ÚDARÁS EITLÍOCHTA NA hÉIREANN
IRISH AVIATION AUTHORITY

Appendix 3: Passenger and commercial revenue econometrics

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1. Passenger Forecast

1.1 We estimate separate log-log regression models between historical passenger traffic at Dublin Airport and 1) Irish GDP and 2) Irish GNI*. We have estimated the relationship over three different historical periods: 1995-2025, 1997-2025 and 2000-2025. We have also estimated the relationship when taking three different approaches to the treatment of the Covid-19 period (2020-2022):

A. Including dummy variables for the three years

B. Excluding the data from 2020-2022

C. Including the data from 2020-2022 with no amendments

GDP

1.2 We use outturn GDP data from the CSO, and historic passenger numbers from Dublin Airport's regulatory accounts, to estimate the below elasticities. In each scenario we find the relationship between GDP and passengers is strongest in Period 1 (data from 1995-2025). This is based on the R^2 for each model. It is also the case that, for each scenario, the fit is strongest the more data points that are included.

Table 1.1: Scenario A, GDP, with dummies for 2020-2022

Period	Timeline	elasticity	std_error	Rsq
1	1995-2025	0.93	0.09	0.82
2	1997-2025	0.87	0.10	0.78
3	2000-2025	0.82	0.13	0.74

Source: IAA

1.3 In GDP Scenario A.1, we observe the highest elasticity. It is marginally higher than the elasticity that is estimated over the same period when data relating to 2020, 2021 and 2022 are removed completely from the model.

Table 1.2: Scenario B, GDP, removing 2020-2022 data

Period	Timeline	elasticity	std_error	Rsq
1	1995-2025	0.91	0.05	0.94
2	1997-2025	0.85	0.05	0.93
3	2000-2025	0.78	0.05	0.91

Source: IAA

1.4 By removing the data from 2020-2022, we observe the lowest standard errors and the highest R squared values across the GDP scenarios. This suggest a model that fits the historic data well, although this alone does not guarantee causality. Unlike scenarios A and C, in scenario B the standard errors are consistent at .05 in each time period.

Table 1.3: Scenario C, GDP, including 2020-2022 data with no dummies

Period	Timeline	elasticity	std_error	Rsq
1	1995-2025	0.60	0.14	0.38
2	1997-2025	0.50	0.16	0.26
3	2000-2025	0.38	0.19	0.14

Source: IAA

1.5 Scenario C demonstrates the breakdown of the relationship between GDP and passengers over the Covid-19 period. The standard errors are highest in this scenario and the R^2 has dropped to 0.14 in Scenario C.3. This suggests a model with low explanatory power that may produce unreliable estimates.

*GNI**

1.6 We use outturn GNI* data from the CSO and historic passenger numbers from Dublin Airport's regulatory accounts to estimate the below elasticities. As with GDP, in each scenario we find the relationship between GNI* and passengers is strongest in Period 1 (data from 1995-2025). This is based on the R^2 and standard error in each model. Unlike GDP, the elasticity is highest in Scenario A.2 (1997-2025), although there is minimal variation in elasticities across each time period in Scenario A.

Table 1.4: Scenario A, GNI*, with dummies for 2020-2022

Period	Timeline	elasticity	std_error	Rsq
1	1995-2025	1.69	0.16	0.82
2	1997-2025	1.70	0.20	0.77
3	2000-2025	1.69	0.27	0.72

Source: IAA

1.7 The elasticities for each period in Scenario A are stronger than any time period in Scenarios B or C. This implies a strong responsiveness in passenger numbers from changes to GNI*. The standard errors in Scenario A are considerably higher than in Scenario B.

Table 1.5: Scenario B, GNI*, removing 2020-2022 data

Period	Timeline	elasticity	std_error	Rsq
1	1995-2025	1.65	0.09	0.93
2	1997-2025	1.64	0.11	0.90
3	2000-2025	1.59	0.15	0.84

Source: IAA

1.8 As with GDP Scenario B, we observe the lowest standard errors and the highest R squared values in GNI* Scenario B. This suggests a model that fits the historic data well. Scenario B still estimates high elasticities in each time period, although not as high as those in Scenario A. The R squared values are similar to the values estimated under the GDP Scenario B.

Table 1.6: Scenario C, GNI*, including 2020-2022 data with no dummies

Period	Timeline	elasticity	std_error	Rsq
1	1995-2025	1.30	0.25	0.48
2	1997-2025	1.21	0.31	0.35
3	2000-2025	1.06	0.42	0.21

Source: IAA

1.9 As in the corresponding GDP scenario, Scenario C is reflective of the severing of relationship between macroeconomic activity and passenger numbers at Dublin Airport over the Covid-19 period. The standard errors are highest in this scenario and the R^2 has dropped to 0.121 in Scenario C.3. Though the standard errors in GNI* Scenario C are higher than in the corresponding GDP scenario, the R^2 for each time period is higher. Regardless, Scenario C GNI* suggests a model with low explanatory power.

*GDP vs GNI**

1.10 Across all scenarios, the GNI* elasticities are considerably higher than GDP elasticities. This suggests that Dublin Airport passenger numbers are more sensitive to changes in GNI* than in GDP.

1.11 The standard errors are higher in the GNI* scenarios than each of the corresponding GDP scenario, while the R^2 values are similar across the corresponding models. The standard errors may be higher for GNI* than GDP in Ireland because GNI* is a constructed measure that involves multiple adjustments to remove multinational distortions, which can introduce additional measurement error.

1.12 We discuss further in the passenger forecast section our rationale for the time period and covid years treatment scenario we ultimately apply. We also explain our position why we think there is merit in giving equal weight to both GDP and GNI* as the macroeconomic variables.

2. Commercial Revenue Forecast

Overview

2.1 Our commercial revenue forecasts have been developed using econometric regressions to estimate suitable elasticities for various revenue lines. For each category, up to six different linear regression models are used to calculate the elasticities. Our regression models test the strength of relationships between each revenue line and different drivers. We calculate log-log regressions; coefficient outputs are therefore interpreted as elasticities. A summary of the structure of each model is shown in Table 2.1.

Table 2.1: Structure of Econometric Models

Model	Variables			
Model 1	Passengers	Covid		
Model 2	Passengers	Covid	Trend	
Model 3	Passengers	Covid		GDP
Model 4	Passengers	Covid	Trend	GDP
Model 5		Covid	Trend	GDP
Model 6		Covid		GDP

Source: IAA

2.2 As discussed in Section 8, we include (where available) data from 2001 to 2025, inclusive, in our assessment. We note that Covid-19 caused a temporary sharp decline in commercial revenues across the period 2020-2022. To control for this negative external shock, we include control variables over this period to isolate this impact. Similar to the passenger forecast elasticities outlined above, we do this by including a dummy variable in each year 2020-2022 (inclusive).

2.3 As noted in the 2022 Review Decision, these tests are being carried out on annual time-series data with a small sample size. However, to estimate relationships as accurately as possible, we believe annual data is more appropriate than monthly as, although passenger numbers can be assessed on a monthly basis, GDP is typically only reported quarterly.

2.4 While we model up to six different linear regressions for each revenue line assessed, we remain of the opinion that it is not appropriate to simultaneously calculate combined passenger and GDP elasticities – i.e. we do not calculate the combined effect of multiple variables but rather stick to a simple elasticity with respect to one driver. Variance Inflation Factor (VIF) diagnostic results suggest our model explanatory variables contain issues with multicollinearity. Multicollinearity in regression analysis can lead to wider confidence intervals and larger standard errors.

2.5 As a general rule, a VIF result of 1 indicates no multicollinearity, 1-5 indicates mild/moderate multicollinearity, and greater than 5 indicates a multicollinearity issue. The results of our VIF diagnostic tests are included in Table 2.2. We note models 4 and 5 contain significant multicollinearity issues. While the results of model 3 fall within the acceptable bound, we are not convinced the trade-off between calculating a combined GDP and passenger elasticity is justified. As shown in Table 2.2, the introduction of a GDP variable to a model which already contains a passenger variable degrades the VIF diagnostic results. This is to be expected as GDP and passenger numbers are relatively correlated (as shown in Section 1 above).

2.6 As a result, we are minded to view the results of model 1,2, and 6 more favourably than

models 3-5.

Table 2.2: VIF Diagnostic Results

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger	2.21	3.11	3.37	3.65	-	-
Covid	2.21	3.35	3.91	4.97	1.46	1.17
GDP	-	-	1.78	43	36.65	1.17
Trend	-	1.54	-	37.17	34.36	

Source: IAA

2.7 While it is typical that trend and GDP variables would be highly correlated, as Irish GDP has grown strongly over the last decade, we consider it appropriate to include a trend component in our assessment. This is particularly useful in models which contain a passenger variable, but less so in models with GDP due to issues with multicollinearity.

Net Direct Retail

2.8 We estimate a passenger elasticity of 1.12 for net direct retail, taking the results of Model 1 as being most appropriate. This is lower than the 2022 Review Decision estimate of 1.3 for overall retail (i.e., including net direct retail, F&B, and retail concessions).

2.9 Diagnostic results of Model 1 show that a high level of the variation in net direct retail revenues can be explained by passenger numbers. We also note the model is statistically significant at the 1% significance level. In Model 2, the trend component is insignificant, and its inclusion reduces the significance of the model as a whole.

Table 2.3: Net Direct Retail Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	1.12***	1.03***	0.76***	0.76***	-	-
Covid	0.12**	0.08	-0.08	-.12*	-.48***	-.44***
GDP Elasticity	-	-	.46***	1.44***	2.06***	1.08***
Trend	-	0.00	-	-.02***	-.22***	-
Adj R-Squared	0.82	0.82	0.86	0.93	0.79	0.73
F-Stat	55.47***	36.25***	51.26***	85.53***	31.11***	33.18***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.10 A passenger elasticity of greater than 1.0 is intuitive and likely also captures the impact of income increases (i.e. the elasticity results from both increasing passenger volumes, and the increasing real average spend per passenger).

F&B

2.11 We estimate a passenger elasticity of between 0.94 and 1.31 for F&B revenues, based on the results of Model 1 and Model 2. However, we note, unlike for net direct retail, in Model 2 the trend variable is statistically significant. We also note the impact of including the trend component increased the explanatory power of Model 2, while the overall statistical value increased significantly. On this basis, we believe that the results of Model 2 are more robust than those of Model 1. We therefore propose a passenger elasticity of 0.94.

2.12 We believe an estimate below 1.0 to be somewhat intuitive. Unlike for net direct retail, the F&B operation at Dublin Airport is concession operated, with operators responsible for their own operational costs. The success of these units is therefore, to an extent, outside of the control of Dublin Airport post-tender award. In addition, the terms of the concession agreements in place can also lead to revenues not increasing directly in line with passenger numbers (for example, if the agreed MAG turns out to be overly ambitious for concessionaires).

Table 2.4: F&B Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	1.31***	.94***	.85***	.85***	-	-
Covid	.26***	0.05	-.02	-.01	-.41***	-.42***
GDP Elasticity	-	-	.61***	.49***	1.18***	1.29***
Trend	-	.01***	-	0	0	-
Adj R-Squared	0.91	0.97	0.98	0.98	0.82	0.83
F-Stat	119.36***	258.27***	419.95***	314.54***	38.36***	59.94***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.13 We note the results of our analysis also show GDP to be statistically significant, resulting in a GDP elasticity of 1.29 under Model 6. However, the robustness of Model 6 is significantly below that of Model 2, and we consider a passenger elasticity continues to be the most appropriate driver.

Retail Concessions

2.14 For retail concessions, we estimate a passenger elasticity of between 0.66 and 0.86 under Model 2 and Model 1 respectively. We believe these results are intuitive as in recent years, Dublin Airport's strategy has involved a shift from retail concession units to insourced direct retail. The robustness diagnostics suggest both Model 1 and Model 2 provide good explanation of the variance in the model, with both models also significant as indicated by the F-Stat.

Table 2.5: Retail Concession Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	.86***	.66***	.68***	.68***	-	-
Covid	.12***	0	0.01	0.02	-.30***	-.31***
GDP Elasticity	-	-	.24*	-.11	0.44	.78***
Trend	-	.01***	-	.01*	0.01	-
Adj R-Squared	0.86	0.89	0.88	0.89	0.68	0.68
F-Stat	74.89***	68.76***	58.84***	49.83***	18.25***	26.66***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.15 While under Model 6 GDP also appears to be statistically significant, we consider a passenger elasticity to better represent the underlying data as, intuitively, this revenue stream relies more on passengers than GDP. As discussed in Section 8, we propose to accept Dublin Airport's suggested elasticity of 0.75, which is broadly the midpoint of our two estimates.

Car Parking

2.16 We estimate a passenger elasticity of between 0.93 and 1.13 for car parking revenues, based on the results of Model 1 and Model 2 of our econometric assessment. We note that both models represent a good fit with the data, and both are statistically significant at the 1% level.

Table 2.6: Car Parking Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	.93***	1.13***	.85***	.85***	-	-
Covid	0.1	.21**	0.05	0	-.4***	-.35***
GDP Elasticity	-	-	0.1	1.53***	2.22***	.79***
Trend	-	-.01	-	-.03***	-.03***	-
Adj R-Squared	0.75	0.77	0.74	0.95	0.71	0.52

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.17 While the explanatory power of Model 4 is greater than that of Model 1 and Model 2 (as measured by the adjusted R-squared statistic), for the multicollinearity reasons we have set out above, we do not propose to use either the GDP or passenger elasticity of this model.

2.18 Intuitively, a passenger elasticity of greater than 1.0 is not incongruous with an operation which is yield managed due to excess demand at certain times. However, for the reasons outlined in Section 8, we propose to adopt a passenger elasticity of 1.0.

2.19 We note under Model 6 GDP is also statistically significant. However, based on robustness diagnostic results, we believe a passenger elasticity better represents the underlying car park revenue relationship which is predominantly driven by passenger volumes.

Advertising

2.20 We estimate a passenger elasticity of between 0.81 and 0.43 for advertising revenues based on the results of Model 1 and Model 2. Under both assessments, the models represent the variation in advertising revenues well and are statistically significant at the 1% level of significance.

2.21 In the 2022 Review Decision, we used a passenger elasticity of 0.8 with respect to advertising revenues. However, as discussed in Section 8, Dublin Airport failed to meet out targets over the regulatory period. We consider an elasticity at the bottom of our range is more appropriate, particularly given we account for CIP2020+ and CIP27 projects through additional uplifts. We also note that Model 2 provides a comparatively better fit to the underlying data then Model 1, as represented by the adjusted R-squared metric.

Table 2.7: Advertising Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	.81***	.43***	.48**	.48***	-	-
Covid	0.06	-.14	-.13	-.11	-.33***	-.36***
GDP Elasticity	-	-	.43**	-.25	0.14	.82***
Trend	-	.01***	-	.02**	.02*	-
Adj R-Squared	0.68	0.78	0.73	0.77	0.69	0.66

F-Stat	25.99***	28.77***	22.41***	21.2***	10.03***	23.83***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.22 We note that Model 6 indicates a statistically significant GDP elasticity of 0.82 and explains a similar amount of the variation as Model 1. However, we continue to consider that passenger volumes are the better driver of advertising revenues. The attractiveness of Dublin Airport to advertising customers is by nature linked to the passenger throughput. We do not consider a combined impact of passengers and GDP for the reasons set out above.

Commercial Property

2.23 We estimate a GDP elasticity for commercial property of 0.63. Despite the adjusted R-squared reducing between Model 5 and Model 6 when the trend variable is removed, for the reasons of multicollinearity identified earlier, we do not believe results from Model 5 provide a reasonable estimate of the GDP elasticity. Under Model 6, the GDP variable is statistically significant at the 1% level of significance, and overall, the model is the most significant of those assessed, as measured by the F-statistic.

Table 2.8: Commercial Property Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	.48***	-.02	-.02	-.02	-	-
Covid	.25***	-.02	-0.04	-.02	-.01	-.03
GDP Elasticity	-	-	.65***	-.01	-.03	.63***
Trend	-	.01***	-	.01***	.01***	-
Adj R-Squared	0.44	0.78	0.69	0.77	0.78	0.70
F-Stat	10.38***	28.83***	18.55***	20.59***	28.78***	29.11***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.24 Our estimate is lower than that used in the 2022 Review Decision. However, we note revenues from commercial property remain below pre-pandemic levels. We therefore believe this is an intuitive result with, as discussed in Section 8, Dublin Airport's property portfolio is largely at full occupancy with the scope for significant step-changes therefore limited without further expansion of the portfolio.

Lounges

2.25 We estimate a passenger elasticity of between 1.4 and 1.9 for lounge revenues under Model 2 and Model 1 respectively. Both models show a good fit to the underlying data. We note that both models are statistically significant at the 1% level, and the passenger variable also significant at the 1% level.

2.26 Although Model 6 shows a statistically significant relationship between lounge revenues and GDP, the overall fit of the model is not as robust as that of Models 1 and 2. We note the overall significance of the model, as measured by the F-statistic, although significant at the 1% level, is not as strong as those of Models 1 and 2. We also consider that lounge revenues are more closely related to passenger volumes than to GDP.

Table 2.9: Lounge Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	1.88***	1.44***	1.41***	1.5***	-	-
Covid	.27*	0.02	-.01	0.08	-.68***	-.67***
GDP Elasticity	-	-	.99**	-.91	2.51	2.03***
Trend	-	.03***	-	0.06	-.02	-
Adj R-Squared	0.83	0.92	0.91	0.91	0.62	0.65
F-Stat	30.99***	45.44***	39.61***	31.58***	7.4***	12.28***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.27 Based on the results of the econometric analysis, we propose a passenger elasticity at the bottom of our calculated range. As discussed in Section 8, we have taken into consideration the impact of Dublin Airport's lounge offering overhaul, and believe an elasticity of 1.4 is a more reasonable, yet challenging, estimate. We note, based on our analysis, Model 2 provides a better fit to the underlying data, and consider a passenger elasticity of greater than 1.0 to be intuitively reasonable, again likely also capturing the impact of higher GDP.

Platinum Services

2.28 The results of our econometric analysis with respect to Platinum Services revenues are overall quite weak. We estimate a passenger elasticity of between 0.65 (insignificant at the 10% level), and 1.44 (significant at the 5% level). This is likely linked to the extent to which these revenues have moved significantly in the periods where Dublin Airport has introduced new or improved products.

2.29 We note that Model 6 provides reasonable regression results. However, we do not assess it is intuitive that GDP should act as a driver for Platinum Services revenues. While the service is of course a premium offering which should be impacted to some extent by GDP, we believe it is more reasonable to continue to use passenger volumes as the trend driver.

Table 2.10: Platinum Services Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	1.44**	0.65	0.5	0.44	-	-
Covid	.63**	0.17	0.05	-.01	-.23	-.18
GDP Elasticity	-	-	2.03***	3.22	4.22*	2.38***
Trend	-	.06***	-	-.04	-.06	-
Adj R-Squared	0.37	0.76	0.81	0.79	0.78	0.78
F-Stat	4.53**	13.68***	13.68***	12.29***	15.08***	22.52***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.30 Based on the results of our analysis, and noting the discussion in Section 8, we propose a passenger elasticity of 1.0 for Platinum Services.

FastTrack

2.31 Our econometric analysis yields a passenger elasticity of between 1.14 and 2.1 for FastTrack revenues. We note that Model 2 provides results which are statistically significant across all

variables, with a high level of the variation in the underlying data explained by the model. Of all models assessed, Model 2 also has the highest overall statistical significance as measured by the F-statistic.

2.32 We note that under Model 6, GDP also appears to be statistically significant with respect to Fastrack revenues. However, like with respect to Platinum Services and lounges, we consider passenger numbers to be a more appropriate driver of FastTrack revenues. We also note the adjusted R-squared is lower under Model 6 than Model 2, indicating less explanatory power, while the overall model significance is also less.

Table 2.11: Fast Track Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	2.1***	1.14***	1***	1.04***	-	-
Covid	.75**	.2*	0.07	0.12	-.41**	-.39***
GDP Elasticity	-	-	2.35***	1.45	3.82	3.09***
Trend	-	.07***	-	0.03	-.02	
Adj R-Squared	0.55	0.92	0.93	0.92	0.81	0.82
F-Stat	8.21***	48.38***	51.23***	35.54***	17.55***	28.88***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.33 As discussed in Section 8, we propose a passenger elasticity of 1.0 for this revenue line. While Model 1 suggests an estimate of 2.1, we believe this is unduly high, given that we have included a significant forecast uplift to take into consideration the additional capacity offered by the new T1 FastTrack facility.

Airport Club

2.34 We estimate a passenger elasticity of between 0.45 (not statistically significant) and 1.49 (statistically significant at the 5% level) for revenues from Airport Club. We note GDP under Model 6 is also statistically significant. However, as with lounges, Platinum Services, and FastTrack, we consider passengers to be the most appropriate driver for Airport Club revenues. It is also likely, in models assessed which do not include a GDP variable, that the passenger term is accounting for higher GDP to some extent.

Table 2.12: Airport Club Elasticities

Model	(1)	(2)	(3)	(4)	(5)	(6)
Passenger Elasticity	1.49**	0.45	0.28	0.25	-	-
Covid	0.54	-.06	-.21	-.23	-.36*	-.34**
GDP Elasticity	-	-	2.6***	3.08	3.66	2.8***
Trend	-	.08***	-	-.02	-.03	-
Adj R-Squared	0.22	0.69	0.72	0.69	0.71	0.74
F-Stat	2.68	9.78***	11.31***	7.57***	10.95***	17.99***

Source: IAA

Note: * = 10% Significance, ** = 5% Significance, *** = 1 Significance

2.35 We consider the passenger elasticity under Model 1 is unduly high – likely capturing the expansion of the Airport Club offering in recent years. We also note the model overall is statistically insignificant. For this reason, we propose to accept Dublin Airport's passenger elasticity of 1.0, assessing, as set out in Section 8, that this provides for an appropriately

challenging target.

Other, US Preclearance, and Property Concessions

2.36 We do not forecast the Other, US Preclearance, or property concessions revenue categories using the elasticity approach.

2.37 For US Preclearance, we forecast this revenue line to grow in line with our US departing passenger forecast, thereby implying an elasticity of 1.0. We forecast the Other Revenue category using the 2025 outturn per passenger, thereby also implying a passenger elasticity of 1.0. For property concessions, we forecast this revenue category on a bottom-up, line-by-line basis.

2.38 These categories are therefore not assessed in this appendix. More information on the forecast methodologies for these categories can be found in Section 8.