



Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

Airport slots: Can regulation be coordinated with competition? Evidence from Dublin airport[☆]

Cathal Guiomard^{*}

DCU Business School, Dublin City University, Dublin, Ireland

ARTICLE INFO

Keywords:

Airports
Airlines
Slot regulation
Competition

ABSTRACT

Slot regulations have implications for airport efficiency and for competition in aviation; this paper analyses the relationship between slot regulation and aviation competition drawing on the experience of the application of the EU slot rules at Dublin airport. It concludes the best way to promote competition in aviation is to avoid choosing an administrative basis of slot allocation, especially when a new airport is being developed, opting instead for market-compatible mechanisms, whether slot trading or runway charges that are differentiated by scarcity value.

1. Introduction

“[T]he IATA [slot allocation] process protects the status quo, entrenches incumbents, is anti-competitive, and is generally blocking effective entry.” [Gillen \(2008\)](#) p.52

When demand for airport facilities exceeds supply, rationing can be achieved by delays (first-come first-served), by administrative rules like slots¹, or by market-clearing prices.

Quantitative evidence on the relationship between capacity and demand at European airports is limited. [SEO \(2017\)](#) contains measures such as movements per runway and a capacity utilisation index, based on Eurocontrol data for 55 European airports. Quantitative estimates of future excess demand are more readily available from a series of ‘Challenges of Growth’ reports prepared by Eurocontrol, the European agency for air navigation safety. The most recent of these, Eurocontrol (2013), sets out four scenarios for capacity shortfalls at European airports for the period 2035–2050, as presented in [Table 1](#).

The most likely 2035 scenario (C) involves a shortfall in airport capacity equivalent to nearly 2 million flights by 2035. If these shortfalls occur, the need for measures to manage demand will be acute, and slot rules versus other options will continue to be a focus for research and policy discussion.

The European Union (EU) has chosen to manage excess airport demand by means of administrative rules. The European Union slot rules are set out in two regulations; [EEC 95/93](#) which was adopted in 1993 and modified by [EC 793/2004](#) a decade later. The regulations derive from the global regime of IATA guidelines which aim to satisfy principles of neutrality, transparency and non-discrimination ([IATA, 2000](#)). A particular challenge for the EU, with its 28 separate jurisdictions and different legal and

[☆] Cathal Guiomard is Course Director in Aviation Management at Dublin City University and was previously the aviation regulator for Ireland. This paper was presented at a conference in Mexico City in November 2015, entitled ‘Getting It Right: Aviation and Airport Service Reforms’. I thank David Gillen, Marina Efthymiou, and especially a referee for comments that substantially improved the paper.

^{*} Address: Q147, Dublin City University Business School, Glasnevin, Dublin 9, Ireland.

E-mail address: cathal.guiomard@dcu.ie.

¹ Article 2(a) of Regulation EEC 95/93 defines a slot as a permission given by a coordinator to use the full range of airport infrastructure necessary to operate an air service at a coordinated airport on a specific date and time for the purpose of landing or take-off.

<http://dx.doi.org/10.1016/j.tra.2017.09.028>

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Table 1

Estimated shortfall in airport capacity in Europe in 2035.

Source: Eurocontrol (2013), Challenges of Growth 2013, Fig. 9.

Scenario	Unaccommodated flights (million) in 2035	Unaccommodated demand (%) in 2035
A: Global growth	4.4	20
B: Regulated growth	1.9	12
C: 'Happy localism'	1.0	7
D: Fragmenting world	0.2	2

administrative traditions, is to achieve consistent application of 'common rules'.

Under Article 3 of [EC 793/2004](#), there are three possible EU airport designations:

- Coordinated (Level 3): airlines wishing to land or take off must hold a slot assigned by the airport's slots coordinator;
- Schedules facilitated (Level 2): airlines are assisted by a schedules facilitator to manage on a voluntary basis scheduling at times with the potential for congestion at the airport; and
- Undesignated (Level 1): airports where there is no significant congestion.

In Summer 2017, according to the IATA World Scheduling Guidelines ([IATA, 2017](#), Annex 3), 75 European airports were designated as schedules facilitated (Level 2) and a further 103 as coordinated (Level 3).²

Slot regulations have implications for airport efficiency and also for competition in aviation; this paper analyses the relationship between regulation and competition, drawing on the experience of applying the EU slot rules at Dublin airport.

The structure of the paper is as follows. Section 2 provides some background on current slot regulatory practice and development in the EU. In the following section, the paper considers the interplay between administrative slot coordination and competition issues and the link between airport capacity investment and the slot allocation regime. Using Dublin airport as a case study, Section 4 presents some of the practical difficulties in the application of the EU's slot regulations and illustrates some of the tensions between regulation and competition set out in Section 3. Section 5 concludes with a number of lessons learned from Irish experience and makes recommendations to EU and international policymakers.

2. The EU slot regulations

In this section of the paper, the rules governing airport designation are set out, with the role of the coordination committee, the slot allocation principles, and a number of recent abortive attempts to reform the current regulations in the direction of market mechanisms.

2.1. Airport designation under EU rules

For an airport to be designated schedules facilitated only the principles of transparency, neutrality and non-discrimination need to be satisfied.

For the status of coordinated, the legal requirements are much more demanding. On the face of it, coordination is a last resort and alternatives to slot controls should be considered, such as increased capacity or operational changes under a voluntary scheduling scheme. If sufficient airport capacity later becomes available, the coordinated status 'shall' (according to the regulations) be lifted; in practice, airports rarely if ever have coordinated status rescinded.

An airport may be designated as coordinated only if all of the following steps have been taken:

1. A thorough analysis of the airport's capacity
2. Based on 'commonly recognised methods'
3. That has been made available to and discussed with interested parties
4. Finds a 'shortfall in capacity' of such a serious nature that 'significant delays cannot be avoided' and
5. That there are no possibilities to resolve these in the short term whether by new or modified infrastructure, or operational or other changes in light of the time required to make such changes.

Especially in jurisdictions where interested parties are willing to make active use of the law courts – including in Ireland (see Section 4 below) – there are cases where the courts have overturned the designation of an airport because of a failure to unambiguously meet *even one* of the five steps listed above.

At a coordinated airport, the coordinator is responsible for slot allocation in line with the Regulation. The coordinator allocates movements with reference to 'coordination parameters'; for example, a maximum number of runway movements at certain hours, and a maximum hourly passenger capacity of the airport terminal. An airline whose slot request cannot be accommodated must be

² Author's email correspondence with IATA, July 2017.

offered the nearest available slot.

2.2. The coordination committee

A coordination committee, composed of the carriers, the airport, the air traffic control (ATC) provider and the coordinator itself, has an advisory role. This committee advises the coordinator on a number of airport capacity issues, especially runway capacity, including the coordination parameters to be used, on ways to increase capacity, methods of monitoring the use of allocated slots, as well as on any serious problems encountered by new entrants at the airport in regards to their slots, and generally to mediate between the parties concerned on complaints concerning slot allocations.

Typically, the coordinator meets with this committee in advance of each scheduling season and presents data on airport capacity – normally provided by the airport operator and the ATC company – along with data on slot use in the current season and slot demand for the subsequent season.³ These numbers are then debated by the committee. Overall, there may be some effort to collectively find ways to optimise the use of the available airport facilities.

From a competition policy perspective, and despite the Regulation's stated ambition to encourage competition and new entry⁴, the role of the coordination committee can be important, especially where it relates to slot disputes between incumbent airlines, and requests for slots from new entrant airlines. Hence, the decision making procedures of the committee can also on occasion matter.

In the UK and Ireland, the voting at a coordination committee is typically according to the following type of scheme. An overall allocation of 1000 votes is available for each topic for which a vote is required at each meeting. These are apportioned as follows: airport operator: 40 votes; ATC provider: 20 votes; representative body for air carriers: 10 votes for each such organisation. The remaining votes are shared in proportion to the number of slots used by airlines at the airport in the previous year. The chair has a casting vote in the event of a tied vote.

Dublin airport is used as an example of such a voting scheme, since some of the necessary underlying data (air traffic movements *by airline*) are available for this airport. Table 2 shows that such a voting scheme allocates some voting power to all airlines and, depending on the number of airlines using the airport, can dampen the voting weight of dominant airlines.

In 2013, for example, the voting scheme gave Aer Lingus 26% of the votes although it accounted for 44% of aircraft movements. Ryanair's share of the votes was 19% although it accounted for 31% of the movements. In that year, Dublin airport had 34 airlines using the airport. At an airport with 80 airlines but the same slot shares, Aer Lingus would have had just 10% of the votes and Ryanair 7%. So, the voting scheme distributed votes between incumbent airlines in such a way as to give airlines with fewer movements more influence on the committee's decisions as compared to the influence of the largest airlines at that airport. At the same time, the committee is composed only of incumbent airlines and therefor must be considered to protect the collective interests of incumbent airlines.

Rules that impose a cost on the parties affected (e.g. an obligation to schedule a flight at a less convenient time) require an enforcement mechanism to bring about compliance. The EU slot regulations prescribe that each EU Member State introduce 'effective, proportionate and dissuasive sanctions' for 'repeated and intentional' air operations that are 'significantly different' from the slot allocated for that movement and that cause 'prejudice to airport or air traffic operations'. The Dublin airport experience with such an enforcement mechanism is discussed in Section 4.

2.3. Allocation of slots under EU rules

The scheduling principles are contained in article 8 of the Slot Regulations. Ulrich (2008) includes a detailed description of the IATA scheduling process using, as a 'real time' month-by-month example, the summer 2004 season.

The most basic principle of the EU (and international) slot allocation regime is the 'grandfather' principle according to which airlines keep the slots they hold if the airline requests for the following season provided the slots have been used for at least 80% of the time during the current period. Incumbency is thus reinforced and entry restricted (Gillen, 2008; Gillen and Starkie, 2015). This result is reinforced by the suspension at the grandfather principle at times of sharp demand declines such as after 9/11, during the Iraq war and SARS epidemic, and in the severe post-2008 economic downturn. This acts to the advantage of incumbent airlines. Sieg (2010) argues that airports favour an 80% rule over outright airline slot ownership, since the grandfather principle boosts flight frequency at times of lower passenger demand. Consistently with this, ACI (2009) opposed the temporary suspension of the 80% rule after the 2008 crisis. A more sympathetic interpretation of the EU regulations is offered by Bauer (2008), one that emphasises the practical issues faced by the industry, in particular the need for any regime to take account of schedule uncertainty and the interdependency of slots. Bauer remarks on the need to use expensive aircraft efficiently but seems somewhat less conscious of the need to take the same approach to costly airport infrastructure.

Once historic slots have been decided on the grandfather principle, further slot requests are granted if there is sufficient capacity; more likely, there is insufficient capacity, so requests that cannot be met are assigned the nearest available slot. When all slot requests cannot be accommodated, the rules recognise a ranking of flights: commercial services are given precedence over non-commercial,

³ Examples of the kinds of data available for a number of international airports are on the website of one of the firms offering coordination services, Airport Coordination Ltd (ACL), at <http://www.acl-uk.org>.

⁴ One of the recitations in the preamble to the Regulation states "Whereas it is Community policy to facilitate competition and to encourage entrance into the market ... and whereas these objectives require strong support for carriers who intend to start operations on intra-Community routes".

Table 2

Voting weights on the Dublin airport coordination committee in 2013.

Sources: ATM shares reported on p.18 of [CAR \(2013\)](#); voting allocation rules contained in schedule 1 of [DACC](#). The table is simplified by disregarding the votes of air carrier representative bodies and aggregating the 32 airlines for which ATM data is only available as a total.

Committee member	Core votes	Additional votes based on slot shares	Percentage of total vote
Airport	40	0	4%
ATC provider	20	0	2%
Aer Lingus	10	(0.44) 600 = 264	27%
Ryanair	10	(0.31) 600 = 186	20%
All other airlines (32)	320	(0.25) 600 = 150	15%
Total	400	600	1000

scheduled over non-scheduled, and all-year over seasonal services.

To offer new routes at coordinated airports, airlines depend on two source of new slots: the ‘slot pool’ and slot exchanges/trading. After slot requests are decided, any unallocated or new slots⁵ or slots returned to the coordinator before the start of the season, are placed in a ‘slot pool’; 50% of these are reserved for ‘new entrants’ if new entrants request them. [Starkie \(2008\)](#) considers that the use by low-cost carriers of secondary airports has made unnecessary for competition purposes the preference given to new entrants by the slot rules. As mentioned above, the coordination committee has a role when there are ‘serious problems’ for new entrants.

The regulations also permit that slots may be exchanged between air carriers ‘one for one’ if the coordinator agrees; they may also be transferred between an airline’s different operations and following a takeover. The competition authority, if involved, will normally take a close interest in the shares of slots of different airlines following a takeover). The regulation is silent on the permissibility of any financial compensation accompanying an exchange of slots. In continental Europe, this meant that trading was treated as illegal, whereas, after the ‘Guernsey Case’ in 1999, the UK courts deemed slot trading to be legal and in line with regulations. Clarification of the status of slot trading is one of the changes being considered in the context of a revised set of Slot Regulation as discussed in the next section of the paper.

2.4. Stalled reforms to the EU slot rules: the 2011 EU airports package

Many studies of the effects of the EU slot allocation scheme have been conducted for the European Commission. Three major studies were published in 2004, 2006 and 2011. Their conclusions are summarised in [Table 3](#). Although the estimated impacts differ greatly (reflecting in particular the differences in the scope of the slot reforms the studies analysed), all show substantial gains from a move from allocation of slots by administrative to market means.

[NERA \(2004\)](#) concluded that all of the market mechanism options it was asked to review – secondary slot trading, higher runway charges, slot auctions or combinations of these – could lead to slots being reallocated to more productive uses, permitting an increase in passenger numbers at congested airports of about 7%, equivalent to about 52 million additional passengers per year at those airports.

A follow-up study on the design and effects of the secondary trading option ([Mott McDonald, 2006](#)), against a background of rising passenger demand, estimated – based on an assessment of eight heavily congested EU airports – that secondary slot trading would increase consumer welfare by up to €31 bn. and producer welfare by up to €1 bn. It also concluded that in 2025 there would be strong benefits to the finances of airport and the nearby regions, with only marginal environmental effects.

However, there was no agreement in the EU on such fundamental revisions to the basis of the prevailing rules, so these reports have not been acted on. A more modest ‘recast’ of the slot regulation was published in an ‘airport package’ of 2011. But even these proposals – i.e. transparent slot trading, tightening the application of the grandfather principle, greater independence for slot coordinators, and facilitation of new entry into slot-coordinated airports – did not meet with the agreement of EU governments and have not been taken further.

A further study ([European Commission staff working paper, 2011](#)) indicated that the measures in the ‘recast’ of the slots rules could be worth €5 billion per annum to the European economy and create 62,000 more jobs over the period 2012–2025 and would allow the airport system to handle 24 million more passengers per year by 2025.

The repeated push for reform has come because the European Union is conscious of the inefficiencies of the current slot regime. Airports, ATC providers and incumbent airlines, on the other hand, seem unwilling to change the status quo, or unable to find terms that attract general support. There is little progress on reform of the EU slot regulations indicating the difficulty of amending rules that create concentrated constituencies of ‘winners’ even when there are large numbers of ‘losers’.

3. The interplay between administrative slot regulation and competition issues

The slot rules and the demand/supply management in airport capacity is an area of active academic research; see, for example, [Starkie \(1998\)](#), [Barbot \(2004\)](#), [Czerny \(2010\)](#), [Basso and Zhang \(2007\)](#) and [Fukui \(2014\)](#). The slot rules, especially slot trading, is also

⁵ New slots might arise from new infrastructure or new operational procedures (changed aircraft-separation rules, or changed ‘average delay’ parameters that are acceptable to airlines).

Table 3
Estimated impacts of move from administered slots to market allocation mechanisms.

Study	Annual passengers	Consumer welfare
NERA (2004)	+ 52 million	
Mott McDonald (2006)		+ €31 bn.
European Commission Staff Working Paper (2011)	+ 24 million	

a concern of competition authorities; increased market concentration and power could adversely affect competition between carriers (OFT and CAA, 2005). Fukui (2014), for example, uses UK slot trading data to conclude that air carriers use slots differently depending on whether the slot is purchased from a partner or a rival airline. Rose (2003), emphasises the arbitrary nature of grandfather rights and argues that for substantial welfare gains a significant proportion of the stock of slots would need to be traded. Administrative systems of allocation like the EU slots regime have a number of well-known efficiency weaknesses that are familiar to economists; these are discussed at length in Czerny et al. (2008), for example. The competition policy aspects are also set out in Gremminger (2006).

Consider the contrast between aviation and the internet media companies. The latter do not allocate advertising slots on a ‘grandfather’ or any administrative principle; they charge what the market will bear. For generations, so have traditional vendors of other quantitatively-limited and time-sensitive slots, including print, radio and television advertising of all kinds. At times of higher value – such as holiday seasons – the buyer must bid more than other bidders to obtain the slot and their advertising history does not count. This reminder of conventional practice in other commercial settings is perhaps necessary in order to underline that the slot allocation system used in aviation – though of long-standing and so familiar – is nonetheless strikingly unusual. There are two consequent sets of problems: harm to efficiency and harm to aviation competition.

From an economics perspective, efficiency is assessed in terms of welfare defined as the sum of producer and consumer surplus. From the consumer aspect, what matters is that the slot scheme maximizes the consumer surplus generated rather than simply the number of passengers. Because the EU slot regime applies across many jurisdictions, there is the added complexity of domestic producers and foreign producers. Seeking to agree reform of the slot rules is more complicated when governments care about the impact on their own consumers and producers who are inversely affected by a slot rule change that affects airline market power.⁶

3.1. Inefficient resource allocation

Researchers investigating aviation have long argued that the IATA slot regime adds to the mismatch between airport capacity and traffic, leading to congestion and delays (Starkie, 2008; Madas and Zografos, 2008; Gillen and Starkie, 2015 and many contributors to Czerny et al. 2008).

Slots allocated on administrative or legal principles are assigned according to non-discrimination and transparency criteria. There is no assurance from these approaches that valuable slots in short supply will be allocated to airlines that will serve larger number of passengers or passengers for whom flying at that time is particularly important. On the contrary, airlines may hoard slots. There are a number of well-known cases in the industry of airlines operating empty, almost empty, or underutilised aircraft in order to retain a slot for the future. A study for the European Commission found that at some airports where slot demand significantly exceeds supply, more than 10% of allocated slots were not utilised (Steere Davies Gleave, 2011). Fukui (2012) has found evidence of US airlines hoarding slots at slot-controlled US airports.

Non-discrimination is a particularly problematic principle from an efficiency perspective. Economic efficiency *requires* discrimination favouring, for example, large over small aircraft, long-haul over short-haul services and other indicators of higher-value. As noted by Bauer (2008), while slot efficiency may be defined in a technical sense as the proportion of available slots that are used, for economists, efficiency is measured by net value i.e. the value of an air service to users less the costs of production incurred by producers. Although the latter concept may for practical reasons be measured by the aggregate of ticket prices collected from passengers using a given service (less costs of service provision), network effects (e.g. ‘feeder’ services to and from hubs) might require a smaller aircraft to have a greater welfare weighting when forming part of a network than when offering a point-to-point flight. As already mentioned, it is consumer surplus rather than, for instance, passenger numbers, that count towards a comprehensive assessment of efficiency.

Administrative allocation has other disadvantages. Since there are no prices, the information contained in the price – a signal possibly indicating the presence of excess capacity or of capacity shortages – is not available. And without explicit prices, airlines are more likely to neglect the opportunity cost of slot use. Similarly, without receiving the revenues from slot prices (at least those that would accrue to the airport), airports have a reduced incentive to expand runway capacity and airport capacity generally. The importance of price signals in the context of timely airport investment decisions is discussed in Section 3.3 below.

3.2. Competition issues

At capacity-constrained airports, including airports constrained at those times of the day most attractive to airlines,

⁶ After the UK leaves the EU, it may be easier for the British government to adopt new slot rules taking account only of UK consumer and producer interests.

administrative slot controls act as a barrier to market entry. For international services, so, of course, do air service agreements. Airlines wishing to expand their services, and/or those wishing to start serving the slot coordinated airports, are hindered or prevented from doing so. Ryanair's enormous growth across Europe took place – by choice but in fact also by necessity – at secondary airports.

With administratively allocated slots, airlines have a financial incentive to inefficiently resist airport expansion even when passengers desire the air services made possible by extra airport capacity. From the viewpoint of incumbent airlines, new capacity will lower implicit slot values. Alternatively put, new airline entrants will increase competition, lower ticket prices, and reduce the revenues earned from the slots already held by an incumbent airline. As long as capacity remains restricted, traffic growth raises ticket prices and creates a premium for incumbent airlines.

In the early 2000s, the UK airport regulator, the CAA, estimated the ticket premium at Heathrow (albeit an exceptionally congested airport) to be £100 per passenger. At that time, the airport charge was capped at some £10 per passenger; the premium was indicative of the extent of unmet demand for additional Heathrow capacity. With traffic demand having expanded in the interim, the premium – an incentive charged to passengers for airlines to inefficiently limit airport capacity – is likely to have increased. Faced with capacity constraints, passengers pay the premium and some potential passengers must use less convenient airports or not fly at all. It is no surprise that the consultancy reports for the EU Commission (see Table 3) suggested large gains from a less restrictive EU regime on slot trading.

Airlines lobby to create or retain the substantial financial and anti-competition value of (grandfathered) slots. Once introduced, relaxation of administrative slot rules faces strong airline resistance. When considering the introduction of administrative slot controls, it is important to recognise that they would create a financial incentive (that might grow over time) for the slot regime not to be reformed afterwards.

By contrast, allowing slots to be traded causes airlines to recognise the opportunity cost of slots, including the cost of keeping slots in low-value uses. Slot trading would create a market for slots, and so make it easier for new airlines to enter a market and for smaller airlines to expand their services.

The possibility of slot trading has sometimes given rise to concerns that it might not increase but rather reduce competition; after all, a higher share of slots, including 'strategic' slot purchases, adds to an airline's dominance at an airport and to its market power, as well as increasing slot mobility and liquidity. Gillen and Morrison (2008) found that after the introduction of slot trading in the US, the proportion of hub slots held by dominant airlines rose.⁷ However, Starkie (2008) argues that a slot is more valuable to an airline with a large network, and larger networks have advantages for passengers (more connectivity, increased frequencies); thus, a higher share of slots held by large incumbent hub airlines does not necessarily lower consumer welfare. The balance between network benefits and market power disbenefits needs scrutiny in a particular case and problem may lie as much in incumbent dominance than in slot trading. OFT (2005) likewise noted that strategic purchasing of slots in order to restrict competition would only arise in cases of airlines that already start from a position of dominance and where competitive pressures from nearby airports is weak.

The UK Office of Fair Trading (now the Competition and Markets Authority) made recommendations in 2005 concerning some relatively simple safeguards that would limit the risk of airlines 'gaming' the slot market, including a prohibition on restrictive covenants in slot trades, as well as requiring the publication of slot trades to clarify the opportunity cost of slots to airlines and airports alike and to promote slot trading.

3.3. Dynamic airport investment and static slot allocation

The inefficiency of administrative slot rules has a dynamic aspect, as regards the impact of the slot rules on incentives for airports to expand infrastructure over time. Adler et al. (2014) argue that slot rule policy should also be made jointly with air transport liberalisation policies, since slot rules will influence the allocation of welfare gains and losses from liberalisation.

There are some important linkages between the slot regime at an airport and investment at the same airport, so that decisions in one domain can support or impede decisions in the other. An efficient level of runway charges both *directly* makes for efficient use of a runway and *indirectly* provides price signals that assist with decisions about when to invest in additional airport capacity. On the other hand, administrative slot allocation, as we have seen, tends to cause an airport to be used less efficiently and can hamper good investment decisions.

To illustrate this argument, a set of principles for good airport investment are offered below as well as how the slot regime can act to support or to undermine these. Recent decisions regarding a second runway at Dublin airport present a concrete illustration of these issues.

Airport investments are costly and irreversible whereas future traffic is uncertain, creating a risk that the profile of *ex post* charges required to recover the costs may be quite different (i.e. much higher) than those announced *ex ante*. It is desirable therefore to seek to ensure:

- That airlines understand and broadly support the projects in the airport's investment programme
- That the costs of that programme are reasonable for delivery of the projects in question

⁷ Gillen and Morrison (2008) also note that competition authorities do not seem to act consistently on slots. When assessing mergers, slot sales are often imposed in order to lower slot dominance, but the stock of slots obtained under the 'grandfather' principle is not scrutinised or required to be lowered in the same way. The administrative slot rules thus preclude the application of standard competition policy considerations in regard to airports.

- That airlines are willing to pay these costs over time in future airport charges
- That projects meeting a specific airline's needs are paid for by that airline whereas investments improving the airport generally are recovered from general airport charges.
- That it be clear in advance whether the airport or the airlines (or some mixture of the two) carry the demand risk for the investment plan.

How might an airport's slot regime support or impede the application of these principles? Slot trading would certainly help to achieve some of these objectives and, more generally, to make for good airport investment decisions.

In the absence of slot charges (or, in the alternative, peak pricing), there is no information – for airlines, the airport, passengers or policymakers – about the value of additional capacity. Whereas if slots are traded in the public domain, the value airlines place on additional airport capacity would be clear to all interested parties, and would indicate whether benefits – as measured by slot prices – of extra capacity exceeded costs. Especially in the many jurisdictions where airports are government-owned, transparent slot values would be useful to policymakers involved in making decisions about airport infrastructure. For regulated airports, transparency would help inform regulatory assessments of the desirability of airport expansion (and greater costs) as part of the regulatory price-setting exercise.

Traded slots could also change airline incentives. Under administrative slot allocation, increasing scarcity yields higher ticket prices and airline revenues – an incentive to resist airport expansion. With traded slots, understood as a requirement for an airline to pay the airport to use the slot (as opposed to inter-airline slot trading)⁸, a failure to build additional infrastructure raises airline's costs to use slots at the airport, whereas the reverse would be true after the building of additional capacity.

These issues as they applied at the time of the building of a second terminal at Dublin airport are discussed in Section 4.3. Gillen and Starkie (2015) offer a very similar analysis which they apply to London's Heathrow airport.

4. Aspects of the application of the EU slot rules at Dublin airport

In this section of the paper, I use Dublin airport as a case study of some of the issues discussed above in more general terms. First, practical difficulties in moving from schedules facilitated to coordinated designation are described. Second, the experience of seeking to apply the EU slot regulations in the absence of a system of sanctions is set out. Finally, the important interrelationship between the slot regime and airport investment is illustrated with reference to the second terminal project at Dublin airport in the mid-2000s.

4.1. A difficult introduction for the EU slot rules at Dublin airport, 2000–2007

In this section of the paper, information on the slot reviews at Dublin airport are set out to support lessons to be drawn for the practical application of the rules for jurisdictions contemplating the best slot allocation regime to use in for the future.⁹

While, on the face of it, systems of administrative rules such as the EU's slot regulations should achieve clarity about an airport's designation, and provide a transparent and smooth process for reviewing or changing the designation. In practice, as the case of Dublin airport illustrates particularly clearly, administrative rules do not prevent considerable uncertainty, conflicts between interested parties, rapid changes to an airport's status, recourse to the courts, delays and unforeseen costs. Rules call forth 'regulatory gaming' when parties have conflicting goals, and in jurisdictions where the courts apply a low threshold for permitting challenges to regulatory decisions, the legal process may add some further uncertainty to the mix. The case of Dublin airport offers an illustration of these outcomes and serves as an example of how a change in slot status may be strongly contested between the airport and a large airline.

Dublin airport had been granted schedules facilitated¹⁰ status in 1999 by the Irish Ministry of Transport. In 2000, the airport operator sought coordinated scheduling status and a capacity study was commissioned. This was published in 2001 when the responsibility for slot designation had passed to a new aviation regulator's office.

The capacity report concluded that there should be sufficient airport capacity to delay a designation of the airport as coordinated "for a small number of years" if aircraft stand allocation and stand management at the airport were improved, and provided airlines cooperated fully with the schedules facilitator. The aviation regulator's office invited comments from the industry on the capacity assessment and whether, having regard to the slot regulation, a basis existed for Dublin airport to be designated coordinated. The airport operator rejected the capacity report's conclusions while the two largest airlines supported it. The regulator's office concluded grounds did not exist to designate Dublin airport as coordinated.

In 2002 the airport operator again sought designation as coordinated. A new capacity assessment was commissioned and published in mid-2004. It concluded that existing infrastructure could cope with expected traffic demand over the three years to 2007 provided there was no significant increase in the rate of refusals by airlines to reschedule flights at the request of the schedules facilitator. In October 2004, the regulator's office announced that, on this second occasion also, that there were no grounds to designate Dublin airport as coordinated. The decision included explicit notice that should airline cooperation with the voluntary

⁸ I am grateful to Peter Forsyth for a discussion of this point.

⁹ Dublin airport slot decisions, industry representations and consultancy reports may be found at: <http://www.aviationreg.ie/slot-allocationschedules-facilitation/documents-slots.244.html>.

¹⁰ At the time, this status was called 'coordinated' rather than 'schedules facilitated'.

regime deteriorate and be shown to threaten to compromise the efficient operation of the airport, then Dublin airport *would* be designated as coordinated. The regulator's office committed to monitoring the capacity position of Dublin airport.

Over the course of the subsequent winter season, the regulator's monitoring revealed an increase of more than 100% (from Summer 2004 to Summer 2005) in the rate of refusals by airlines to accede to requests by the schedules facilitator to operate at amended times. So, in April 2005, the regulator duly designated Dublin airport as coordinated with effect from Summer 2006 and appointed a firm to act as coordinator.

However, this decision was quashed by the Irish High Court on the basis of a legal challenge taken by an airline using the airport. The airline argued, and the court accepted, that the slot regulation required that a *fresh* thorough assessment of the airport's capacity needed to have been carried out before a decision to change Dublin airport's designation. It was the judge's view that each decision required, as a prerequisite, a separate capacity study, notwithstanding the short passage of time between two decisions and even though the available assessment was considered by the regulator to have been conditional on the absence of two specific scenarios. Furthermore, any new capacity study needed to be consulted on. The court concluded that the regulator had therefore not been entitled to make the decision to coordinate Dublin airport; the decision was set aside, and Dublin airport reverted to being schedules facilitated.

Passenger traffic at Dublin airport continued to grow very rapidly, reflecting the booming Irish economy. Almost 14 million passengers used Dublin airport at the time of the first slot decision in 2001, 17 million in 2004 at the time of the second decision, 21 million in 2006 when the High Court made its decision, and 23 million by the end of 2007, the year the slot status was considered a third time; thus, traffic grew by 26% in the two years to 2007 alone. (Dublin airport annual reports.) During these years, some expansions of facilities and enhancement of the efficiency of others were carried, but not keeping pace with passenger traffic growth and Dublin airport was very visibly very congested by the mid-2000s. In recognition of this fact, planning for a new terminal and related facilities (which opened in late 2010) was underway, although in the very short term the associated disruption would reduce airside capacity.

With the 2005 decision set aside by the 2006 court decision, and in order to ensure that Dublin airport would have the appropriate schedules designation, against a background of such very rapid traffic growth, an up to date capacity assessment was commissioned by the regulator's office and published in December 2006. As before, the airport's terminal, apron and runway/taxiway system were assessed. On the basis of there being "insufficient airport runway and apron capacity during peak times", it was recommended that Dublin airport be coordinated from Winter 2007. Furthermore, because the trend at the time in Dublin was for outturn peak traffic to exceed forecast peak traffic, it was recommended that coordination also be "strongly considered" for Summer 2007.

The regulator's office consulted on the 2006 capacity assessment. There was strong support for coordination status from the airport operator and from a number of airlines including Aer Lingus, with some submissions arguing that airport capacity had been overestimated and delays underestimated because the base period for the capacity assessment (Summer 2006) had been a period when the airport had been coordinated. The schedules facilitator submitted that the level of demand was not amenable to management by means of a voluntary scheduling regime.¹¹ However, strong opposition to coordinated status continued to be articulated by Ryanair, the largest airline at the airport.

After an extensive new analysis¹², the regulator's office set out the grounds for its conclusion. This was that a continuation of a voluntary scheduling regime – such as schedules facilitation offered – would not be an effective means to manage slot demand down to the capacity of the airport's infrastructure without significant delays being experienced at Dublin airport that could not be resolved in the short term.

Accordingly, from Summer 2007 onwards, the regulator designated Dublin airport as coordinated for the purpose of the EU slot regulations.

As set out in summary form in Table 4, between 2000 and 2007, a period of just seven years (albeit years in which passenger traffic increased by some 60%), the slot status of Dublin airport was assessed three times. Each time the airport operator sought to be designated as coordinated; on the first two occasions, the regulator's office rejected the request on the basis of the findings of a capacity study that indicated the airport has broadly sufficient capacity, at least if used efficiently, and provided that airlines co-operated with the schedules facilitator. Shortly after the second refusal, as traffic grew and airline cooperation with the voluntary regime declined, the regulator's office granted Dublin airport coordinated status; immediately, one of the largest airlines at the airport challenged the decision in court. The court overturned the regulator's decision, because the decision had not been supported by a fresh capacity assessment. A new assessment was therefore commissioned, a new round of consultation undertaken, and a new decision made. After a further acceleration of traffic growth, and evident congestion particularly in the passenger terminal, Dublin was designated coordinated in 2007. The designation has not changed since.

Consideration of some general lessons from Ireland's experience of applying the EU slot rules appears in the final section of the paper.

¹¹ For instance, as of end-January 2007, 21% of Summer 2007 departures between 05:00 and 05:59 UTC hour were planned to operate without a slot.

¹² Not untypically for the evolution of regulatory decision making documents over time, the first decision on the scheduling status of Dublin airport (CP10/2001) ran to a total of 9 pages, whereas the final documents (CP2/2007 and CP3/2007) adds up to a total of eighty pages; if adjusted for font size, the increase would be even greater.

Table 4
Slot designation developments at Dublin airport 2000–2007.
Source: accompanying text; airport passenger numbers from airport annual reports.

Year	Airport	Capacity assessment	Airlines	Regulator	High court	Airport mppa
2000	Coordinated status sought	Sufficient for a few years	Coordinated status opposed	Coordinated status rejected		13.8
2002	Coordinated status sought					15.1
2004		Sufficient to 2007 if airlines cooperate fully with facilitator		Coordinated status rejected on condition full airline cooperation with facilitator		17.1
2005			Cooperation with facilitator deteriorates significantly	Coordinated status granted		18.5
2005/6			Regulator's decision challenged by one airline on ground of no new capacity assessment		Coordinated status overturned – airport reverts to facilitated status	21.2
2006/7		Insufficient at peak times	Main airline users at airport divided	Coordinated status granted		23.3

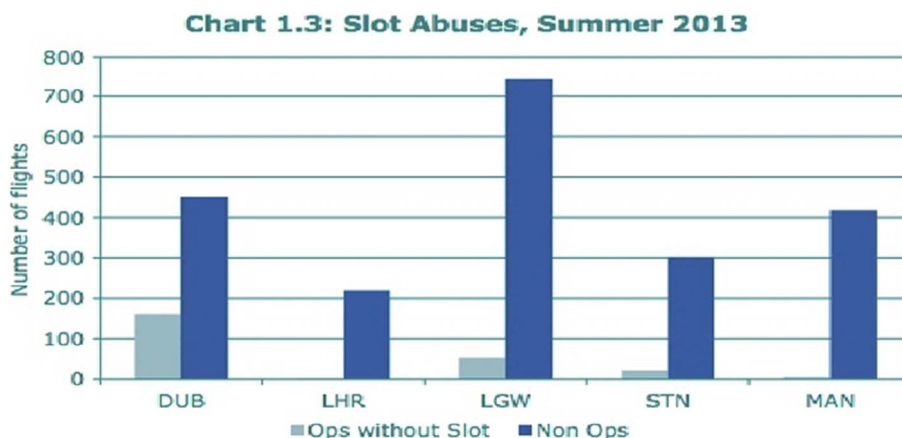


Chart 1. Slot abuses, Summer 2013, selected airports.

Source: 2013 Annual Report, [Commission for Aviation Regulation, Ireland](#).

4.2. Slot designation without sanctions for abuse

Although the Regulations were introduced in Ireland in 2000, the Ministerial Order that established an enforcement mechanism¹³ was only made more than a decade later (2013). In the interim, airlines operated ‘off slot’ not infrequently, as may be seen in the two following charts, taken from the 2013 and 2014 Annual Reports of the Irish aviation regulator’s office based on slot data from Dublin airport.

Chart 1 compares the number of slot abuses at Dublin – where there was no sanction for operating without a slot or at a time other than that allocated – and at a selection of UK airports where slot sanctions applied. The absolute number of operations without a slot is the highest in Dublin, even though Heathrow and Gatwick are much larger airports in aircraft movement terms, and Stansted and Manchester are of similar size to Dublin. The number of unused slots was also relatively high in Dublin airport. Similar patterns are apparent in the data for earlier years.

Chart 2 reports the number of slot abuses over time at Dublin airport, in particular, before 2014, when there was no sanctions regime, and for 2014 when there was. The pattern is unmistakable: prior to the introduction of sanctions, some 400–500 movements a year operated without a slot. In 2014, this fell to about 50.

This improvement occurred despite the sanctions regime in Ireland being quite cumbersome. The prevailing interpretation by lawyers of the Irish constitution is that only the courts may levy fines. In the UK, the slot coordinator, following due process agreed with the regulator i.e. the CAA, fines airlines in breach of the slot rules. This is in line with general UK practice whereby many different regulatory agencies, as well as the competition authority, directly levy fines. However, under Ireland’s Ministerial Order, the coordinator must apply to the Irish courts for a determination that an airline has breached the slot rules; if the application is successful, a fine is paid for each breach to the regulator’s office.

Despite the indirectness of the process, the chart suggests that airlines using Dublin airport have become more compliant with the slot regime once the penalty scheme was introduced. More broadly,¹⁴ this poses the question as to whether the airport operator might possibly have had a more smoothly operating airport by pushing for slot sanctions rather than a change in slot designation?

4.3. Regulatory assessment of airport investment in the absence of the price signals from slot trading or peak-period pricing¹⁵

The challenge of regulatory decisions about airport investment when there is neither slot trading nor peak pricing are illustrated by one of the investment projects considered as part of the 2014 regulatory review of charges at Dublin airport. It should be remembered that under the price cap form of regulation, a regulator can neither compel nor prevent a regulated firm from making any specific investment. Rather, the regulator’s decision relates to *whether* and *how much* of the cost of an investment can be recovered (over time) through airport charges. Insofar as a firm can finance an investment in some other manner than through the regulated charge, it may invest as it wishes. Conversely, a maximum price cap determines the maximum revenues a regulated firm may collect for a given volume of demand but does not directly influence how those revenues are spent; of course, the spending pattern may affect the setting of the price in subsequent periods.

Dublin airport has an existing main runway 2.74 km in length and the airport operator, as part of its investment plan for 2015–2020, proposed to build a 3.66 km parallel runway, at an estimated cost of about €250 m.¹⁶ The main disagreement with

¹³ Available at <http://www.irishstatutebook.ie/eli/2013/si/460/made/en/pdf>.

¹⁴ As remarked upon by a referee.

¹⁵ A closely related analysis, focusing on Heathrow airport, may be found in [Gillen and Starkie \(2015\)](#).

¹⁶ All values in 2014 prices; the runway project is analysed in the 2014 determination decision (CAR, 2014), in particular, in section 10; the report and related materials are available at www.aviationreg.ie.



Chart 2. Reduction in incidents of slot abuses, Dublin airport, 2010–2014.
Source: 2014 Annual Report, [Commission for Aviation Regulation, Ireland](#).

airlines concerned the runway's proposed length. The case for a long runway – capable of serving very long-haul destinations in the East Asia – was supported by the airport operator and the Irish government's economic-development agencies; some airlines offering short-haul services did not wish to pay for the additional cost.

As far as is known, slots have not been traded at Dublin airport; in any case, there was no information about user valuation of additional runway capacity. The airport operator – based on passenger surveys it conducted – asserted that benefits would be large; some airlines suggested that a shorter runway would suffice for nearly all passengers. In view of the conflicting claims, the regulatory office proposed for the future, when considering additional investment, the regulator may look for evidence of the willingness of users to pay a premium to operate in the peak hours when deciding whether there is sufficient demand for the investment.

In 2014, the regulator's office rejected the proposal for a 3.66 km runway citing, *inter alia*, the absence of peak pricing by Dublin airport and the resultant uncertainty about the value to users of extra capacity. The costs of a shorter runway (3.1 km) was allowed in the general airport cost base – in line with the investment principles set out above – with the regulator proposing that the extra cost of a longer runway be collected by the airport from those airlines supporting a longer runway. The regulator's report noted that while a longer runway might permit airlines to add very long-haul services, the higher airport charges arising from the additional costs could also make some short-haul services less economic or uneconomic.

The regulator's 2014 report stressed that at an airport where capacity is fully utilised but there is unmet demand at certain times of the day, two response by the airport are possible. One is to build additional capacity (raising costs and charges); the other response is to require some airlines to operate at other times of the day. Slot pricing/trading would directly assist making the choice between new investment or additional off-peak services, helping decide the timing and magnitude of airport investment. Nonetheless, as at most other airports, peak pricing has not been used in Dublin, and is strongly opposed by the airport operator and airlines.

5. Lessons learned from the EU's experience of slot rules

The European Union's two-plus decades of administrative slot rules offer a number of lessons to jurisdictions reviewing slots policy, or preparing to build substantial airport capacity and considering how to deploy those expensive assets in an efficient manner. An EU-style system should be effective in certain respects. When capacity is scarce, it should reduce the cost of congestion provided this efficiency gain is not dissipated by allocating slots to less valuable services. Even when capacity is ample, a slots regime smoothes the flow of traffic. Moreover, at regulated airports with severe capacity constraints, a regulated charge will be below the market-clearing charge, so a slot regime is a way to reconcile demand with capacity. (Forsyth, 2008)¹⁷.

On the other hand, these considerations do not require that slot allocation be on an administrative non-price basis. As this paper has sought to show, the experience of the EU's slot rules suggest the following four lessons.

First, possible slot regimes need to be considered alongside capacity investment decisions. Pressure to introduce slot rules arises particularly when airport (or airspace) capacity falls behind demand. To the extent that capacity and demand can be aligned – adding capacity that users (airlines) are prepared to pay for – then slots should be allocated using market prices. The prices will give an incentive to use expensive infrastructure efficiently as well as indicating when capacity needs to be expanded.

Second, the Irish experience shows that the transaction costs of applying slot rules can be underestimated, especially where disagreements about capacity allocation arise between airlines, or between airlines and airports.

Third, Dublin experience also shows runway capacity may be substantially increased by efficiency improvements made by carriers, airport and ATC, deferring costly infrastructure spending until it can no longer be avoided. As well as *allocating* slots efficiently,

¹⁷ At extremely capacity-constrained airports, slot prices might yield revenues in excess of those that would generate a return to shareholders equal to the cost of capital; in this sense, slot trading is required for effective price regulation.

the capacity of e.g. a runway should also be maximised.

Fourth, the familiarity in the aviation sector of *administrative* slot allocation should not hide its rarity outside aviation. In the EU greater efforts are needed to reform the slot system in the name of efficiency.

Outside the EU, the authorities should hesitate to introduce any scheme that is hard to revise and administrative slot rules will certainly prove very hard to revise. The EU's slot rules were introduced in 1993, but to date it has not been possible to substitute price allocation despite estimated potential gains of 24 m. passengers per annum, 60,000 more jobs, and €5bn in additional economic activity by 2025. Because of the tremendous practical issues posed for the EU by a transition from grandfathered to auctioned slots, it is not expected that the EU would now take the radical step of abolishing the grandfather principle and auctioning airport slots. Countries building expensive new hub airports should therefore try as far as possible to avoid finding themselves facing this quandary in the future.

References

- ACI, 2009. Proposed suspension of the EU slots usage rule, position of European Airports. Available at www.aci-europe.org.
- Adler, Nicole, Fu, Xiaowen, Oum, Tae, Yu, Chunyan, 2014. Air transport liberalisation and airport slot allocation, the case of the Northeast Asian transport market. *Transp. Res. Part A* 62, 3–19.
- Barbot, C., 2004. Economic effects of re-allocating airports slots: a vertical differentiation approach. *J. Air Transp. Manage.* 10 (5), 333–343.
- Basso, L.J., Zhang, A., 2007. Congestible facility rivalry in vertical structures. *J. Urban Econ.* 61 (2), 218–237.
- Bauer, Jörg, 2008. Do Airlines Use Slots Efficiently?, Chapter 9 in Czerny et al. (2008), pp. 151–171.
- CAR, 2013. Maximum Levels of Airport Charges at Dublin Airport – Issues Paper, Commission for Aviation Regulation (CAR) Paper 2/2013, available online at www.aviationreg.ie.
- CAR, 2014. Maximum Level of Airport Charges at Dublin Airport – 2014 Determination, Commission Paper 2/2014, available online at www.aviationreg.ie.
- Commission for Aviation Regulation, Annual Reports (2013, 2014), available online at www.aviationreg.ie.
- Czerny, Achim, Forsyth, Peter, Gillen, David, Niemeier, Hans-Martin, 2008. Airport Slots– International experiences and options for reform, Ashgate Publishing Ltd.
- Czerny, A.L., 2010. Airport congestion management under uncertainty. *Transp. Res. Part B: Methodol.* 44 (3), 371–380.
- DACC, Dublin Airport Coordination Committee constitution, available at <https://www.acl-uk.org/>.
- EEC 95/93, 1993. Regulation on common rules for the allocation of slots at Community airports, Off. J. EU L 14.
- EU 793/2004, 2004. Regulation of the European Parliament and of the Council amending Council Regulation (EEC) No 95/93 on common rules for the allocation of slots at Community airports. Off. J. EU L 138.
- European Commission Staff Working Paper, 2011. Summary of the Impact Assessment accompanying the Proposal for a Regulation of the European Parliament and of the Council on common rules for the allocation of slots at European Union airports (Recast), SEC/2011/1444 final.
- Forsyth, Peter, 2008. Airport Slots: Perspectives and Policies, Chapter 20 in Czerny et al., 2008, pp. 379–405.
- Fukui, A., 2012. Do carriers abuse the slot system to inhibit airport capacity usage? Evidence from the US experience. *J. Air Transp. Manage.* 1–6.
- Fukui, H., 2014. Effect of slot trading on route-level competition: evidence from experience in the UK. *Transp. Res. Part A* 69, 124–141.
- Gillen, David, 2008. Airport Slots: A Primer, Chapter 4 in Czerny et al. (2008), pp. 41–59.
- Gillen, David, Morrison, William, 2008. Slots and Competition Policy: Theory and International Practice, Chapter 10 in Czerny et al. (2008), pp. 173–191.
- Gillen, David, Starkie, David, 2015. Congested Hubs, the EU Slot Regulation and Incentives to Invest, available at SSRN: <https://ssrn.com/abstract=2592449>.
- Gremminger, Michael, 2006. Commercial slot allocation – a competition policy perspective, presentation to EUACA seminar on secondary trading, Amsterdam. available at http://www.cohor.org/wp-content/uploads/upload_old/Michael%20Gremminger.pdf.
- IATA Worldwide Slot Guidelines, 2017. 800 Place Victoria P.O. Box 113 Montreal, Quebec, Canada.
- IATA Worldwide Slot Guidelines, 2000. 800 Place Victoria P.O. Box 113 Montreal, Quebec, Canada.
- Madas, M.A., Zografos, K.G., 2008. Airport capacity vs. demand: mismatch or mismanagement? *Transp. Res. Part A: Policy Pract.* 42 (1), 203–226.
- McDonald, Mott, 2006. Study on the Impact of the Introduction of Secondary Trading at Community airports. available at http://ec.europa.eu/transport/modes/air/airports/slots_en.htm.
- NERA, 2004. Study to Assess the Effects of Different Slot Allocation Schemes. Final report to the EU Commission, available at http://ec.europa.eu/transport/modes/air/airports/slots_en.htm.
- OFT (UK Office of Fair Trading), 2005. *Competition Issues Associated With the Trading of Airport Slots*. The Stationery Office, Norwich, UK.
- Rose, Edmond, 2003. Airport slots: who benefits from allocating them? In Dieter Helm and Derek Holt, 2003, *Air Transport and Infrastructure: the challenges ahead*, OXERA Consulting Limited.
- SEO Amsterdam Economics and Cranfield University, 2017. The Impact of Airport Capacity Constraints on Airfares. available at www.seo.nl.
- Sieg, Gernot, 2010. Grandfather rights in the market for airport slots. *Transp. Res. Part B* 44 (1), 29–37.
- Starkie, David, 1998. Allocating airport slots: a role for the market? *J. Air Transp. Manage.* 4 (2), 111–116.
- Starkie, David, 2008. The Dilemma of Slot Concentration at Network Hubs, Chapter 11 in Czerny et al. (2008), pp. 193–203.
- Steele Davies Gleave, 2011. Impact Assessment of Revisions to Regulation 95/93. available at http://ec.europa.eu/transport/modes/air/airports/slots_en.htm.
- Ulrich, Claus, 2008. How the Present (IATA) Slot Allocation Works, Chapter 2 in Czerny et al. (2008), pp. 9–20.