International approaches to airport and air traffic control regulation

Final Report

by

MKmetric Gesellschaft für Systemplanung mbH

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Independence and disclaimer
We have carefully researched and processed all the information contained in this study. In cases, we have drawn on information from third parties and internal company processes and data, which we have labelled. The work required in the scope of services was carried out conscientiously and performed as listed. There was no influence by third parties, so that the results are solely the result of our work. We vouch for the careful and correct processing and accuracy of the results. The pdf-file version of the published report provided by us is to be regarded as the original.

Reference: Adler N., Arblaster M., Forsyth P., Guiomard C., Niemeier H-M., Mandel B., "International approaches to airport and air traffic control regulation", MKmetric GmbH Karlsruhe, 07'2024.

Structure of the report

EXECUTIVE SUMMARY

This report has been produced by a consultancy team (MKm) for the CAA and responds to a tender seeking lessons from international approaches to airport and air traffic control regulation. The report is based on multiple case studies. For each case study, basic relevant information is presented and lessons are suggested for the work of the CAA.

Benchmarking: We recommend the implementation of comprehensive benchmarking for London Heathrow and NERL. Benchmarking provides essential insights into performance and identifies significant efficiency gaps and areas requiring improvement. For example, previous benchmarking studies revealed substantial inefficiencies across multiple airports in Italy and within the Air Traffic Control (ATC) system across Europe. These findings have been instrumental in guiding targeted efficiency improvements. Therefore, regular benchmarking exercises would offer the CAA valuable information to enhance operational efficiency and service quality.

Investment:
i. At London Heathrow Airport, the focus should be on ensuring constructive engagement, particularly regarding capital expenditure (capex). Collaborative investment decisions at Heathrow will likely facilitate necessary expansions and improvements whilst minimising disputes. The progress in Dublin Airport's collaborative approach to capex decisions serves as a useful model, highlighting the benefits of stakeholder engagement in achieving large-scale projects.

ii. For NERL, it is critical to encourage investment aimed at enhancing capacity and resilience. Investment in infrastructure is fundamental to ensuring service continuity and preventing significant service failures, such as those experienced in recent years. Investment should be made in new technology with open systems in order to overcome the current silo structure of ATC. It is important to establish a robust process of both ex-ante and ex-post capex scrutiny with constructive engagement. Airways New Zealand provides an example of an accountability and transparency practice in this regard.

Streamlining Regulation with elements of light-handed regulation:
i. The regulatory process could be streamlined by minimising the number of regulatory building blocks under a concentrated review and concentrating on the most critical issues. By focusing on key areas — such as traffic forecasts and major operational and capital expenditure allowances — the CAA may improve regulatory clarity and efficiency. Streamlining efforts should aim to reduce the complexity and scope of regulatory reviews, ensuring a more focused and effective approach. This will facilitate more timely and impactful decision-making, aligning regulatory efforts with the most significant factors affecting aviation regulation.

ii. Negotiations work effectively in a well-designed regulatory framework with an independent arbitrator and a price cap fall back option. Australian monitoring of airport charges has lacked a regulatory fall-back, in particular an arbitration process where disputes cannot otherwise be resolved. The regulator of Copenhagen airport is not independent and the Swiss and German regulators do not have a price cap as the fall-back option. Air navigation service providers in Australia and New Zealand have been able to engage directly with their customers. Although a regulator has not been involved, at least in the initial stages in the case of Australia, the presence of a regulator directly, or potentially, is important.

1. BENCHMARKING

1.1 Benchmarking is a method that provides support for regulators when setting price caps for organisations, including airports and air traffic control providers. It enables the assessment and comparison of efficiency and performance across organisations and time. This section explores international examples where benchmarking has contributed to setting targets for service quality, operational efficiency, and cost management.

1.2 We examine case studies from Italy and the Single European Skies. The Italian Transport Regulation Authority (ART) has employed Stochastic Frontier Analysis (SFA) to measure airport efficiency for operational costs. The Performance Review Body (PRB) of the European Commission has utilised both SFA and Data Envelopment Analysis (DEA) to provide advice for the Single European Sky (SES) initiative. These examples demonstrate the practical applications and challenges of benchmarking in the regulatory context.

Italian Airports: Application of Stochastic Frontier Analysis to estimate operating cost inefficiency

1.3 Since the late 1990s, the Italian government together with the European Union have gradually changed the regulatory framework with respect to the economic regulation of Italian airports. The Italian Transport Regulation Authority (ART) in Ruling 38/2023 introduced a price cap mechanism with a dual-till approach and used Stochastic Frontier Analysis (SFA) to estimate operating cost efficiency.

1.4 **Model Structure**: The cost function is expressed as a combination of deterministic factors (output, input prices and firm characteristics) and stochastic components (random shock and inefficiency). Two main forms of the cost function were considered: Cobb-Douglas and Translog, which account for constant and variable returns to scale respectively. Multiple SFA models were tested, including those of Pitt and Lee (1981), Battese and Coelli (1988, 1992), and Greene (2005). ART argued that the Pitt and Lee (1981) model with a translog cost function proved to be the most appropriate.

1.5 **Variables**: Data from 22 airports over the period 2013-2020 were collected, with adjustments made for inconsistencies due to the Covid-19 pandemic. The analysis included operational costs, input prices (labour and other inputs), fixed inputs (maximum theoretical capacity of the airport infrastructure), and control variables (airport infrastructure, market characteristics and environmental conditions).

1.6 **Findings**: The operating costs for the regulatory period are based on 2019 costs, adjusted for inflation and traffic volume changes. The elasticity of operating costs with respect to output was estimated at 0.3%. According to the Pitt and Lee (1981) model, inefficiency was estimated to be 20% on average for the Italian airports, ranging from 4% at the 10th percentile to 40% at the 90th percentile. Tests for different functional forms and price normalisations were applied and the analysis confirmed that the model and variables provide a consistent and reliable estimation of airport efficiency.

1.7 **Stakeholder feedback**: ADR, the owners of the Rome airports Fiumicino and Ciampino, argued that 64% of their costs are fixed, 26% partially fixed and a mere 10% are variable, mainly due to regulatory and contractual constraints. Therefore,

they argued that the cost reduction set by ARTwould be infeasible. They also stated that various measures were already implemented to improve efficiency, including energy consumption reductions and maintenance process streamlining[1]. ADR further argued that there were issues of robustness and implementation when applying such a model to a complex system such as an airport. The results are heavily influenced by the explanatory variables included in the analysis and those that are omitted, which may lead to an overestimation of the productivity coefficients. Specifically, the failure to consider airport layout, climatic conditions and regional economic conditions could all impact the outcomes but were not considered sufficiently. Finally, they stated that the SFA method requires extensive and accurate data, and variability in data quality and availability across different airports could cause issues of accuracy.

Lessons Learned

1.8 Many papers have been published in the academic literature assessing the efficiency of airports within countries, regions, globally and across timeframes. Both data envelopment analysis and stochastic frontier analysis have been applied. It is reasonable to implement such an approach in order to estimate the potential cost savings that could be achieved by such systems.

1.9 At the same time, such an approach must be undertaken carefully and sufficient airports of similar size ought to be compared. In Italy, of the 22 airports assessed, two are large airports that potentially need a European comparison in order to assess their productivity. Furthermore, the analysis involved 154 observations which is a relatively small number for such an analysis.

1.10 The Rome airport owner complained that data may not be accurate or comparable. The regulator (ART) explained that the data is created according to a detailed manual, which is self-reported and carefully audited. Such measures should ensure comparability of data, an exercise that could and should be undertaken by the CAA.

European ANSPs: Applying Stochastic Frontier Analysis & Data Envelopment Analysis to estimate cost inefficiencies

1.11 The major issues with the air traffic control (ATC) market are fragmentation and slow technology adoption, which together create an unnecessarily high cost system and regulatory challenges (Baumgartner and Finger (2014), Adler et al. (2022), Forsyth and Niemeier (2023)). The European ATC market is highly fragmented, with numerous service providers operating independently. Each provider manages its own airspace, procures its own systems, implements its own operating procedures and most train their own staff. This leads to high costs due to the lack of coordination and standardisation. The small scale of operations for many ATC providers prevents them from achieving economies of scale. This

[1] ART, the regulator, permitted the airports to provide further evidence, should they feel that the cost savings expected were too high. The final decision could be as low as 30% of the ART's benchmarking estimate provided the airport management were able to justify their arguments. This is obviously a rather broad range, but it provides robustness to the regulatory decisions and it reduces the information gap between regulator and airport since it requires the airport to explain why the inefficiency gap is not as large as previously estimated.

inefficiency is compounded by the fragmented market structure, where each provider operates within a limited airspace and cannot leverage larger-scale efficiencies. Furthermore, there is a significant lag in adopting new and advanced technologies within the ATC market. The fragmentation of the market contributes to this slow adoption as does the need for collaboration across the value chain, leading to inconsistent implementation and delayed benefits. Regulation has proven to be rather ineffective. Regulated charges do not signal the scarcity of resources and do not sufficiently incentivize providers to adopt new technologies or expand capacity to reduce congestion.

1.12 Traditionally, the Performance Review Body (PRB) relied on partial measures of productivity to provide information for the regulator. There is also a benchmark comparison between US and EU air traffic management, which is heavily contested by ANSPs. In 2018, the PRB commissioned a report utilizing Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) to estimate the efficiency of ANSPs. The PRB advises the European Commission who set a revenue cap for all ANSPs in the Single European Sky (SES). This cap is set for the system as a whole, which is then converted into caps for the individual ANSPs. Given this practical knowledge, the PRB used expert knowledge and judgement to set a revenue cap, which led to a slight decrease of regulated revenues as compared to the previous periods.

1.13 The PRB felt that a more systematic and robust methodology was needed. KPIs can be misleading and are subject to the Fox paradox. An ANSP might be superior in terms of specific KPIs (for example, labour productivity and capital productivity) but nevertheless have a lower overall efficiency, hence the paradox (Fox, 1999). The analysis should be robust and conservative so that it was difficult to be challenged by ANSPs which of course have a much better understanding of their inefficiencies compared to that of the PRB. The analysis adopted the principle of doubt. Where DEA and SFA came to different estimates of efficiency, the higher value was taken. The study for the PRB was done by the Academic Group (Adler et al., 2018 and also 2023). It estimated that the inefficiency gap was roughly 30 % in 2018. This value was regarded by experts as realistic. In the consultation, the method and results of the study were challenged by ANSPs whereas the airlines were in favour. In 2023, the PRB asked again for such a study (on methods and results see 1.15 below).

1.14 The PRB followed a ‘glide path’ approach, and discussed alternative pathways to close the gap over a period of one, two or even three regulatory periods. While productivity gains should be ultimately passed to the users, setting prices at costs reduces the incentives for cost reductions. Leaving some of the gains from productivity to the ANSP was regarded as crucial to incentivise management to further reduce costs. Another issue was whether the cap should decrease faster or slower, thereby signalling what behaviour was to be expected. The PRB also discussed how to set the initial level of the cap for the subsequent reference period. If all cost savings from the previous regulatory period are taken to lower the cap, the ANSPs have an incentive to be a high cost provider at the time of setting the cap. Hence the pros and cons of setting the cap at a level which avoids this strategic behaviour were considered.

1.15 The regulatory discussions within the PRB were influenced by the strategic behaviour of the ANSPs. As traffic delays increased in 2018 and 2019, ANSPs

argued that cost efficiency considerations should be less of a concern and that a higher cap was needed for investments in capacity. This argument was not very convincing as the costs of additional ATCOs was rather low and would lead only to a very marginal increase of the cap. The delays were considered to be the result of mismanagement and the regulatory penalty for delays were considered far too low. Delays, like high costs, were the result of weak incentives and not the result of a trade-off between quality and costs (Forsyth and Niemeier, 2023). However, the ANSP strategy was in the end very effective in undermining the regulatory process because (i) intuitively more capacity seems to imply higher prices and (ii) the EU Commission had to reach a compromise with the member states who own the ANSPs (with the exceptions of NATS and ENAV, where the governments own 49% and 53% respectively). The lack of an independent regulator[2] led in the end to regulatory decisions which did not close the inefficiency gap sufficiently.

1.16 Benchmarking by the Academic Group (2018 and 2023) estimated the level of inefficiency of the ANSPs across Europe using DEA and SFA. Since each method has advantages and limitations, the two approaches were applied in both reports. Both models assessed cost efficiency that also accounted for airspace characteristics, measured by complexity, variability and delays. The specific data that was utilised in the two cost minimising approaches are specified in Tables 2 and 3.

1.17 The first report prepared for Reference Period 3 (2020 to 2024) suggested that ANSPs could save between 25% and 30% of total costs on average. However, potential cost savings vary significantly among individual ANSPs. The main cost drivers for en-route services were found to be flight hours controlled, airspace complexity, traffic variability and the sector opening hours. The second report prepared for Reference Period 4 (2025 to 2029), suggests possible cost savings of 16% on average. The SFA model indicated that a 1% increase in flight hours, capital prices, and labour prices would lead to total cost increases of 0.33%, 0.29%, and 0.56%, respectively.

Model	**Variables**
Inputs	
Total Costs	Total expenses PPP corrected
Outputs	
Flight hours	Total IFR flight hours controlled en-route
Sector opening hours	Total hours that sum of sectors open
Complexity Flight hours	Complexity Index flight hours controlled
Variability Flight hours	Variability Index flight hours controlled
Delays	Total minutes of delay annually ascribed to ANSP
Estimation Approach	
	Variable returns-to-scale
	Outlier MUAC eliminated

Table 2: Variables applied in Data Envelopment Analysis Model

[2] According to the OECD (2016), an independent regulator as a public body should be separated from the policy-setting and fiscal policy functions that are exercised by the government. Further details are discussed in 2.3 for ATC and 3.2 for airports.

Dependent Variable	
Total Cost	Total cost/PPP Producer price index
Independent Inputs	
Output	Total IFR flight hours controlled en-route
Labour price	(total staff cost/ ATCO hours)/PPP producer price index
Capital price	(depreciation cost + cost of capital) / (sector openings/PPP) producer price index
Environmental Variables	
Airspace characteristics	Variability (seasonality), complexity, sector opening hours, time trend, delays

Table 3: Variables in the Stochastic Frontier Cost Function

1.18 As can be seen in Figure 1, for the period 2012 to 2019, total costs increased by under 10%. We note that total IFR flight kms controlled increased by around 23%, suggesting that the process has helped to maintain some pressure on costs overall. The time trend in the stochastic frontier approach was significant and suggested a cost reduction over two reference periods of 1% annually. However, this represents a relatively modest change in comparison to the estimated potential for cost reductions according to the models.

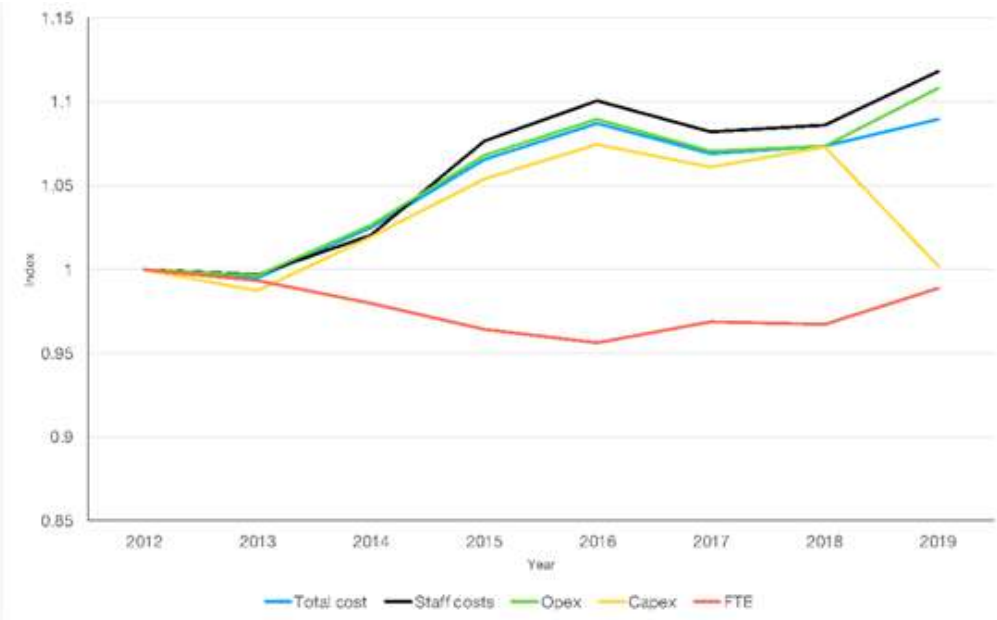

Figure 1: Costs normalised to year 2012 (after inflation and purchase price parity adjustment)

1.19 The response to the two reports included comments from ANSPs, airlines and National Supervisory Authorities (NSA). Somewhat unsurprisingly, the ANSPs felt that the levels of inefficiency estimates were unrealistic whereas the airlines were concerned about the potential for worsening inefficiency over the fourth reference period. The ANSPs criticised a lack of transparency in data sources and outlier

testing procedures. The data drew from the openly published reports that are submitted by Member States and subsequently checked by the Performance Review Unit. The Academic Group study was also criticised for not considering external factors such as the war in Ukraine and its impact on air traffic and ANSP cost efficiency performance.

1.20 The PRB confines the scope of benchmarking to those ANSPs which are subject to the SES charges regulation. As the UK left the European Union, NATS was taken out of the benchmark with the result that the efficiency gap was reduced. However, it is also possible to include other countries in the benchmarking. It would likely be helpful to further compare NERL to NavCanada and the Federal Aviation Administration (FAA) of the United States. Eight reports have so far been prepared by the FAA and Eurocontrol comparing the two systems, the most recent being published in 2024 (European Commission, et al. 2024). The reports suggest that both regions use similar technologies and operational concepts, but the performance indicators reveal different levels of efficiency. The FAA consistently shows higher controller productivity, serving 1.5 times the IFR flight hours controlled per ATCO hour according to the 2024 report. The European ANSPs also employ approximately double the number of administrative staff, despite serving lower traffic levels. We note that both regions have seen increased ATM/CNS provision costs following the Covid-19 pandemic, however Europe has experienced a more significant rise.

1.21 According to these reports, the US and Europe both suffer delays but for different reasons. In the US, most delays are attributed to adverse weather, especially at airports. In contrast, Europe's delays are mainly due to ATC capacity and staffing constraints. The management of these delays also differs with the US focusing on tactical traffic management on the day of operations and Europe emphasising strategic planning and advanced scheduling. Given the size of the Canadian and US airspaces, an analysis at the level of the area control centres would likely lead to a more useful analysis with respect to output, labour and technologies hence productivity.

1.22 One of the major issues when setting cost reduction targets is the need to also consider quality. Frequently, this is measured in the ATC market in terms of the delays caused to airlines and passengers as a result of the ANSP's insufficient capacity. Take the case of NATS[3]. Between 2016 and 2019, NERL earned up to £5 million in bonuses and paid less than a million in penalties for missing delay targets according to their financial reports. It would appear to be very important to tie regulation to quality and not only costs, thus aligning the interests of the ANSPs with that of the customers, namely airlines and passengers. Financial incentives are set for capacity and environment, permitting a 0.8% bonus and 1.75% penalty under the British regulation, which is lower than the +2% bonus / -4% penalty set under the Single European Skies initiative[4]. It is likely that the very small amounts currently paid/received are insufficient to incentivise NATS to change its behaviour much (Andribet et al., 2022; Forsyth and Niemeier, 2023).

[3] NATS is a public-private partnership with 49% state-owned, 42% owned by the Airline Group, 4% by London Heathrow airport and 5% by NATS employees. The Airline Group is a consortium including British Airways, the Pension Protection Fund, easyJet and USS Sherwood Limited. Nominal shareholdings in the Airline Group are retained by Alix Partners, Deutsche Lufthansa AG, TUI Airways Limited and Virgin Atlantic Airways Limited.

[4] According to the *ACE Benchmarking Report (2024 Edition)* of EUROCONTROL.

1.23 There is a need for collaboration among all stakeholders (ANSPs, NSAs, CAAs, airlines and airports) to achieve common goals and improve overall network performance. Projects that rely on real-time data sharing, such as optimum trajectory design, face challenges related to confidentiality and the need for cooperation between different stakeholders. Furthermore, the aviation industry must contribute to the broader transport decarbonisation goals, including both CO2 and non-CO2 emissions. The ANSPs could contribute to the reduction of environmental emissions and potentially need to be incentivized to achieve such goals. Without a doubt, the need for collaboration between ANSPs and across the aviation value chain makes the adoption of technologies more complicated and difficult to achieve and mediation between stakeholders could be an important role for the CAA.

1.24 Longer term suggestion: In a SESAR funded research project called ACCHANGE, the idea of auctioning ATC service in Western Europe was assessed (Adler et al., 2024). The main policy conclusions suggest that competition for the market attained through an auction for en-route ANSP may lead to significant social cost efficiencies, along similar lines to that undertaken today for terminal ATC services in several countries including the UK. Such a system also exists in other transport sectors, including bus and rail services. The auction mechanism, combined with reward and penalty schemes based on service quality, is likely to reduce air traffic control charges by up to one third on average. Such a system would encourage providers to bid for multiple regions, leading to the defragmentation of the European air traffic control market. This defragmentation could help achieve economies of scale and improve overall efficiency. Winning auctions in adjacent regions would allow providers to integrate their services, reducing inefficiencies caused by fragmented airspace control. The auction could incentivise ANSPs to adopt new technologies and optimise capacity to manage congestion effectively if there were substantial rewards and penalties permitted by the auction mechanism. Finally, the mechanism could be designed to be self-financing, with rewards equalling penalties in equilibrium, ensuring that the government does not need to subsidise or tax the industry. By fostering competition for the market and incentivising quality and efficiency, the proposed system could help create a sustainable and resilient ATC market.

Lessons learned

1.25 **Institutional Gridlock**: The institutional framework of ATC is complex and includes many stakeholders with vested interests. This has led to a situation where no single actor is powerful enough to implement reforms, but each is powerful enough to obstruct changes. Projects, such as that of the Functional Airspace Blocks (FABs), which encourages the integration of airspaces across countries, face challenges related to labour unions, national sovereignty and military information exchange, which in turn have severely hindered achieving greater economies of scale.

1.26 **Weak institutional regulatory setting**: The PRB used comprehensive benchmarking methods, including DEA & SFA, which reflects progress in terms of regulatory application. These methods provide improved knowledge compared to partial measures with respect to the inefficiency gap but do not guarantee a better outcome. An additional opportunity for comparators includes an analysis of the UK, Canada and the FAA, possibly at the level of the area control centres. The

institutional weaknesses, in particular the lack of an independent regulator, dominates the outcome and makes it relatively easy to undermine effective regulation by the PRB and the EU Commission.

1.27 **Improving quality**: The regulation of quality is very important for ATC because delays are very expensive for the airlines and passengers rather than the ANSPs. The performance could be improved by applying a much stronger reward and penalty system to meet service quality standards.

1.28 **Longer term**: An alternative to current forms of regulation would be to tender en-route ATC services across the European airspace. This option is discussed and positively evaluated in current academic research, undertaken in terminal ATC provision and utilized by multiple transport sectors today.

2. INVESTMENT INCENTIVES

2.1 This part of the report reviews the incentives for investment under the Light-Handed Regulation approach used for airports in Australia. It also considers the experience of airport investment under a conventional price cap at Dublin airport. In both cases, some lessons are suggested.

Australian Airports Investment under Light-Handed Regulation

2.2 The major four Australian airports (Sydney, Melbourne, Brisbane and Perth) are subject to light-handed regulation, consisting of monitoring and periodic review to assess whether they are abusing their market power.

2.3 Apart from investments in runways Australian airports have undertaken major investment projects, including investments in terminals, car parks, aprons and retail facilities. Some of these have been costly, and contributed to the capital base of the airports significantly. This has been done with the approval of the airlines. While there is no formal customer engagement mechanism, the airports and airlines have discussed and agreed to fund the investments. The result has been that the airports have maintained quality of service while making increases in output feasible. The Australian Competition and Consumer Commission (ACCC) monitors quality but has no authority to mandate changes. Monitoring results show the quality level has been relatively stable (“good”), and it appears that investment is neither too low nor high. Airlines are prepared to pay for what they are getting.

2.4 The one aspect of the dispute is that of airport charges. The airlines are very critical of the overall level of charges. This is reflected in the overall rate of return which the airports have been achieving, which are at the upper end of the range for airports across the world. The Productivity Commission, a government economic advisory body, has reviewed the airport’s performance periodically, and it has concluded that there was no serious evidence of the abuse of market power (Productivity Commission, 2019), (though it did not provide a detailed examination of costs and revenue of the airports). The airlines have disputed this.

2.5 In short, the current process of investment at airports works well (albeit with high profitability of the airports) – there is no need for any specific “investment incentive”. This is a form of customer engagement where both parties agree on the need for investment and airlines are prepared to fund it.

2.6 When it comes to runway investment and the overall level of airport charges, the scope for customer engagement is limited though not always prohibitively so. The airlines and airports have conflicting objectives - airlines want lower charges, and airports want higher charges. There are two relevant case studies in Australia, Brisbane and Sydney (in addition, Perth airport is considering building an additional runway).

2.7 With both of these, there has been excess demand, though the extent of the shortfall in capacity in Sydney has been much greater than in Brisbane. The excess demand has been handled by slots, though there has been some use of minimum prices. There have been the usual problems of airlines not being able to secure slots. The responses of the two airports to capacity shortfalls have been quite different.

2.8 Brisbane airport recognised that there would be a capacity shortfall and set in motion the building of an additional runway (which was a slow process given that ground stabilisation was needed). The runway was opened in 2020. The airport was proactive in investing, and it did not seek to allow capacity to become inadequate and use its market power to raise charges. This was a decision by the owners. Significantly, while the airport was “privatised”, more than 50% of the ownership at the time of the investment was with government bodies, including Schiphol Airport in Amsterdam. Owners did not seem to act as profit maximisers and invested when excess demand was becoming evident.

2.9 Sydney Airport, by contrast, has had owners with a clear profit objective (rather like Heathrow). It was willing to allow demand to outstrip capacity. The owners were given the option to build an additional airport at a different site. They did not take up this option and stated that new capacity was not needed for decades to come. It is well recognised that one of the drawbacks of the slot system is that it gives airlines which have slots, and possibly the airport, an incentive to under build capacity to safeguard and increase the slot rents (Forsyth, 2008; Gillen and Starkie, 2016). If the airport is tightly regulated, the airlines will reap most of the rents, but under light-handed regulation, the airport can price so that it shares the rents with the airlines. The government set up a commission of inquiry (as in London) which recommended, based on a Cost Benefit Analysis, a new airport by the mid-2020s. In the end, the government decided to build the new airport itself, and completion is due in 2026.

Lessons Learned

2.10 Major airports in Australia, such as those of Sydney, Melbourne, Brisbane and Perth, are subject to light-handed regulation with no dispute resolution mechanism. Light-handed regulation in Australia is consistent with airlines and airports being able to conclude agreements about all but the most problematic investments such as major runways. When justifying large investments to airline customers, airports (e.g. Perth airport) sometimes use a regulated asset base (RAB) approach. Runway investments which are typically complex, including environmental evaluations, are not always handled well by constructive engagement. Brisbane, which at the time of investment was only partially privatised, was very willing to invest in a new runway and did so with little difficulty. Sydney Airport (fully privatised) was very unwilling to invest in new runway capacity, which would reduce slot rents. The government intervened and invested in a new, competitive,

airport. Ownership of the airport, whether fully privatised or partly publicly owned, was a large factor in determining the willingness to invest.

2.11 The main point of difference between the airlines and the airports is over the level of charges, which the airlines argue is too high. Australian airports have rates of return which are at the higher end of the scale worldwide, suggesting the possible use of market power.

2.12 Quality is monitored by the competition regulator, the Australian Competition and Consumer Commission, which has reported the quality performance as “good”.

Dublin Airport’s Experience of Investment under a Price Cap

2.13 In the early 2000s, economic regulation of the public Dublin airport was new and contentious. Investment plans were often at the centre of these disagreements. Today, circumstances have changed and also investments are handled in a different way within the regulatory process.

2.14 One change is that regulatory decisions concerning the most costly investments - a second terminal (in 2010) and a second runway (in 2022) - have now been made and the new assets are being used and paid for. So, at least for a period, investment will involve smaller and less controversial projects, although there are many of these. A notable difference between the two large projects was that airlines broadly agreed on the need for a second runway (R2) but disagreed on the right scale and cost for a second Dublin passenger terminal (T2). Thus, the regulatory framework could absorb R2 under traditional capex assessment processes but a very particular and special framework was needed for T2, as described below.

2.15 The regulatory process to assess capex at Dublin airport also changed in 2019. The previous approach was the standard one: the regulated firm provided information on projects, consultation took place, some consultancy reports were published, and the regulator decided what investments to add to the RAB along with the cost allowance for each project and the future treatment of non-delivery or over-spending. Afterwards, outturn costs were evaluated and any necessary ex post adjustments made. (A set of ‘RAB roll-forward principles’ is published at the start of each price review to set out an explicit policy for how deviations between plans and outcomes are to be treated.)

2.16 This standard approach has some well-known shortcomings. Investment is dynamic but regulation is inflexible. Unconstrained, a firm will wish, where possible, to revise investment plans in terms of need, scale, financing and cost in line with changing economic conditions. But because regulatory decisions are intermittent, an operator’s investment plans must be drawn up a long time before the point at which the projects are intended to be delivered. Future costs and future demand may be rather uncertain at that point. A price cap is recognised to be quite an inflexible tool to incentivise and deliver efficient investment.

2.17 Some of the inflexibility can be moderated by the regulator setting investment ‘allowances’ rather than project-by-project budgets, but that approach generates other difficulties. Parties argue over whether the projects actually pursued and the outturn costs are in line with the expectation at the beginning.

2.18 The new approach used in Dublin airport - called 'StageGate' - has produced smoother discussions between parties about the capital investment plan. Also, an important feature of the StageGate approach is reliance on a cost adjudication by an Independent Fund Surveyor (IFS). (An IFS is also used for Heathrow airport investments under a similar process called Gateway.)

2.19 The experience in Dublin is positive and works as follows. Investment projects are divided into core and development projects; the second group is primarily related to capacity building. Core projects (recently about 20% of investment spending in Dublin airport), if supported by the regulator after consultation with the industry and by independent cost adjudication, are added to the RAB and to the airport's cost base that is remunerated from airport charges.

2.20 Other projects are subject to the 'StageGate' process. For each such project, an initial allowance (StageGate 0) is set. When the project has reached a sufficient level of design, it moves to StageGate 1. At this stage, the airport operator provides up-to-date costings, and supporting information, to the IFS for assessment. If the IFS considers the costs to be reasonable and the scope to be appropriate, it will support the proposal. The IAA considers the IFS's advice and the views of airport users and decides whether to move the project to Stage Gate 2. Representatives of the parties meet about quarterly for project and cost updates in stage 2. On delivery, and after reconciliation of outturn costs with the stage 1 costs, the project is added to the RAB and remuneration of the project over its useful life is decided[5].

Stage	
0	Initial budget allowance
1	Project is designed and costed. IFS adjudication. IAA decision whether to move to 2.
2	Ongoing consultation between parties as the project is delivered.
3	Outturn cost reconciliation. Asset added to the RAB and remuneration set.

Table 1: StageGate process at Dublin airport

2.21 The StageGate process, in effect, moves capex discussions out of the regulatory to-and-fro and towards more commercial discussions between a supplier and users. This process is generally considered to have facilitated business-like discussion of many capex issues at Dublin airport. The airport consults and shares information on a much wider basis than before. Any deviations from plans are brought to the attention of airport users at an early date. Collaboration has improved. The contribution of the IFS offers reassurance to both sides. The StageGate process also increases the flexibility of capex decisions within a price control period. Apart from the success to date of the StageGate process, lessons about airport investment from Dublin airport may be drawn by looking back at two earlier, locally large, projects.

2.22 In 2005-2010, the regulatory challenge of T2 was considerable. The case offers a number of possible lessons about making costly, controversial investments more acceptable to airport users and easier to 'digest' within a regulatory price cap. But this was achieved only by adding considerable extra complexity to the calculation of the RAB in terms of T2.

[5] For example Table 9.2 of CP1/2022.

2.23 The second terminal project tripled the value of the asset base of Dublin airport (in 2010). This meant that cost overruns and/or demand underperformance posed substantial risks both to the operator's finances and to the airport charges paid by passengers. To moderate such risks, the regulatory treatment of the project was crafted in a specific way. (The treatment of other assets was left unchanged.) The new features were two-fold; a more nuanced approach to airport pricing and a phased (traffic related) addition of the T2 costs to the RAB.

2.24 The regulator proposed four new-to-Dublin features in airport pricing. Specifically: price triggers, peak pricing, time profiling of charges and differential charges. These ideas - not all of which were undertaken - reflected the regulator's firm conviction that the price structure was of the first importance in its own right. But, in the circumstances of T2, a carefully designed price structure - in particular, linking charges to the beneficiaries of the investments which therefore lessened the price impact for those not using the new asset - should make capital projects less controversial for those airport users who would not be heavy users of them.

2.25 T2 was built to accommodate a large throughput of early-morning passengers. The regulator sought peak pricing so that these users would contribute more to the remuneration of the asset. But the regulator did not wish to micromanage regulated charges and in the end the airport operator refused to introduce peak pricing. The regulator also sought differential charges between the new high-spec T2 and the older and somewhat care-worn T1. This too was never introduced. On the other hand, as in many regulated sectors now, triggers are used routinely.

2.26 Two regulatory changes that were made to the treatment of T2 were: time profiling of charges and phased additions to the RAB. The T2 building was very large and would have had excessive capacity unless passenger traffic rose strongly as the airport operator had forecasted to justify the project. So the capital cost of T2 was divided into two parts in the ratio 75:25. The first part was added to the RAB in a conventional way once the facility was in use. However, the second part was to be added to the RAB only when airport-wide passenger numbers reached 30 million passengers per annum. When planning T2, the DAA foresaw this level of traffic being reached by 2015. In fact, because of the 2008 economic crash, traffic first declined by 25% and did not reach 30 million passengers until 2018. This phasing therefore avoided the traffic undershoot from causing a perverse additional rise in airport charges. But this was at the expense of increasing financial risk to the DAA; and the back loading of the cost recovery was much more prolonged than intended because of the 2008 financial crash. A trade-off between airport financeability and passenger protection was required of the regulatory agency.

2.27 A further innovation introduced in the economic regulation of Dublin airport in these years was a move from a strict single till to a hybrid till. The quantitative importance of this measure was small but the principle is capable of wider application.

2.28 At one point, Dublin airport wished to build an additional multi-storey car park. Airlines doubted the airport's forecast for future demand and feared the project would lose money which, under a strict single till, would reduce the cross-subsidy from non-aeronautical profits to airport charges, increasing charges. In effect, the airlines would be subsidising the airport's project. The regulator wanted to find a way around this dispute while allowing the regulated firm to make commercial

decisions. The solution was to devise a process to allow, by agreement between the parties, non-aeronautical investments to be made outside the till. Certain office blocks ('Dublin Airport City') have been built on that basis. Having a hybrid till can be helpful in such cases where parties are in disagreement. (The process to place an investment outside the regulatory till is set out in CP1/2012.)

Lessons Learned

2.29 Looking back at the regulation of the investment in Dublin's T2, there are some lessons that may apply more generally. It helps to have some flexibility in the boundary of the regulatory till. Careful attention to the price structure, as well as improving efficiency, can reduce disagreement when investments are contested. In some cases, it may be possible and appropriate and possible to phase-in the rate at which an asset is added to the RAB without destabilising a regulated firm's finances; but there may be a hostage to fortune in terms of future macroeconomic volatility. Such an approach may also be more difficult for the very largest projects which may require more certainty for investors and lenders.

2.30 Finally, a lesson from Dublin is that a StageGate-type process to evaluate and cost significant investments, based on much greater sharing by the airport of up-to-date information, and supported by independent cost adjudication, is superior to the traditional manner in which the Irish aviation regulator dealt with aviation investments. As the above discussion argued, there is improved transparency and a basis for a more business-like negotiation between supplier and user.

2.31 The fact that the approach to price cap regulation in Ireland is based on the UK model may mean that it is easier than otherwise to apply any lessons drawn from Irish aviation regulation.

Single European Sky Regulation, Skyguide, and Airways New Zealand

2.32 ATC is undergoing a process in which the old radar-based technology is being replaced by digital technology. The old system consists of vertically integrated systems for a specific territorial area which is very often the national state. These act like silos in spite of the fact that ATC is a network. The creation of the SES has the objective to overcome these silos. Standardisation has been reached to some degree, but the new digital technology allows for open systems which are not patched. The ATM Masterplan and economic regulation under the SES find it difficult to make progress to organise and regulate the switch to a new digital technology.

2.33 Resilience can be achieved with the old and new technologies. The old radar system also had back-ups, but it is more costly to provide back-up solutions for each silo compared to systems which cooperate. There are currently different solutions of different quality that have been developed and deployed (see for example 4-FLIGHT which connects ten Air Navigation Services in Europe[6]). Skyguide and Airways New Zealand offer interesting insights in terms of deployment and regulation.

2.34 In principle, the regulator can incentivize investment in standardised technology across a network. Where the new technology is cost saving, the regulator keeps

[6] In terms of digitalization, 4-Flight offers a lower quality than Skyguide's Virtual Centre.

the price cap unchanged and the ANSPs are incentivised to deliver the investment. If the investment improves quality and leads to higher costs then the price cap needs to increase. SES regulation follows the regulatory asset base model. In this case the investments should be scrutinised which can be done in cooperation with the users. If the investment is delivered as specified it is added to the asset base (Forsyth and Niemeier, 2023). As these investments in standardised technology create positive externalities for other users and ANSPs it is important to use constructive engagement as a regulatory tool (Arblaster, 2018).

2.35 In practice, the SES regulation follows the regulatory asset base model and tries to deploy new compatible technology through an ATM Masterplan. The PRB and the national regulators are supposed to scrutinise these investments, but this is rather difficult as the PRB acts on a European level and most national regulators lack independence and expertise[7]. Constructive engagement is not much used. Charges are relatively high, and capital expenditure allowances are sometimes redeployed to cover unexpected cost increases. Pressure on inefficient ANSPs to adopt cost-saving new technology is limited (Forsyth and Niemeier, 2023 and case study 12, below, on benchmarking in ATC).

2.36 **Skyguide**[8]could not provide services for five hours in June 2022 due to a network switch failure at one of the Swiss Area Control Centres (Accenture, 2022, Republik, 2022). As Skyguide was unable to manage flights, a 'Clear the Sky' order was issued. This failure is separate from, but related to, Skyguide's plans for a new "Virtual Center." The service failure occurred because the technical problem could not be covered by the second Swiss control centre taking over the first's traffic; current location-dependent operations cannot simply be extended to another airspace. Finger and Gortazar (2024) argue that Skyguide had to operate two independent Area Control Centres for political reasons. This is uneconomical and hence a Virtual Center was planned to address the shortcomings of location dependent operation and reduce operating costs. In 2014 Skyguide started a project to replace the two separate systems with a modern system architecture, which allows location independent operation. Since 2018 applications have been migrated to the new platform but the project finalisation has been delayed and is now expected to be finished in 2027.

2.37 Skyguide's Virtual Center is considered an ATM Transformation flagship. Flagships are selected by the Performance Review Commission (PRC) to encourage successful innovations under the ATM Masterplan.

[7] The PRB checks the planned and realised investments in financial terms, but cannot control if the investment projects have been actually delivered on time and with the promised quantity and quality. This has to be done by the national regulators. The EU Commission attempted to establish an independent regulator, but was blocked by the member states. At the national level the function of ownership and regulation are generally not separated. Hence the delivery of the investment projects are not sufficiently scrutinised (Andribert et al., 2022; Forsyth and Niemeier, 2023). It should be noted that the delivery of the new technology is more difficult to control than the delivery of a physical asset. However, there are also experts for computer software who can evaluate the quality of such sort of investments. In addition, the airlines as users have sufficient competence. The role of the regulator is to enable digitalisation through better control if the delivery meets the promises. The role of the regulator is not to determine a specific innovation path.

[8] Although Skyguide controls a smaller area of the European network by comparison with NERL and DFS, it is an interesting and relevant case study in as much as the adoption of compatible modern technology is key for the performance of ANSPs (Andribert et al., 2022).

2.38 Skyguide has had to finance investments[9] out of its own funds but does not have much margin to do this. It is required to run legacy systems and new systems which increases financial pressure associated with new investment. In the end, it financed Virtual Centres out of operational expenses by buying services[10]. This does not increase the regulated asset base and in addition the maintenance of the legacy system was financially constrained.

2.39 Skyguide investment in a Virtual Center would benefit if neighbouring countries adopt the same technology. This coordination could not be achieved to date. Instead, neighbouring countries still have invested in legacy technologies. The adoption of a common Virtual Center covering many countries would involve writing off that investment. Although the ATM Masterplan was improved in 2020, it could not achieve the necessary coordination. Virtual Centres face a number of other problems such as conservatism around management of airspace, national approach to infrastructure, sovereignty issues and coordination with military aviation.

2.40 **Airways New Zealand** provides air traffic management in New Zealand airspace which includes domestic air space over the North and South Islands and a large area of oceanic airspace over the Pacific Ocean, altogether covering an area of 30 million square kilometres. Airways has been operating with two area control centres (ACCs), one in Auckland on the North Island, and one in Christchurch on the South Island. New Zealand is subject to a high risk of earthquakes as a result of its location on a fault line. In 2011, a massive earthquake occurred in Christ-church creating substantial loss of lives (181 deaths) and damage to property. Christchurch Airport and Airways' Christchurch ACC were temporarily closed.

2.41 Although building and other regulations in New Zealand have historically taken the high risk of earthquakes into account, there was an increased focus on improving the resilience of New Zealand's buildings and other infrastructure following the 2011 earthquake. New Zealand's air traffic management has moved into two disaster-resilient buildings designed to a standard that would enable them to be operational immediately after an earthquake or other disaster (Airways, 2023). In addition, Airways has moved onto a new digital air traffic management software platform, SkyLine-X, which enables the two centres to be interoperable, so that if one ACC is disrupted, air traffic management services from the other ACC could be provided for aerodrome, approach and en-route services.

Lessons Learned

2.42 For deployment of new digital technology, it seems necessary to use more constructive engagement combined with a much stricter application of the standard regulatory asset base form of regulation. Investment needs to be rigorously assessed ex-ante. Delivery and over-run costs need to be scrutinised ex-post by an independent regulator in terms of efficiency of the expenditure.

[9] The EU SES Performance Regulation allows for major restructuring investment costs to be charged to the users after user consultation and scrutiny by the Performance Review Body. However, this has so far not been used by the ANSPs (European Commission, 2019).

[10] Switzerland is excluded from European R&D funds and its service-oriented approach might contradict the current asset focused performance scheme of the PRB. Financial pressures have increased for Skyguide to provide enough funding to maintain and operate its systems while still driving innovation according to the European ATM Master Plan. This has happened although the charges of Skyguide are very high compared to other ANSPs.

2.43 Digitalisation offers not only cost savings but, more importantly, a resilient ATC system. Digitalisation creates the opportunity for open systems which could overcome the traditional silo technologies.

2.44 Maintaining the old system and investing in innovative technology is a managerial challenge. It can be achieved as the Airways New Zealand case shows. Sky-guide's problems demonstrate that the SES programme lacks user engagement.

3. LIGHT-HANDED REGULATION AND CUSTOMER ENGAGEMENT

3.1 This part of the report discussed lessons from regulatory practices based on four case studies. These relate to the Australian and New Zealand experience with customer engagement in regulating ANSPs. Consideration is then given to lessons from negotiated settlements in North America. We turn back to Australian energy market regulation and its move towards 'consumer-centric' regulation. In Australia, customer engagement happens within the framework of Light-Handed Regulation and we analyse that case. Three countries have airportsthat are regulated under different forms of Light Handed Regulation and we seek lessons. Finally, the process of regulating Dublin airport is examined for lessons about keeping the process of a regulatory review within reasonable bounds.

Light-handed regulation at continental EU airports: Copenhagen, Munich, Zurich

3.2 In continental Europe[11] there are three particular examples of airports regulated with a form of light-handed regulation (see Forsyth et al. 2021 and 2023). They are Copenhagen and the major German and Swiss airports. The approach is that the airlines and airport initially negotiate about the charges, but if agreement cannot be reached, a regulator sets the charges. The systems for the different airports differ.

3.3 With Copenhagen, the Danish regulator has applied a price cap for many years. It has built up a history of decisions that have been accepted by all parties. Although the regulator is not legally independent, it has so far largely acted independently and acquired the status of a fair arbitrator not captured by special interests. If parties do not agree on charges, then a price cap based on a regulatory asset base and a mixed till is imposed[12]. The airport has been majority privately owned since 2000.

3.4 In Frankfurt and Munich, if parties do not agree on charges, rate-of-return regulation with a dual till is implemented by a regulator that is not independent. The lack of separation of regulation and ownership which might lead to regulatory capture has been criticised by airlines, academics (Littlechild, 2011) and the German competition authorities (Monopolkommission, 2016) This leaves airlines in a weak position as rate-of-return regulation leads to higher charges than price capped airports. Munich airport is publicly owned and Frankfurt airports is minority privatised.

3.5 At both Geneva and Zurich airports, if the parties disagree on charges, the law explicitly states that charges should be cost related, but the services do not have to be efficiently provided. Consultation is restricted to two airlines and the Board of

[11] Gatwick airport falls in the same category of regulation.
[12] So far this has not happened.

Airlines. The airlines are heterogeneous and have different interests. An agreement reached between the airport and the main airlines might not be in the interest of all airlines. Geneva is a public airport. Zurich was privatised in 2006 and the private sector has a majority share.

3.6 The form of regulation adopted by the regulator will have a significant impact on the outcome of the process, in terms of the level of charges and incentives. A critical aspect is the expectations formed about the likely course of action by the regulator. Parties will negotiate an outcome close to the expected choice by the regulator (King and Maddock, 1999).

3.7 If the regulator is expected to opt for rate-of-return regulation, the charges will be close to the average cost, and there will be no strong incentive for the airport to seek efficiencies which would lower the cost or charges. If there is a price cap, there will be an incentive for the airport to seek efficiencies, which it will do if it is a profit-oriented firm (e.g., if it is privately owned (Forsyth, 2004).

3.8 Thus, with Copenhagen, if the regulator is called upon to adjudicate, the price cap will induce the airport to be cost efficient. With the other cases, the rate-of-return regulation will blunt any incentives for the airport to become efficient and overall charges levels are likely to be high. If costs cannot be adjusted quickly, and as regulation does not incentivise such flexibility, charges might be higher than under a price cap regime. This is likely to be the case unless there are specific incentives given to management to opt for efficient solutions. We are not aware of any.

3.9 Another relevant factor is the degree to which the regulator is independent. This requires that regulation is institutionally separated from ownership, which is the case in Switzerland but not in Denmark and Germany. In Switzerland the independent regulator is bound by a law which explicitly states that the services do not have to be cost efficient. This makes the regulation weak in terms of promoting efficiency. At Copenhagen the regulator has acquired the reputation of being fair and not captured by the airport, but this reputation is always at danger if policy intervenes as in 2014 and 2015 (Forsyth et al., 2021 and 2023). The minority share of the state in Copenhagen and the share of a Danish pension fund are seen as potential conflicts of interest[13]. German airport regulation is not independent. This may induce it to opt for regulation which favours the airport against the interests of the airlines.

3.10 In addition, the interests of the airlines are not homogenous[14]. An agreement reached between the airport and the hub carrier (which in Frankfurt holds a minority share and in Munich operates a terminal jointly) does not necessarily reflect the interests of all carriers and users. This is also a problem at Copenhagen, Zürich and Geneva airports. At Copenhagen, the hub carrier has a market share that is sufficiently large to represent the airlines alone when negotiating the regulatory agreement with the airport. It has been suggested that the negotiating parties should not be based entirely on the majority in terms of

[13] The Danish state holds 39.2 %, the Canadian pension fund Ontario Teachers Pension has a share of 29.3% and Denmark's largest pension fund Arbejdsmarkedets Tillægspension (ATP) holds 29.3%.

[14] Consumer interests do not play much of a role in these cases. It is in the interest of the consumers that airlines are represented fairly in the negotiations because otherwise competition between airlines might be lessened.

traffic share. A certain number of airlines, preferably with different business models, should be part of the airline group.

3.11 The period in which the charges are set can influence the workings of constructive engagement or negotiation. Are the prices set for an extended period? If not, the scope for major changes using customer engagement are limited since there will not be much scope to change prices even if both parties agree since the prices will be locked in.

3.12 With Copenhagen there is a 5-year regulatory period which gives the airport incentives to reduce costs. This is normally not the case in Munich, but after Covid-19 the airport and airlines reached an agreement for 10 years. Agreements for Frankfurt Airport have been much shorter and have not been continuously reached[15]. In Zürich, there was an agreement reached in a dispute in 2014, but the term was not specified.

3.13 The overall outcome of European style light-handed regulation with a price cap is similar to the outcome of a price cap regulated airport (apart from the lack of an independent regulator in Copenhagen). The outcome for the other light-handed regulation cases is likely to be similar to those of airports which are subject to rate-of-return regulation. Light-handed regulation of itself does not create strong incentives for good performance if the fall-back regulation is a form of cost plus regulation.

Lessons Learned

3.14 A number of airports in Europe are subject to light-handed regulation consisting of the ability of an airport and airlines to negotiate charges and other matters, with a fall-back option of regulation (or, negotiate/arbitrate). The positive feature of this model is the scope for customer engagement but with the assurance that the airport will not be able to overtly take advantage of market power.

3.15 Outcomes in terms of the use of market power, and the closeness of charges to the efficient level of costs, depend on the form of regulation, ownership of the airport and whether there is an independent regulator:

- Light-handed regulation of a privately-owned airport by an independent regulator using a price cap as the fall-back option could potentially result in efficient outcomes.
- If light-handed regulation by a dependent regulator involves public ownership and/or some form of cost-plus regulation (as with Munich and the Swiss airports), it may result in charges above the level of efficient costs and charges.

Australian Airports: Customer engagement and light-handed regulation

3.16 One of the key reasons for the move to light-handed regulation of the Australian airports was to increase the scope for airport-airline negotiations. Negotiations can cover a wide range of issues, including charges, security arrangements, risk sharing, quality levels and dispute resolution arrangements, not just investment, as discussed elsewhere. Under light-handed regulation, there is no formal set of

[15] In such cases, rate of return regulation with a dual till tends to result in a relatively high charge.

arrangements, but rather, airlines and airports simply negotiate when necessary as long as the negotiation is consistent with the government's (broad) Aeronautical Pricing Principles. The performance of negotiations is reviewed from time to time by the Productivity Commission (Productivity Commission, 2019, Ch 4). The Commission concluded that the system was working well, and that there was no evidence that the airports with market power had "exercised that power in negotiations with airlines to the detriment of the community" (PC, 2019 p119). It noted that sometimes negotiations took a matter of years, which suggested that the parties were treating the negotiations seriously.

3.17 An example of a complex negotiation was one between Qantas and Brisbane airport. The two parties entered a detailed negotiation involving a range of matters, including the airport's desire to implement pre-finance for the second runway, then under construction, the future ownership of the Qantas domestic terminal and other matters. Qantas was very much opposed to pre-finance. In the end, the matters were resolved to the satisfaction of the parties. However, the arrangements are confidential.

3.18 There was one aspect of the negotiation arrangements which the Commission argued was a matter of concern. This was the problem of anti-competitive clauses in agreements between an airport and an airline. This could happen if there were an incentive given to one airline, the signatory airline, but not extended to competitor airlines.

3.19 One issue which has been a source of contention has been the lack of any dispute resolution mechanism. Both the airlines and the general regulator, the Australian Competition and Consumer Commission (ACCC), have consistently argued for such a mechanism, and the airports have argued against it. There is some expectation that such a mechanism would result in lower airport charges. Such a mechanism would lessen the freedom of action of the airport (and possibly the airlines). The airport would be under pressure to propose changes which are likely to meet the approval of the airlines. It is possible that the arbitrator will become a de facto regulator, regularly making determinations over such matters as the level of charges.

3.20 While there is no dispute mechanism in Australia, the parties have occasionally used court processes to settle charges disputes. There was a dispute about the level of charges between Perth airport and Qantas which ended in a court judgement in 2022. However, Perth Airport and Qantas have recently concluded a negotiation, which took several years, involving substantial investments such as terminals and a new runway, amicably.

3.21 A Dispute Resolution Mechanism (DRM) can be a useful half-way house between the free-for-all of an unregulated form of light-handed regulation (as in Australia) with airports possessing market power free to exercise it and the rigidities of price cap which, once set, is difficult to change.

3.22 Negotiations, or customer engagement, in a light-handed regulation setting has the advantage that the scope for negotiation can be very broad. Many potential options facing the airport and airlines involve the airport raising its charges, such as when investment is required. When there is a price cap, the scope for negotiation is limited because airports will not be prepared to spend their own funds to make a change because they are prohibited by the price cap from increasing their charges.

There may be some scope for airlines to cover the cost of the changes themselves, but often this is not feasible. If light-handed regulation is accompanied by a dispute resolution mechanism, the best of both worlds might be achieved with the flexibility of light-handed regulation being combined with the assurance that the market power of the airport will not be abused.

Lessons Learned

3.23 Unconstrained light-handed regulation provides the maximum scope for customer engagement at airports.

3.24 When light-handed regulation is combined with a dispute resolution mechanism there will be moderate scope for customer engagement with protection from the excessive use of market power. In this respect the combination provides a half-way house between unconstrained light-handed regulation and full price cap or rate of return regulation.

3.25 All models of customer engagement need to guard against anti-competitive clauses in contracts.

3.26 Price cap and rate-of-return regulation limits the scope for customer engagement by making it more difficult for the airport to conclude contracts which involve the airport increasing its prices without approval from the regulator.

Customer engagement in ATC sectors in Australia & New Zealand

3.27 The aim of customer engagement is to better incorporate customer preferences in utility and aviation regulation. In addition, customer engagement can help resolve some of the information asymmetries between regulators, firms and customers.

Air services Australia price notifications

3.28 Airservices Australia (Airservices) is a wholly owned government corporation, is the sole supplier of civilian air navigation services in the airspace, and in addition, provides aviation rescue firefighting services (ARFF).

3.29 Under its establishment Act, the Airservices Act 1995, Airservices is required to earn a reasonable rate of return on capital with the expectation that Airservices will pay a reasonable dividend to the government, although the dividends paid to the government are not fixed in practice. The Civil Aviation Safety Authority (CASA) constrains the operation of Airservices through determining the level of service supplied at each airport which results in the supply of services to some regional and remote airports on an uncommercial basis.

3.30 Since its inception Airservices' prices have been regulated under prices surveillance provisions currently contained in the Australian Competition and Consumer Act 2010 (the CCA) (Part VIIA). These provisions require Airservices to notify the Australian Competition and Consumer Commission (ACCC) for a price review if they propose to increase the price of any of their regulated services (all core services), no review is required otherwise[16]. In its assessment of price notifications the ACCC considers that the criteria in the Act will generally be met by

[16] The legislative framework is different from that which applies to most other regulated industries in Australia.

economically efficient prices which reflect an efficient cost base and a reasonable rate of return on capital (ACCC, 2017). The legislation is framed in terms of 'discouraging' an entity with market power in using it in its pricing and is non-binding in this respect. There are no explicit provisions related to protection of, or engagement with, customers or final consumers. After an ACCC price review, the relevant Government Minister must be notified by Airservices' Board of proposed price changes and can accept or reject them. In practice, ACCC decisions are followed.

Customer engagement with Airservices prior to regulatory review

3.31 Until the early 2000s Airservices chose to review its prices on an annual basis. At that time, the ACCC, with the support of airline users, encouraged Airservices to develop a longer term pricing approach. Additionally, Airservices was encouraged to consult directly with industry stakeholders before submitting a pricing proposal to the ACCC.

3.32 The new customer engagement process involved the formation of an industry steering committee and working groups and covered Airservices' prices for the period 2004-05 to 2008-09 (ACCC, 2004). Apart from one initial meeting, the regulator was not represented nor involved in directing the engagement process.

3.33 The industry committee decided to adopt the 'building block' model generally used by the ACCC for price determination in regulation of utility industries, and undertook detailed analysis of the elements of the model. The committee engaged independent consultants to assist it on specific technical issues, which included the cost of capital. The industry committee process resulted in agreement on prices prior to Airservices' submission of the proposal to the ACCC.

3.34 While major airlines were very positive about the engagement process, representatives of regional and general aviation operators found it difficult to engage in the working group process, and were not satisfied by the outcome of the committee process which had affected the structure of Airservices' prices. As a result, the ACCC directed that separate additional consultations with regional and general aviation users should be conducted. Modifications were made to Airservices' pricing structure which resulted in lower increases in terminal navigation charges at smaller airports.

3.35 The 2011 ACCC price review, considered that although Airservices' consultation process on its capital expenditure program was generally satisfactory, there was scope to allow stakeholders to provide more informed input on the benefits and costs of specific projects in the future. Additionally, the ACCC considered that the WACC incorporated in Airservices' pricing proposal was too high and approved prices which reflected a lower WACC.

3.36 Airservices experienced a period of losses around 2015 attributed to a significant fall in mining activity in Australia and associated reduction in 'fly-in fly-out' travel. At the time, Airservices consulted industry on proposed price rises but was met with widespread and significant industry resistance (ACCC, 2011)[17]. Industry stakeholders argued that Airservices should respond to the decline in demand

[17] Discussion with the Chief Financial Officer at Airservices Australia

through increasing its efficiency. Airservices embarked on an efficiency drive which continued over the next few years, including over the period of the pandemic.

3.37 Airservices returned to profitability prior to the onset of the pandemic without increasing its prices and so avoided a price review by the ACCC. The Australian Government provided substantial grants to Airservices, as well as assistance to airlines, during the pandemic. As there were no proposed price increases during this period, the ACCC was not involved in reviewing Airservices' pricing until 2023.

3.38 As a result of feedback received through engagement on their initial price proposal, Airservices have revised the timing for the introduction of price increases (ACCC, 2023).

Lessons Learned

3.39 The Airservices case study shows that direct customer engagement between the service provider and its customers before the price proposal is submitted to the regulator have been successful in that airlines have been able to influence Airservices. Airline customers have supported a pricing proposal, as happened in 2004, and through their industry knowledge airlines have been able to influence Airservices to increase its efficiency, instead of seeking a price increase from the regulator.

3.40 Although the regulator's role may be reduced through direct industry engagement between the service provider and users, the role of the regulator is still important. There is potential for conflicting interests among consumers of regulated services, especially where customers have diverse characteristics. The regulator needs to ensure that all relevant user groups have been adequately represented in consultations and in the outcome of a pricing decision. Additionally, the regulator has expertise in technical areas, such as the cost of capital.

Customer engagement with Airways New Zealand without regulation.

3.41 Airways New Zealand (Airways) is a wholly government owned corporation under the State Owned Enterprises Act 1986 (SOE Act) which requires that SOE's to be managed as if they were privately owned (section 4). In comparison to Australia, New Zealand's airspace has a significantly smaller volume of air traffic.

3.42 Airways self-regulates with a threat of regulation under provisions in the Commerce Act 1986 which allows for the imposition of price controls on an SOE if recommended by an inquiry by the New Zealand Commerce Commission.

3.43 Airways has adopted an Economic Value Added (EVA) methodology to measure its economic performance which incorporates a target of zero economic profit over a three year price cycle. Through the aim that EVA equal zero this measure includes the economic cost of supplying equity funds without earning monopoly profits (Airways New Zealand, 2019). Airway's customer engagement is based on a three year price cycle over which revenue is expected to generate an EVA equal to zero. The adoption of the EVA method was a means of balancing shareholder interests for a profitable business against customers' interests for safe, efficient and cost-effective air navigation services (Austin, 2005).

Airways' customer engagement

3.44 Airways carries out formal consultation processes on the pricing of its air navigation services (Airways, 2022). Its pricing approach appears to be modelled on the general building block model to pricing services used by independent regulators, such as the New Zealand Commerce Commission. Submissions, and Airways responses to issues raised in the customer engagement process, are placed on its website. Airways has consulted its customers on the development of its pricing methodology and its service quality agreement.

3.45 In 2013, Airways developed an approach to consulting customers on investment plans (Arblaster, 2018, pp 203-205), which identified investment projects which were 'discretionary' in the sense that they were above the minimum safety requirements required by the safety regulator. For these projects consultation occurred on the trade-off between incurring costs associated with the investment project and the benefits derived from the project, such as fuel savings and increased flight predictability. A 'Scorecard' was also introduced to track actual performance against target performance associated with specific metrics for major investment projects.

3.46 The 'Scorecard' approach has continued to be used. It measures Airways' performance on a limited number of metrics important to customers using a mix of qualitative and quantitative metrics on safety, operational and productivity dimensions of performance (Airways, 2022). The Scorecard is provided to customers on a regular basis over a price cycle to provide transparency and accountability on Airways' service delivery performance. Examples of metrics, safety (reported incidents and comments), environmental performance (track miles saved and CO2 saved) and service availability (by broad types of equipment).

Lessons Learned

3.47 The Airways' case study on customer engagement shows it is possible to develop techniques, such as the 'Scorecard', to enhance industry consultation. Although a regulator is not involved in Airways' case, a credible threat of regulation is likely to be present and an influence on Airways' behaviour.

4. STREAMLINING REGULATION

Dublin Airport: Streamlining the Regulatory Process

4.1 In the early years of the Irish airport regulation, the length of its decision documents[18] increased rapidly. Between 2001 and 2008, the aggregate length of the IAA's decisions climbed from around 400 to 600 pages.

4.2 There were similar increases in the volume of materials submitted by stakeholders during consultations and especially so in the case of the operator of Dublin airport. The IAA considered that, without action, the escalation was likely to continue and to overwhelm all stakeholders. A decision was taken that any single decision document from the regulator's office should aim to be no longer than 100 two-sided pages. The important aspect was not the exact page target, but rather the

[18] Issues Paper, Draft Decision and Final Decision.

intention of setting a limit. IAA documents in the next price review were pulled back to a total of about 500 pages. But such a goal needs regular re-commitment or slippage will resume.

4.3 This policy required the regulator's office to seek to limit the scope of a price review. The IAA's early price reviews had involved stakeholders seeking to reopen aspects of earlier decisions about which they were unhappy. Examples included investments that had earlier been added to the RAB and the treatment of differences between allowances and cost outruns. Around 2009, the IAA announced that, from then on, matters decided in earlier reviews would not be considered again unless there were fresh developments that made the earlier issues pertinent to the subsequent regulatory period. This was eventually accepted by stakeholders.

4.4 In the UK, at least when viewed from outside, the very large scale of materials produced during a review of charges at Heathrow is notable. As in other regulated sectors, processes and documentation ratchet upwards. As part of the CAA's 2024 consultation on setting future price controls, a joint letter was submitted on behalf of the airport operator and airlines at Heathrow. This sought an improved price control process with some emphasis on increased resources for the CAA. Simultaneously, the airport operator and airlines submitted a long list of key matters that the CAA needed to take into account.

4.5 We suggest that there is a trade-off to be made. On the positive side, the CAA's current process means that issues raised by stakeholders receive detailed and careful attention, sometimes by the creation of a dedicated new work stream, involving a CAA analysis, a round of consultation and a decision. But, on the other hand, the overall focus is surely lost.

4.6 One might ask of any given regulatory regime, does the scope and definition and methodology of service quality metrics need full reconsideration every five years? And likewise the precise inflation index to be applied? The traffic risk sharing scheme? RAB depreciation policy? The methodology for forecasting passengers and aircraft movements? All of these? And if in future the focus on environmental issues needs to increase, other methodologies and approaches could be retained for a further price control period. The CAA in the past reviewed issues like the definition of the regulatory till but for decades afterwards has not reopened discussion of that policy.

Lessons learned

4.7 A more focussed approach would appear to be consistent with the principles of Better Regulation in the UK.Very likely, all parties would agree that a price review on the recent scale is excessive. But how to downsize? The most promising route would probably be a discussion between the two sides of the aviation industry; industry agreement on downsizing would likely be welcome to the CAA. Consideration could be given to:

- a materiality threshold; unless a change being sought would, on a reasonable CAA and simplified calculation, change the aggregate of airport charges over a five year period by more than £X million, it would not be further considered;
- discussion between stakeholders seeking to match a set of quantitatively small issues being advocated by service providers, on one side, with a second set of

small issues promoted by service users, with a view to jointly notifying the CAA to withdraw both sets of issues from the price review.

- No doubt parties could investigate other avenues.

4.8 The CAA may want to consider, in its next consultation, raising with stakeholders their willingness to investigate a streamlining of the process and the scope of future reviews of the charges of HAL and NATS. Indeed, that could be a matter for constructive engagement.

4.9 A CAA aviation price review for HAL or NERL will never be a small exercise. But with some careful thinking by all concerned, it could be made more manageable than of late.

5. LESSONS AND CONCLUSIONS

5.1 This final section of the report summarises the analysis from the individual case studies. The emphasis is on identifying lessons that appear applicable to aviation regulation in the UK and that are incremental in nature rather than requiring a major recasting of the CAA's approach. We have taken account of, but have not responded to, all the observations made by stakeholders at the workshop organised by the CAA nor to every written response that we have received. Our mandate is to seek to identify useful lessons for the UK rather than engaging in detail on features and practices of the current regime.

5.2 We are cognisant of the key role of the CAA in promoting passengers' interests. In practical terms, promoting passenger interests particularly means the CAA's role in ensuring the quality of service that passengers experience at a reasonable cost. Passengers are directly affected by the length of the security queues, the availability of seats and the availability of facilities. The role is particularly important when the enterprise is subject to price cap regulation, which gives rise to well-known incentives for the enterprise to downgrade quality as a means of reducing costs. This is relevant to both Heathrow and NERL.

5.3 There is an additional problem which is present when an airport is slot constrained. Price caps will be helpful to the airline consumers, through moderating the prices they pay, but the benefits will not be enjoyed by the passengers – rather, the airlines will enjoy the slot rents and do not need to pass on the benefits of regulation to their passengers (Starkie, 1998). With price caps, the interests of the airline customers are safeguarded, and the interests of passenger consumers are advanced by monitoring and if need be, financial incentives to ensure the service quality which passengers seek.

5.4 It is slightly different with NERL. There is no slot constraint, and to the extent that there is a competitive airline environment, the gains from a price cap will be ultimately passed on to the passenger consumers.

5.5 We do suggest that the CAA should be involved in negotiations in order to protect the interests of the end consumer, namely the passenger. This should at least happen in the discussions around service quality, which is very important under a price cap regime.

5.6 We organise this section of the report in four parts. First, we refer to the use of benchmarking in economic regulation. Second, we discuss investment incentives for infrastructure provision, service resilience and service continuity. Third, we discuss the case studies focussing on light-handed regulation and engagement. Finally, we derive lessons from the processes used elsewhere to streamline and improve the regulatory process.

Benchmarking

5.7 In 2019, conscious of the limits of the partial measures of ANSP productivity used previously, the Performance Review Board (PRB) commissioned a benchmarking study of ANSP efficiency (the report of the Academic Group). The report was based on benchmarking methodologies and concluded that there was a 30% average level of inefficiency in the ATC system in 2018. However, in the absence of an independent economic regulator within the Single European Skies policy architecture, the EU Commission, lobbied by Member State government owners, set a target which did not close the inefficiency gap sufficiently.

5.8 The ANSP benchmarking exercise for the PRB was repeated in 2023. Regulatory benchmarking has also been used to compare ATC efficiency in Europe and the US, and to assess efficiency at Italian airports, finding once again, in each of these cases, a substantial efficiency gap in current performance. Overall the experience with benchmarking methods such as stochastic frontier analysis (SFA) and data envelopment analysis (DEA) as regulatory tools for airports and ATC is positive, providing useful insight in cases of information asymmetry.

5.9 This report has argued that efficiency could be improved in the ATC sector by applying much stronger rewards and penalties with respect to service quality (i.e. delay) standards. An alternative to regulation would be to tender ATC services in en-route European airspace. While the first of these lessons would appear applicable in the UK context, the latter would require international agreement.

Investments

5.10 The case studies have considered investment incentives based on experience at Australian and a number of continental European airports under light-handed regulation and in Dublin under price cap regulation. Service continuity and resilience are also considered.

5.11 Investment incentives under light-handed regulation - in cases spanning Australian airports and continental European airports - does not seem to constitute a model that is applicable as such to UK aviation regulation, given the CAA's statutory duties under its legal environment. Moreover, the Australian experience - for example, the greater willingness of Brisbane compared to Sydney airport to build a new runway - suggests that light-handed regulation still encounters problems with airports in private, profit-oriented ownership and with significant market power, at least in respect of building the costliest aviation infrastructures. However, aspects of light-handed regulation - in particular, approaches that support industry engagement and consultation - could be adapted to engagement over less costly aviation infrastructure in the UK.

5.12 Dublin airport operates under an ex-ante price cap regime; in principle, the same regime as in Heathrow. The approach has allowed large-scale capacity

expansions to take place, notably a second terminal (2010) and a second runway (2022), although the first of these was exceptionally contentious. Price cap decisions currently involve material, but less costly projects, and the assessment process has moved towards a more collaborative approach to investment decisions. The latter, the StageGate process, has eliminated some, though not all, of the disputes over a project's need, scale and cost. In the price cap decisions that grappled with the costs of the second Dublin airport terminal, certain specific technical innovations were applied to the price cap calculation to better share the investment risk between the airport and its users. Some of these may be applicable to future very-large-scale investments in UK aviation infrastructure.

5.13 In the ATC sector, investment has not delivered security of service-continuity, with significant service delivery failures in the UK in August 2023 and in Switzerland in June 2022. In the background, the Single European Sky programme has not delivered investment in the ATC network such that individual Area Control Centres can take over in the event of a failure at another centre in the system. There is a lack of standardisation. Investment should be made in new digital technology allowing for open systems to overcome silo solutions. To function well, especially in terms of engagement and consultation, economic regulation depends upon the provision by the regulated firm of sufficient and timely information. In particular, transparent forward-looking business plans and investment plans that are clear as to costs, deadlines and, most of all, explicit deliverables. For example, the reduction in average flight delays to be achieved by a given investment by an ANSP. In that regard, consideration might be given to applying material financial penalties to regulated firms for non-delivery of business plans and investment plans of sufficient transparency and timeliness. In addition, non-delivery of transparent data ex-post, which permits auditing of the specific service improvement that has been achieved by the expenditures in question should also lead to notable penalties.

5.14 Concerning the investments in service quality, which is certainly required under price-cap regulation, the various case studies we considered were notable for the difference in the level of scrutiny and detail of the regulatory oversight and monitoring in these areas. Arguably, the 'pinch points' for passengers are relatively few; these include security and baggage delivery delays at airports and flight delays due to air traffic control. Fewer, larger financial penalties, accompanied by periodic high-level passenger surveys, might serve to concentrate the effort of regulated firms in key areas and achieve some lightening of economic regulation. Considered from either a service quality perspective (flight delays) or from an ex post investment audit viewpoint, the ANSP case studies underline the importance of a robust process of ex ante capex scrutiny and for strong incentives to make investments in up-to-date ATC technology. The duplication and insufficient interoperability of ATC software between centres suggest that there is a case for a more regulator-led capex process, including rewards for investment in the latest technology and penalties for the continued absence of digitised ATC services.

Streamlining regulation with elements of light-handed regulation

5.15 We have examined two case studies involving negotiations or constructive engagement in relatively light-handed airport environments involving European and Australian airports. These can be compared.

5.16 Negotiation works adequately in Australia – it has to, given that there is no regulation. Issues which have been successfully negotiated include pre financing, new terminals, runways, and the like. However, negotiation about the level of charges does not work and airlines have no recourse to a dispute resolution mechanism. This is something about which airlines and the Competition Authority (ACCC) are very critical. Airlines are able to agree with the airports on non-charge issues while disagreeing on the issue of charges fundamentally.

5.17 By contrast, in Europe, in the light-handed cases we have discussed, there has been regulatory backup. There seems to be less detailed negotiations about the running of the airports and stakeholders have mixed views about how effective constructive engagement has been. This has had the effect that:

- Airlines are moderately satisfied at Copenhagen that their financial interests are being recognised (charges are not too high). Negotiation is real and so far an agreement has always been reached. Moreover, the regulator is not independent of the government.
- In Germany (Frankfurt and Munich), the regulator is also not independent. Negotiations between airlines and airports often failed and agreements have been reached on a purely annual basis.
- In Switzerland, airlines challenged airport charges before the courts and sought to change the regulatory regime, but policy decided in favour of the airports, and negotiation has been limited. There is an independent regulator but it is constrained in what it can do.

5.18 In all negotiations the fair presentation of the interests of the airlines is an issue. There is always the danger that agreements are reached which reflect the interests of hub airlines more than of the interests of other airlines.

5.19 Backup regulation includes a price cap (Copenhagen) and rate-of-return regulation in Germany and Switzerland. These create very different incentives for the airports to produce efficiently. While in Copenhagen the incentives are set in the direction of efficiency, the incentives in Germany and Switzerland work in the opposite direction. The Australian system differs from that at Heathrow more than do those of continental Europe and the Australian regime is more controversial than the systems operating in the European airports.

5.20 In the case of ANSPs, the experience in Australia and New Zealand of direct consultation between the service provider and consumers without the presence of a regulator is discussed. The two cases show this form of consumer engagement can be successful in the sense that airline customers are able to influence the air navigation service provider and agreements have been reached. In Australia and New Zealand there are examples of agreement on pricing methodologies and a service quality agreement. Airspace users were able to influence the Australian air navigation service provider to undertake a cost efficiency program instead of increasing prices.

5.21 The regulator has still been important when direct customer engagement occurs. In Australia, the regulator has identified issues with pricing proposals, such as seeing that smaller users are adequately represented and their services priced appropriately, and has applied technical expertise on issues such as the weighted average cost of capital (WACC). In New Zealand the backdrop of a regulatory

model applied to airports by the New Zealand Commerce Commission, and a threat of regulation, are likely to have influenced the Airways approach.

5.22 There has been limited time to examine the two energy market case studies of negotiated settlements in-depth. In both the US and Australian cases, long and litigious processes preceded the adoption of increased customer engagement with service providers. Additionally, in both cases, regulatory measures have been adopted to increase the efficiency of regulatory processes; such as separation of policy from factual issues. The WACC was set and then removed from the negotiation process, which instead focused on customer engagement with respect to capex, opex and the trade-off between price and quality of service.

5.23 In general, the scale of regulatory exercises tends to ratchet upwards, even though the principle of diminishing returns might suggest falling benefits from broader and deeper analyses. This report contrasted the regulatory process at Dublin and Heathrow airports.

5.24 We suggest that the next UK aviation reviews seek the agreement of stakeholders to narrow the regulatory focus to building blocks with the largest impact on the Heathrow price cap: the cost of capital, the traffic forecast, and opex and capex allowances. This would assist the stakeholders' stated desire for an improved process of regulation, offering increased clarity and a timetable that could be expected to be met. The report made some suggestions as to ways in which building blocks could be divided into more and less important areas with the possibility of focussing effort and engagement on the former.

6. REFERENCES

ACCC (2004). Airservices Australia, Price Notification, Final Decision, December,https://www.accc.gov.au/system/files/Airservices%20Australia%202004-05%20price%20notification-Final%20decision.pdf

ACCC (2011) Airservices Australia price notification ACCC decision June 2015,.https://www.accc.gov.au/system/files/Airservices%20price%20notification%202015%20-%20ACCC%20decision.pdf?ref=0&download=y

ACCC (2017). Statement on approach to assessing price notifications under Part VIIA of the Competition and Consumer Act 2010:https://www.accc.gov.au/system/files/Statement%20of%20regulatory%20approach%20to%20assessing%20price%20notifications%20under%20....pdf

ACCC (2023) Airservices Australia 2023, https://www.accc.gov.au/by-industry/travel-and-airports/airport-and-aviation-price-notification/airservices-australia-2023

Accenture (2022). Independent investigation of the major incident occurred on the 15th of June 2022 at Skyguide. Report to the Federal Department of the Environment, Transport, Energy and Communications (DETEC).

Airways New Zealand (2019). EVA Reporting Framework, p.4. https://www.airways.co.nz/assets/Uploads/EVA-Framework-2019-06-FINAL.pdf

Adler, N., Bogetoft, P., and Volta, N. (2018). Air Navigation Service Providers: Advice on benchmarking of ANSPs and EU-wide cost targets. Academic Group Final Report, 2018-05-23.

Adler, N., Hanany, E., and Proost, S. (2022). Competition in congested service networks with application to air traffic control provision in Europe. *Management Science*, 68(4), 2751-2784.

Adler, N., Hanany, E., and Proost, S. (2024). Auctioning congested service networks with application to air traffic control markets. Working paper at ResearchGate.net.

Airways New Zealand (2022) Customer Consultation documents for 2022-2025 at:https://www.airways.co.nz/airspace-users/industry-consultation/airways-pricing-consultation-for-the-2022-to-2025-period/

Airways New Zealand. (2023). New air traffic management platform and resilient builds a milestone for Airways. Media Centre 6 December, https://www.airways.co.nz/media-centre/media-statements/new-air-traffic-management-platform-and-resilient-buildings-a-milestone-for-airways/

Andribet, P, M Baumgartner, and J-M Garot (2022). Reinventing European air trafficcontrol based on the covid-19 pandemic experience, *Utilities Policy,* 75, 101343.

Arblaster, M. (2018). Air Traffic Management: Economics, regulation and governance. Elsevier.

Asimow, M. (1994). VIAL Committee Recommends PUC Reforms. *California Regulatory Law Reporter*, 14, 3-5.

Austin, L. (2005). Benchmarking to economic value added: The case of Airways Corporation of New Zealand Limited. *Benchmarking: An International Journal*, 12, 138-150.

Australian Competition and Consumer Commission. (2017). Statement of regulatory approach to assessing price notifications under Part VIIA of the Competition and Consumer Act 2010.

Australian Competition and Consumer Commission. (2024). Airport Monitoring Report 2022-2023. ACCC April.

Australian Energy Regulator (2021). Creating a more efficient process https://www.aer.gov.au/about/strategic-initiatives/better-resets-handbook

Australian Energy Regulator (2023). Rate of Return Instrument - Explanatory Statement, February. https://www.aer.gov.au/system/files/AER%20-%20Rate%20of%20Return%20Instrument%20-%20Explanatory%20Statement%20-%2024%20February%202023_1.pdf

Australian Energy Regulator (AER). (2024). Website. The guidance documents and final report from the customer forum: https://www.aer.gov.au/ausnet-services-trial The monitoring reports: https://www.aer.gov.au/industry/registers/resources/reviews/consultation-new-reg-process/update

The final evaluation: https://www.aer.gov.au/industry/registers/resources/reviews/consultation-new-reg-process

Baumgartner, M.,and Finger, M. (2014). The Single European Sky gridlock: A difficult 10 year reform process. *Utilities Policy*, 31, 289-301.

Case Law, Florida. (2014). Citizens of the State of Florida versus Florida Public Service Commission, No. SC13-144, Decided August 28, 2014 reported at: https://caselaw.findlaw.com/court/fl-supreme-court/1676931.html

Chakravorty, S. (2015). A study of the negotiated-settlement practice in regulation: Some evidence from Florida. *Utilities Policy*, 32, 12-18.

Colombi, R., Kumbhakar, S. C., Martini, G., and Vittadini, G. (2014). Closed-skew normality in stochastic frontiers with individual effects and long/short-run efficiency. *Journal of Productivity Analysis*, 42(2), 123-136.

Doucet, J. and Littlechild, S. (2009). Negotiated settlements and the National Energy Board in Canada. *Energy Policy*, 37, 4633-464.

European Commission (2019). Commission Implementing Regulation (EU) 2019/317 of 11 February 2019 laying down a performance and charging scheme in the single European sky and repealing Implementing Regulations (EU) No 390/2013 and (EU) No 391/2013, Official Journal of the European Union, L 56/1.

European Commission-Comparison, FAA and Eurocontrol (2024) of Air Traffic Management related operational and economic Performance U.S. – Europe, 31ad10d4-51e3-43cf-8592-edbfb69f7ff0_en (europa.eu). Accessed on the 28.5.2024.

FABEC Research Workshop. (2020, October 21-23). Interdependencies within ATM performance in the context of a dynamic environment.

Finger, M. andGortazar, N. (2024). ATM transformation flagships - continuing the journey. *European transport regulation observer policy brief*, issue 2024/05.

Fichert, F. (2023). Airport regulation and benchmarking: Case study Germany. In P. Forsyth, J. Mueller, H.-M. Niemeier, and E. Pels (Eds.), Economic regulation of urban and regional airports: Incentives, efficiency and benchmarking. Springer, pp. 371-382.

Forsyth, P. (2004). Replacing Regulation: Airport Price Monitoring in Australia. InD. Gillen, P. Forsyth, A. Knorr, O. G. Mayer, and H-M. Niemeier*(*Eds.),*The economic regulation of airports: recent developments in Australasia, North America and Europe*. Ashgate, pp. 3-22.

Forsyth, P. (2008). Airport Slots: Perspectives and Policies. In A. Czerny, P. Forsyth, D. Gillen, and H.-M. Niemeier (Eds.), Airport Slots - International Experiences and Options for Reform, Ashgate, pp. 379-405.

Forsyth, P., Guiomard, J. C., Müller, and Niemeier, H.-M. (2021). Changing airport governance and regulation: The regional aspect. In A. Graham, N. Adler, H.-M. Niemeier, O. Betancor, A. P. Antunes, V. Bilotkach, E. J. Calderón, and G. Martini (Eds.), *Air transport and regional development policies*, Routledge, pp. 49-80.

Forsyth, P., Mueller, J., and Niemeier, H.-M. (2023). Changing government and regulation of regulation: A comparison of Austria, Denmark, Hungary, Italy, Portugal and Spain. In P. Forsyth, J. Mueller, H.-M. Niemeier, and E. Pels (Eds.), *Economic regulation of urban and regional airports: Incentives, efficiency and benchmarking*, Springer Nature, pp. 397-422.

Forsyth, P., and Niemeier, H.-M. (2023). Regulation of air traffic control services: Principles and European experience. In M. Efthymiou (Ed.), *Air traffic management principles, performance, markets*. Routledge, pp. 168-199.

Fox, K.J., 1999. Efficiency at different levels of aggregation: public vs. private sector firms. *Economics Letters*, *65*, 173-176.

Gillen, D., and Starkie, D. (2016). EU Slot Policy at Congested Hubs, and Incentives to Add Capacity. *Journal of Transport Economics and Policy*, 50, 151-163.

Hahn, R., Metcalfe, R., andRundhammer, F. (2017). Working with Customers to Improve Regulation, June. Working paper, Smith School of Enterprise and the Environment, University of Oxford.

Harvard Electricity Policy Group. (1995). Regulatory Decision making Reform. *Administrative Law Journal of the American University*, 8, 789-912.

Havyatt, D. (2022). Toward consumer-centric energy network regulation: Australia's experience. *Utilities Policy*, 78, 101404.

King, S. P. and Maddock, R. (1999). Light-handed regulation of access in Australia: negotiation with arbitration. *Information Economics and Policy*, 11, 1-22.

Littlechild, S. (2009). The bird in the hand: Stipulated settlements in the Florida electricity sector. *Utilities Policy*, 17, 276-287.

Littlechild, S. (2011). Regulation and Customer Engagement Economics of Energy & Environmental Policy. International Association for Energy Economics.

Littlechild, S. (2012). German airport regulation: Framework agreements, civil law and the EU directive. *Journal of Air Transport Management*, 21, 63-75.

Martini, G., Scotti, D., Viola, D., andVittadini, G. (2020). Persistent and temporary inefficiency in airport cost function: An application to Italy. *Transportation Research Part A: Policy and Practice*, 132, 999-1019.

Monopolkommission. (2016). Wettbewerb 2016, 21. Hauptgutachten. Bonn.

Niemeier, H-M (2021). Is economics good for aviation policy? Some problems in bridging the gap between theory and policy, J*ournal of Air Transport Management*, 96, 102107.

OECD (2016).*Being an Independent Regulator*, The Governance of Regulators, OECD Publishing, Paris,https://doi.org/10.1787/9789264255401-en

Productivity Commission. (2019). Economic regulation of airports. Report 92.

Republik (2022). Single point of failure: Dübendorf, 8 Nov. 2022, https://www.republik.ch/2022/11/08/warum-der-schweizer-luftraum-wirklich-fuer-5-stunden-gesperrt-wa

Starkie, D. (1998). Allocating Airport Slots: A Role for the Market, *Journal of Air Transport Management*, 4, 111-116.

Wise Persons Group. (2019). On the future of the Single European Sky. Retrieved from https://ec.europa.eu/transport/sites/transport/files/2019-04-report-of-the-wise-persons-group-on-the-future-of-the-single-european-sky.pdf

7. APPENDICES

7.1 In this appendix, we discuss the introduction of 'negotiated settlements' in the US and in Canada, then the move to 'consumer-centric' approach to regulation in Australian energy markets and finish with short descriptions of the two most utilised methods for estimating cost efficiency, namely data envelopment analysis and stochastic frontier analysis.

Negotiated Settlements introduced in the US and Canada to increase user involvement in regulation

7.2 Traditionally, the prices that consumers in the US and Canada pay for essential services, such as electricity, have been determined under rate-of-return (ROR) regulation, including through formal contested proceedings. Under ROR regulation, a public utility commission considers testimony by interested parties, including the regulated utility and consumer representatives. The commission then sets prices to generate revenue for the utility sufficient to cover its prudently incurred costs and provide a fair rate of return on its rate base (Chakravorty, 2015). Historically, the rate determination processes were lengthy (they could take up to six years), inflexible and costly Asimow (1994).

7.3 In the mid-1990s Public Utility Commissions in the US started to encourage parties to settle before final decisions were made in rate cases.

The experience of negotiated settlements in the US and Canada

7.4 The role of the regulator changed with the development of active negotiations by users, and/or their representatives. The utility regulator moved to facilitating discussion, negotiation and if possible agreement among the interested parties. The new processes began with natural gas pipelines at the Federal level and then extended to electric rate cases in parts of the US and in Canada.

7.5 Stephen Littlechild (2009) examined negotiated settlements in energy markets in various jurisdictions in North America. In one study of decisions made by the Florida Public Service Commission (FPSC), Littlechild compares the outcomes of negotiated settlements with the parties' initial positions. He finds that:

- Negotiated settlements in Florida have primarily been driven or supported by consumer representatives, including consumer advocates, interveners' and the Office of Public Counsel.

7.6 The complexity of issues, and the varying number of interveners, has not made it difficult to reach agreements to sign stipulations and the use of stipulations has increased dramatically over time.

7.7 Negotiated settlements can occur without agreement of all the parties. In a case in Florida consumer representatives challenged the decision of the regulator, the Florida Public Service Commission, which had increased the rate base of electric services provided by the public utility. The decision of the Appeal Court affirmed the Commission's decision based on the robustness of the processes[19].

7.8 A potential problem with negotiated settlements is that in some cases consumer advocates have sought pricing outcomes which reflect relatively larger initial price decreases, compared to price decreases towards the end of the agreement, through adjustment of depreciation rates over the period. A study in Florida used data from the Florida Public Service Commission to estimate the payoff functions of the consumer advocates and the firms found that the consumer advocate and the firm weigh a present rate change more than the consumer's future average price in their settlement decisions (Chakravorty, 2015). It suggests that in some cases consumer advocates may agree to settlements primarily to secure substantial immediate rate reductions from current rates as an observable signal of positive consumer advocate performance.

Lessons Learned

7.9 Introduction of negotiated settlements, where consumers, or their representatives, negotiate directly with service providers and are encouraged to reach agreement prior to the completion of formal regulatory processes, are a way to reduce long and litigious, regulatory price determination processes.

7.10 Greater direct negotiation between consumers and service providers can enable more flexible and innovative outcomes potentially more suited to the needs of users and suppliers. Final agreements involve regulatory review and sign off before being implemented.

[19] Citizens of the State of Florida versus Florida Public Service Commission, No. SC13-144, Decided August 28, 2014 reported at: https://caselaw.findlaw.com/court/fl-supreme-court/1676931.html

Information availability

7.11 There is little recent information on negotiated settlements and it is difficult to establish just how widespread the practice currently is.[20]

Trialling 'Consumer-centric regulation' in Australia's Energy Markets before adoption of a new process

7.12 This case relates to a new approach to customer engagement which was initially subject to a trial and then adopted more broadly Havyatt (2022).

7.13 The Australian Energy Regulator (AER) is a separate independent entity within the Australian Competition and Consumer Commission (ACCC) and regulates electricity transmission and distribution networks and gas pipelines in the National Energy Market (NEM) (Australian Energy Regulator, 2024). The Australian Energy Market Commission develops regulatory rules based on the building block approach to regulation that the AER must apply in its regulation of the NEM. The rules include a provision which requires regulation to respond to consumers' preferences in accepting operating and capital expenditure forecasts.

7.14 From the inception of its role, the AER's regulatory determination processes became increasingly protracted and adversarial. Network service providers used their ability to apply to the Australian Competition Tribunal for Limited Merits Review leading to some determinations not being finalised until after the start of the control period Havyatt (2022). Issues related to the allowed rate of return on capital dominated the reviews with network service providers re-litigating issues that the AER had determined as part of developing relevant guidelines through a consultation process.

Enhanced customer engagement in regulation of electricity distribution

7.15 Initially a workshop was set up to explore ways different organisations could work more closely together. A project team was then established to scope ways to improve customer engagement in regulatory processes and to identify opportunities for regulatory innovation.

7.16 The team developed a new regulatory approach which was trialled in the context of a revenue-allowance determination for an electricity-distribution network service provider, AusNet, which had agreed to participate in the trial[21].

7.17 Under the approach consumers had a more central role in the regulatory process which aimed to benefit consumers, network service providers and the regulator through an improved culture.

7.18 The approach used the existing regulatory rules which applied incentive-based regulation in a building-block model. The objective of the new approach was for the network service provider to reach an agreement with a consumer forum on its regulatory proposal before submitting it to the regulator. This primarily meant

[20] Email correspondence with Professor Mark Jamison, Public Utilities Research Centre, Florida, USA. 13 May 2024.

[21] This case study has benefited from a discussion with the New Reg Trial project leader for the AER's new approach to regulation of electricity networks - 31 May 2024.

agreeing on the operating and capital expenditure proposals to be included in the building-block model.

7.19 The trial was independently monitored and evaluated by consultants. The final evaluation of the trial from CEPA occurred in 2021. Observations from the trials:

- The process did not achieve a faster or less costly review, however from AusNet's perspective, the process had not cost more than an adversarial process.
- There was improvement in customer engagement with AusNet which extended beyond the negotiation on the building-block elements.
- Some changes to the trialled approach to improve communication and accountability arrangements for future negotiated settlement processes were suggested.

The adoption of a new approach to customer engagement in regulation of Australia's energy market

7.20 The AER released a guideline: Better resets handbook – Towards consumer-centric network proposals, in December 2021 (Australian Energy Regulator, 2021). The new handbook outlines the AER's expectations relating to the submission of 'consumer-centric regulatory proposals'. The AER identified circumstances where 'genuine engagement' with consumers would lead to parts of the proposal, such as forecast expenditures and depreciation, being accepted by the AER at the draft decision stage, leading to a more efficient regulatory process for all stakeholders.

7.21 Other potential efficiencies in the regulatory process were also identified and implemented in the AER's regulatory processes. The Weighted Average Cost of Capital (WACC), an issue commonly subject to appeal in the AER's regulation, is now separated from other aspects of price determinations and determined separately at an industry level every four years and updated annually (Australian Energy Regulator, 2023). This has had the effect of lowering the financial impact of individual regulatory determinations and reducing litigation.

7.22 Other new approaches adopted by the AER include placing a stronger focus on pre lodgement engagement with the service provider, fast tracking price determinations if certain criteria are met and greater use of a top down approach relative to a bottom up approach.

Lessons Learned

7.23 Increasingly long and contentious regulatory processes over time can lead to a recognition by stakeholders that a significant change in approach is required. Trialling a new process, and learning from the lessons from it, is a careful way of introducing significant change regulatory processes. In the case of a large number of similar service providers, as often exists in energy networks, a trial of a new process with one willing service provider can occur. However, in a market structure where there is one service provider an alternative avenue for a trial would need to be explored, such as through a trial with one service in the case where multiple services are provided. The success of a trial can lead to the introduction of significant changes in processes more broadly with greater confidence across relevant services.

7.24 A new approach to customer engagement involves setting up a consumer forum with the emphasis on increased consumer understanding of the trade-offs between increased capex and opex and the quality of service benefits derived.

7.25 The regulator may assist engagement processes by reviewing presentations on the trade-offs between different outcomes from capital and operational expenditures and their implications for rates to assess whether the descriptions of the trade-offs were appropriate, i.e. by assessing cost allowances and efficiency between desired outcomes and potential price implications.

Data Envelopment Analysis

7.26 Data Envelopment Analysis (DEA) is a non-parametric method that assesses the efficiency of decision-making units (DMUs), such as businesses, public sector agencies, or other organisations. The primary purpose of DEA is to evaluate the relative efficiency of DMUs that convert multiple inputs into multiple outputs, identifying the most efficient units by constructing a frontier against which all units are compared.

7.27 Efficiency in DEA is measured as a ratio of weighted outputs to weighted inputs. A DMU is considered efficient if it operates on the frontier, meaning no other DMU can produce more outputs with the same inputs or the same outputs with fewer inputs. Unlike parametric methods that assume a specific functional form for the production process, DEA is non-parametric hence does not require assumptions about the functional form of the production relationship. It uses linear programming techniques to construct the efficiency frontier.

7.28 DEA can be input-oriented, focusing on minimising inputs while maintaining the same level of outputs, or output-oriented, focusing on maximising outputs with the same level of inputs. It can also be scale-oriented, considering returns to scale in the efficiency analysis. DEA provides a benchmarking tool for DMUs, where efficient units serve as benchmarks for inefficient ones, highlighting areas where improvements can be made.

7.29 The process of DEA involves several steps. First, inputs and outputs relevant to the context and goals of the analysis are selected. Then, data on these inputs and outputs are collected for each DMU. The DEA model is constructed using linear programming, in which a series of optimisation problems are solved in order to determine the efficiency scores of each DMU relative to the efficiency frontier. Efficiency scores are calculated for each DMU, where a score of 1 (or 100%) indicates a DMU is on the frontier and is considered efficient, while scores less than 1 indicate inefficiency. Finally, the results are analysed to identify efficient and inefficient DMUs, determining the sources of inefficiency and recommending improvements based on the benchmarks provided by the efficient units.

7.30 DEA has been applied to many sectors, including public services like schools and hospitals, healthcare, banking, energy, and transportation. It is flexible.

7.31 We also note that DEA has limitations, including sensitivity to measurement errors and outliers, the relative nature of efficiency within the sample of DMUs, and the assumption that all deviations from the frontier are due to inefficiency rather than random noise.

Stochastic Frontier Analysis

7.32 Stochastic Frontier Analysis (SFA) is an econometric method to estimate the efficiency of production in firms or organisations. This method involves the construction of a frontier production function, which represents the maximum possible output that could be achieved with a given set of inputs, under conditions similar to the organisations analysed. The deviation of each firm's output from this frontier is attributed to two components: inefficiency and statistical noise.

7.33 The efficiency component captures the deviation due to factors within the firm's control, such as managerial inefficiency or suboptimal use of resources. The statistical noise component accounts for random external shocks and measurement errors that affect output but are beyond the firm's control. By separating these two components, SFA provides a measure of a firm's efficiency.

7.34 SFA is typically conducted using maximum likelihood estimation techniques to fit the stochastic frontier model. This model includes a composed error term, which combines the inefficiency term, (usually assumed to follow a specific distribution, such as half-normal or exponential) and the statistical noise term (typically assumed to follow a normal distribution). The parameters of the production function and the distributions of the error terms are estimated simultaneously.

We also note that SFA can be sensitive to the choice of model specifications, including the selection of inputs and outputs, the distributional assumptions, and the functional form of the production frontier.

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