p<0.1

Note: Elasticities are reported for logged variables, semi-elasticities for non-logged variables.

Table 3 presents the results of the Negative Binomial Fixed Effects model estimating the total network frequency. The primary variable of interest, Diff-in-Diff$_{\text{full network}}$, shows a positive and significant coefficient of 0.0726, indicating that that IAG's acquisition of Aer Lingus results in a 7.5321% increase in flight frequency, significant at the 5% level. This result demonstrates a positive impact on the total network frequency, confirming that after the merger flight frequency improved on Aer Lingus & IAG routes indicating an increase in airline quality.

The control variables—Distance, $\ln$(Population), $\ln$(GDP-pc), and Tourism—reflect signs and significance levels consistent with findings from the literature, further validating the model. Specifically, the coefficient for Distance is significant at the 1% level. The semi-elasticity of -0.0322 suggests that each additional nautical mile is associated with a 3.22% decrease in flight frequency. The coefficients for $\ln$(Population) and $\ln$(GDP-pc) are 0.1244 and 0.1765, respectively, both significant at the 1% level. These results indicate that a 1% increase in population or GDP per capita is associated with a 0.1244% and 0.1765% increase in the log count of flight frequency, respectively. These elasticities are aligned with existing literature, reinforcing the robustness of the model. The negative coefficient for $\ln$(HHI) (-0.6883, significant at the 1%

level) suggests that a 1% increase in market concentration, as measured by the Herfindahl-Hirschman Index, corresponds to a 0.6883% decrease in the log count of flight frequency. This result highlights the negative impact of increased market concentration on flight frequency, consistent with the economic theory that higher concentration reduces competition and service frequency. Tourism shows a significant positive effect, with a coefficient of 0.3006 and a semi-elasticity of 35.0648, indicating that the presence of tourism activities significantly boosts flight frequency by 35.0648%. It is worth noting the size of this increase, this is likely as a result of IAG consisting of Vueling and Iberia. According to the Irish governments website, 2.5 million Irish tourists visit Spain annually. Given IAG operates two major Hubs between Barcelona and Madrid, it is ideally placed to capture this demand.

6.1.2 Effects on competitive routes prior to the merger

Table 4: Negative Binomial Fixed Effects on Competitive Routes

Variable	Coefficient	Elasticity	Semi-Elasticity
Distance	-0.0003***		-0.0331***
ln(Population)	0.1216***	0.1216***	
ln(GDP-pc)	0.1972***	0.1972***	
ln(HHI)	-0.6977***	-0.6977***	
Tourism	0.3026***		35.3389***
Diff-in-Diff$_{Anti-Competitve}$	0.0078		0.7832

*** p<0.01, ** p<0.05, * p<0.1

Note: Elasticities are reported for logged variables, semi-elasticities for non-logged variables.

Table 4 reports the results from a Negative Binomial Fixed Effects model on routes where IAG and Aer Lingus competed against eachother prior to the merger. The control variables—Distance, $\ln$(Population), $\ln$(GDP-pc), and Tourism—reflect signs and significance levels consistent with findings from the literature, validating the model.

The most significant result in Table 4 The primary variable of interest, Diff-in-Diff$_{Anti-Competitve}$, shows a coefficient which is not statistically significant. Indicating that there is no significant drop in flight frequency in shared routes, and as a result there is no indication of collusive behaviour post merger.

6.1.3 Effects on the Redistribution of routes

In order to investigate whether certain Irish airports have experienced a drop in flight frequency, I interacted the Diff-in-Diff operator with dummy variables representing each of the Irish secondary airport, as well as dummy variables representing each of IAG's major hubs. The IAG hubs examined were London-Heathrow (LHR) , Barcelona-El Prat Airport (BCN), Madrid–Barajas Airport(MAD) while hte irish airports wher Cork airport (ORK), Shannon airport (SNN) and Dublin Airport (DUB).

Table 5: Negative Binomial Fixed Effects Regression Results (Distributed Effects)

Variable	Coefficient	Elasticity	Semi-Elasticity
Distance	-0.0003***		-0.0339***
ln(Population)	0.1360***	0.1360***	
ln(GDP-pc)	0.2133***	0.2133***	
ln(HHI)	-0.6814***	-0.6814***	
Tourism	0.2891***		33.5223***
Diff-in-Diff$_{DUB}$	0.1203***		12.7812***
Diff-in-Diff$_{ORK}$	-0.0639		-6.1932
Diff-in-Diff$_{SNN}$	-0.1227*		-11.5444*
Diff-in-Diff$_{NOC}$	0.0076		0.7662
Diff-in-Diff$_{LHR}$	-0.0851		-8.1616
Diff-in-Diff$_{MAD}$	0.1761		19.2590
Diff-in-Diff$_{BCN}$	0.1593		17.2724

*** p<0.01, ** p<0.05, * p<0.1

Note: Elasticities are reported for logged variables, semi-elasticities for non-logged variables.

Tourism, again, shows a significant positive effect, with a coefficient of 0.2891 and a semi-elasticity of 33.5223, indicating that the presence of tourism activities significantly boosts flight frequency by 33.5223%.

The variables Diff-in-Diff$_{\text{NOC}}$, Diff-in-Diff$_{\text{ORK}}$, Diff-in-Diff$_{\text{LHR}}$, Diff-in-Diff$_{\text{MAD}}$, and Diff-in-Diff$_{\text{BCN}}$ show coefficients that are not statistically significant. However, the variable Diff-in-Diff$_{\text{SNN}}$ shows a negative coefficient of -0.1227, significant at the 10% level. The semi-elasticity is -11.5444, indicating that the merger is associated with an 11.5444% decrease in flight frequency. This would indicate that since IAG's acquisition of Aer lingus they have decreased the number of flights operating out of Shannon airport. Shannon airport is a secondary hub located in the South-West of Ireland and this result signifies a fall in welfare of the people in this region.

This is however in line with the literature. Bilotkach et al., 2013 shows that upon consolidation, hub-and-spoke airlines primary hubs experience an increase in airline traffic at the expense of secondary airports. This hypothesis is further supported by the fact that the Diff-in-Diff$_{DUB}$ shows a positive coefficient of 0.1203, significant at the 1% level. This indicates that Dublin airport, Ireland primary hub and one of IAG's primary hubs, experiences a 12.7812% increase in flight frequency as a result of the merger.

Overall, these findings support the conclusion that various economic and demographic factors significantly influence flight frequencies on redistributed routes, with notable impacts from market concentration, tourism activities, and specific regional interventions.

7 Conclusion

This study provides a comprehensive analysis of the impact of International Airlines Group's (IAG) acquisition of Aer Lingus on the Irish air transportation market. Utilizing a Differences-in-Differences methodology, the research examines changes in flight frequency and competition across various routes departing from Irish airports. The findings reveal several key insights.

First, the acquisition led to a significant increase in annual flight frequencies departing from Irish airports. This increase suggests that the integration of Aer Lingus into the IAG network improved the operational capacity and network connectivity. The analysis indicates a 7.5321% rise in flight frequency across IAG & Aer Lingus combined network of routes, highlighting the beneficial effects of the merger on airline service quality.

Second, the study finds no significant evidence of anti-competitive behavior on routes where IAG and Aer Lingus previously competed. The coefficient for the Diff-in-Diff$_{Anti-Competitive}$ variable is not statistically significant, indicating that flight frequencies on these routes remained stable post-acquisition. This stability suggests that the merger did not lead to collusive behavior or a reduction in service levels on competitive routes, aligning with the commitments made by IAG to preserve competition.

Third, the redistribution of routes analysis reveals that the merger had varying impacts on different Irish airports. Dublin Airport, as a primary hub, experienced a notable increase in flight frequency, while Shannon Airport saw a decrease. This shift aligns with the literature on airline consolidations, which often results in increased traffic at primary hubs at the expense of secondary airports (Bilotkach,Fageda,& Flores-Fillol 2013). This indicates a fall in the welfare of airline passengers in the south west of Ireland. The findings underscore the importance of strategic oversight in maintaining regional connectivity and addressing potential disparities in service distribution.

Overall, this study supports the European Commission's decision to approve the IAG acquisition of Aer Lingus, demonstrating that the merger was beneficial for the Irish air transportation market overall. It highlights the importance of regulatory frameworks in ensuring that mergers and acquisitions enhance market efficiency without compromising competition. A potential topic for future research would be into the price effects of this merger as is done in Fageda & Perdiguero 2014 to provide a complete overview of the markets dynamics.

The insights gained from this analysis contribute to the broader understanding of airline mergers and their implications for market dynamics. By providing empirical evidence on the positive outcomes of the IAG and Aer Lingus merger, this study offers valuable guidance for policymakers and stakeholders in evaluating and regulating future airline consolidations. The study also highlights the benefits that can be enjoyed as a result of good regulatory controls. The European Commissions decisions in firstly rejecting Ryanair's attempted acquisitions of Aer Lingus, which would have effectively granted them a near monopoly position in the Irish air transportation market and likely have lowered the public welfare as is commonly the case in monopoly market, and its subsequent approval of IAG's acquisition of Aer Lingus which I have shown improved the quality of IAG and Aer Lingus service in Ireland highlights the importance of prudent competition policy.

References

Angrist, J. D., & Pischke, J.-S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.

Angrist, J. D., & Pischke, J.-S. (2015). *Mastering 'metrics: The path from cause to effect*. Princeton University Press.

Barrett, S. D. (2006). Commercialising a national airline—the aer lingus case study. *Journal of Air Transport Management*, *12*(3), 159–167. https://doi.org/10.1016/j.jairtraman.2005.11.001

Bilotkach, V. (2011). Multimarket contact and intensity of competition: Evidence from an airline merger. *Review of Industrial Organization*, *38*(1), 95–115. https://doi.org/10.1007/s11151-010-9274-4

Bilotkach, V., Fageda, X., & Flores-Fillol, R. (2013). Airline consolidation and the distribution of traffic between primary and secondary hubs. *Regional Science and Urban Economics*, *43*(6), 951–963. https://doi.org/10.1016/j.regsciurbeco.2013.09.013

Borenstein, S. (1990). Airline mergers, airport dominance, and market power. *The American Economic Review*, *80*(2), 400–404. https://www.jstor.org/stable/2006608

Commission, E. (2013). *Commission decision of 27.2.2013 declaring a concentration to be incompatible with the internal market and the eea agreement (case no comp/m.6663 - ryanair / aer lingus iii)* (tech. rep.). European Commission. https://ec.europa.eu/competition/mergers/cases/decisions/m6663_20130227_20600_3582534_EN.pdf

European Commission, J. R. C. ((2024). Ardeco database [Accessed: 2024-07-09]. https://urban.jrc.ec.europa.eu/ardeco/viewer/89293?jdvfys=asc&jdvfc=all&jdvfnl=9%2C0%2C1%2C2%2C3

Fageda, X. (2014a). An empirical assessment of the merger between iberia, clickair and vueling. *Cuadernos Económicos de ICE*, *88*, 73–88. https://www.ice-revista.es/en/

Fageda, X. (2014b). What hurts the dominant airlines at hub airports? *Institut de Recerca en Economia Aplicada Regional i Pública Document de Treball*, (2014/14), 1–21. https://www.ub.edu/irea/

Fageda, X., & Flores-Fillol, R. (2012a). Air services on thin routes: Regional versus low-cost airlines. *Regional Science and Urban Economics*, *42*(4), 702–714. https://doi.org/10.1016/j.regsciurbeco.2012.03.005

Fageda, X., & Flores-Fillol, R. (2012b). On the optimal distribution of traffic of network airlines. *European Economic Review*, *56*(6), 1164–1179. https://doi.org/10.1016/j.euroecorev.2012.05.001

Fageda, X., & Perdiguero, J. (2014). An empirical analysis of a merger between a network and low-cost airlines. *Journal of Transport Economics and Policy*, *48*(1), 81–96. https://www.jstor.org/stable/24396250

Gaggero, A. A., & Piga, C. A. (2010). Airline competition in the british isles. *Transportation Research Part E: Logistics and Transportation Review*, *46*(2), 270–279. https://doi.org/10.1016/j.tre.2009.08.009

Gregory J. Werden, A. S. J., & Johnson, R. L. (1991). The effects of mergers on price and output: Two case studies from the airline industry. *Managerial and Decision Economics*, *12*(5), 341–352. https://www.jstor.org/stable/2487230

Kim, E. H., & Singal, V. (1993). Mergers and market power: Evidence from the airline industry. *The American Economic Review*, *83*(3), 549–569. https://www.jstor.org/stable/2117533

Meyer, B. D. (1995). Natural and quasi-experiments in economics. *Journal of Business Economic Statistics*, *13*(2), 151–161. https://doi.org/10.2307/1392369

Morrison, S. A. (1996). Airline mergers: A longer view. *Journal of Transport Economics and Policy*, *30*(3), 237–250. https://www.jstor.org/stable/20053705

O'Connell, J. F., & Connolly, D. (2017). The strategic evolution of aer lingus from a full-service airline to a low-cost carrier and finally positioning itself into a value hybrid airline. *Tourism Economics*, *23*(6), 1296–1320. https://doi.org/10.1177/1354816616683492

OECD. (2024). Oecd data explorer: Tl2 populations [Accessed: 2024-07-09]. https://data-explorer.oecd.org/vis?tm=TL2%20populations&pg=0&snb=39&vw=tb&df%

5Bds%5D=dsDisseminateFinalDMZ&df%5Bid%5D=DSD_REG_DEMO@DF_POP_BROAD&df%5Bag%5D=OECD.CFE.EDS&df%5Bvs%5D=2.0&pd=2002,&dq=A.TL2+TL3.CAN+MEX+ME09+ME15+ME15R1+ME15R2+ME15R3+ME15R4+ME15R5+ME15R6+ME15R7+ME15R8+USA+US01+US02+US04+US05+US06+US08+US09+US10+US11+US12+US13+US178+US179..POP._T._T.PS&to%5BTIME_PERIOD%5D=false

Richard, O. (2003). Flight frequency and mergers in airline markets. *International Journal of Industrial Organization*, *21*(6), 907–922. https://doi.org/10.1016/S0167-7187(03)00002-X

Silva, J. M. C. S., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics*, *88*(4), 641–658. https://doi.org/10.1162/rest.88.4.641

Volodymyr Bilotkach, X. F., & Flores-Fillol, R. (2008). Scheduled service versus personal transportation: The role of distance. *Document de Treball XREAP*, (2008-13). https://www.xreap.cat/documents/2008/working-papers/2008-13

Appendix

Table 6: Difference-in-Difference operator in each model choice

	(1) OLS	(2) PPML	(3) PPML-FE	(4) NB	(5) NB-FE	(6) ZINB
Distance	-0.259***	-0.001***	0.000	-0.000***	-0.000***	-0.000***
	(0.057)	(0.000)	(.)	(0.000)	(0.000)	(0.000)
$\ln$(Population)	124.786***	0.358***	-0.083	0.210***	0.124***	0.210***
	(45.100)	(0.089)	(0.067)	(0.022)	(0.033)	(0.022)
$\ln$(GDP-pc)	316.092***	0.569***	-0.339*	0.802***	0.177***	0.802***
	(93.449)	(0.094)	(0.185)	(0.039)	(0.067)	(0.039)
$\ln$(HHI)	-1505.348***	-2.097***	-0.599***	-2.014***	-0.688***	-2.014***
	(202.005)	(0.144)	(0.052)	(0.057)	(0.041)	(0.057)
Tourism	-141.707**	-0.343***	0.000	-0.267***	0.301***	-0.267***
	(59.529)	(0.117)	(.)	(0.040)	(0.082)	(0.040)
Diff-in-Diff$_{fullnetwork}$	110.788**	0.380***	0.097**	0.365***	0.073**	0.365***
	(45.562)	(0.139)	(0.043)	(0.071)	(0.029)	(0.071)
Constant	-4576.876***	-5.178***	11.500***	-5.590***	-1.161	-5.590***
	(1183.486)	(1.810)	(2.356)	(0.474)	(0.868)	(0.474)
$\ln(\alpha)$				-0.205***		-0.205***
				(0.031)		(0.031)
inflate						
Distance						0.000
						(0.000)
$\ln$(Population)						-0.000
						(0.024)
$\ln$(GDP-pc)						-0.000
						(0.046)
$\ln$(HHI)						-0.000
						(0.080)
Tourism						-0.000
						(0.049)
Diff-in-Diff$_{fullnetwork}$						0.000
						(0.065)
Constant						-25.042***
						(0.562)
R-squared	0.417620	0.582383				
Log likelihood	-18100	-338000	-28800	-15700	-10900	-15700
AIC	36300	676000	57600	31400	2.1800	3.1400
BIC	3.6300	676000	57700	31400	2.19e+04	3.1600
Model degrees of freedom	13	13	11	13	14	13

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Year effects controlled for with dummies included but not reported