UNIVERSITY OF WESTMINSTER

The cost of passenger delay to airlines in Europe

Consultation document

University of Westminster

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Executive summary and feedback request

This document updates estimates, previously adopted by EUROCONTROL, of the cost of passenger delay to European airlines. It draws on various sources of evidence, with a particular focus on the impact of Regulation (EC) No 261/2004, which establishes the rules for compensation and assistance to airline passengers in the event of denied boarding, cancellation or delay. It reviews major legal rulings on the Regulation to assess the broader cost impacts on airlines. It also assesses changes to the Regulation being considered by the European Commission, in order to ensure that the cost framework used for these delay cost calculations is sufficiently adaptable to such changes and to gain an insight into the likely future regulatory emphasis, particularly where this has a financial implication for airlines. The objective is to produce cost reference values for industry use, which accurately reflect airline delay costs. These are produced for 15 aircraft types[1], across a range of delay durations, according to 'low', 'base' and 'high' cost scenarios, for the year 2014.

The Regulation 261 revision process remains far from complete. The European Parliament will negotiate with the European Council (EU member states), after the latter has reached agreement on a common position; meanwhile industry views are amongst those being taken into consideration before adoption of the revised Regulation.

Endogenous factors in scope in this report thus include changes to the regulatory context, both those effected through settled case law since the implementation of the Regulation and planned changes to the rules in coming years, and also changes in the rate of complaints. Increasing awareness of Regulation 261 is likely to drive up claim rates to airlines and thus increase the cost of a given disruption. Studies regarding the enforcement of the Regulation have shown gradual but slow improvements over time, although many member states still do not enforce the Regulation effectively. Exogenous factors in scope include aircraft seating densities and load factors, inflation and changes in air transport market conditions.

Since the objective is to model the cost of delay for *given* aircraft delays, changes in performance (e.g. regarding delays) are out of scope, although these affect net airline costs. Court rulings that are likely to generate retrospective claims are not specifically modelled, as these do not directly impact future delay costs (apart from indirect, strategic effects). Similarly, the extent to which airlines absorb such costs strategically is not quantified, although these effects may be considerable and may need to be accounted for in future.

Although the passenger cost of delay is often a dominating delay cost for operators, it is concluded that there remains incomplete quantitative evidence supporting the calculation thereof. The published literature on such costs and factors likely to influence them (indirectly) are examined, including a European Commission Impact Assessment published in 2013, focusing on Regulation 261, although the extent to which quantitative inputs can be used from other reporting methods to update the values previously adopted by EUROCONTROL is very limited. Ultimately, for both the passenger hard and soft costs of delay to the airline, simple inflationary increases have been applied to the 2010 costs, in parallel to updated seat, load factor and passenger allocations for the 15 aircraft types considered.

The values presented here are statistical (probabilistic) results, suitable for use as reference values. Further research is required to provide a more robust estimate of such costs as a function of delay duration and aircraft type. Until such systematic research is implemented, airline feedback on the values presented is particularly useful, and invited herewith. Other airline delay costs, relating to fuel, maintenance, crew and fleet provisions are more readily quantifiable from (published) data sources, and are being reported upon separately.

[1] Three of these, *viz*. the DH8D, E190 and A332, were not included in the original set of aircraft evaluated, and thus extend the range of reported costs.

Why evidence-based feedback is important

The table below presents the total costs of passenger delay to the airlines, by delay duration and aircraft type, for the base cost scenario, in 2014-Euros. (It is a copy of Table 12, presented at the end of the calculations which follow.) Compared with the previously reported values for 2010, the **average increase is 20%**. Most of this increase has been driven by increasing passenger densities on European flights.

Total cost of passenger delay by delay duration and aircraft type (base cost scenario)

Delay (mins)	5	15	30	60	90	120	180	240	300
B733	40	250	910	3 320	6 800	11 110	22 180	36 370	53 520
B734	40	290	1 040	3 780	7 750	12 670	25 280	41 470	61 020
B735	30	230	810	2 950	6 040	9 860	19 690	32 290	47 510
B738	40	330	1 170	4 250	8 700	14 220	28 390	46 570	68 520
B752	50	400	1 420	5 180	10 610	17 340	34 610	56 770	83 520
B763	70	490	1 760	6 420	13 150	21 490	42 900	70 360	103 530
B744	110	790	2 850	10 360	21 220	34 670	69 220	113 530	167 050
A319	40	270	960	3 510	7 180	11 730	23 420	38 410	56 520
A320	40	310	1 110	4 030	8 260	13 500	26 940	44 190	65 020
A321	50	380	1 350	4 900	10 040	16 400	32 750	53 710	79 020
AT43	10	90	310	1 120	2 290	3 740	7 460	12 240	18 010
AT72	20	120	440	1 610	3 300	5 400	10 780	17 680	26 010
DH8D	20	140	490	1 770	3 620	5 920	11 810	19 380	28 510
E190	30	180	660	2 390	4 890	7 990	15 960	26 170	38 510
A332	80	550	1 980	7 200	14 740	24 080	48 080	78 860	116 030

These results will be used to develop European reference values for use by industry and in wider research, updating previously published values adopted by EUROCONTROL. The Performance Review commission of EUROCONTROL has used such findings in the past, and is likely to do so again in the future.

Since it is further intended that this methodology, and these values, will be taken forward for use in operational contexts (such as dynamic cost indexing for delay recovery), it is equally important that the delay costs neither under- nor over-estimate actual airline costs, to the best possible extent.

For example, it is clear that over-estimation of such costs may lead to inappropriately high fuel burn to recover delay. Under-estimation may lead to inadequate investment to mitigate such costs strategically, for example through new technologies or simply by adding buffer to schedules.

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Feedback on the delay cost values presented in this document is invited, particularly from airlines. All feedback will be treated in confidence and suggestions for evidence-based adjustments will be taken into account. We have intentionally offered a broad background to prompt similarly broad responses.

Kindly respond in the first instance to:

airspace-research@westminster.ac.uk

by **02 October 2015**. We would be happy to arrange a (further) discussion by telephone, as preferred. Thank you for your consideration.

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1 The cost of passenger delay to European airlines

1.1 Overview of cost types

Three types of passenger costs of delay may be considered:

- **'hard' costs**: borne by the airline (measurable, bottom-line costs such as re-booking and compensation);
- **'soft' costs**: borne by the airline (such as loss of market share due to passenger dissatisfaction);
- **'internalised' costs**: borne by the passenger, not passed on to the airline (e.g. potential loss of business due to late arrival at meeting; partial loss of social activity[2].

We are concerned here only with costs impacting the airline, i.e. the first two types, although it should be noted that compensation due to passengers for delays and cancellations is, in principle, designed to offset the third type of cost (European Commission, 2013c). A fuller discussion of these cost types may be found in our previous reporting adopted by EUROCONTROL (Cook and Tanner, 2011).

1.2 The European regulatory context

Regulation (EC) No 261/2004 (European Commission, 2004) establishes the rules for compensation and assistance to airline passengers in the event of denied boarding, cancellation or delay. This Regulation came into effect on 17 February 2005. The implementation of the Regulation across Europe is not consistent. Case law has a decisive impact on the interpretation and application of Regulation 261. European Court of Justice rulings are legally binding from the date that the relevant Regulation came into force, and all airlines are legally obliged to respect them (European Commission, 2013c). A number of national rulings have also impacted the interpretation and application of the Regulation, also mostly in terms of extending the scope in favour of the passenger. For a review, set also in a wider international context, see Correia and Rouissi (2015).

Social and political priorities in Europe have shifted to further support passenger rights, as evidenced by high-level position documents such as 'Flightpath 2050' (European Commission, 2011b) and the European Commission's 2011 White Paper (European Commission, 2011c)[3]. Several problems with regard to the implementation and scope of Regulation 261/2004 have been identified, with a roadmap for the revision of the Regulation published in late 2011 (European Commission, 2011d).

1.2.1 Regulation 261 – original provisions, February 2005

Figure 1 shows passenger entitlements as a function of delay duration, in a simplified form[4]. The length of haul terminologies are specified here for simplicity. Where 'short haul' is denoted in this report, the Regulation refers to flights of ≤ 1500 km; 'medium haul' relates to intra-EU flights of > 1500 km and other flights of 1500-3500 km; 'long haul' relates to all other flights – i.e. non-intra-EU and > 3500 km. The delays refer to departure delay. Hotel accommodation is also required if a delay necessitates an overnight stay. The right to care (e.g. provision of meals) also applies – as in cases of denied boarding or flight cancellation (but then only when the passenger pursues the delayed travel and opts for re-routing). Care is due even if the disruption is caused by "extraordinary circumstances", since these only exempt operators from paying compensation (Rouissi and Correia (2014)[5]; European Commission (2013c)).

[2] See also Lubbe and Victor (2012). For quantified values of time, see Cook and Tanner (2011) (Annex C) and Maibach *et al*. (2008), the latter used for reference by Commission services (European Commission, 2013c).

[3] The White Paper calls for a uniform interpretation of EU law on passenger rights and a harmonised and effective enforcement thereof. The consultation period for the mid-term review of the White Paper runs from 10MAR15 to 02JUN15: http://ec.europa.eu/transport/media/consultations/2015-white-paper-2011-midterm-review_en.htm

[4] See Article 7(2) of the Regulation, cited in Appendix A, for the literal terminology.

[5] Also published as Correia and Rouissi (2015).

Haul	Delay duration			
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours
Short haul	🍽	🍽	🍽	🧾 🍽
Medium haul		🍽	🍽	🧾 🍽
Long haul			🍽	🧾 🍽

Key
🍽 Care (e.g. reasonable meals and refreshments)
🧾 Reimbursement of ticket

Figure 1. Original provisions of Regulation 261

We review major rulings on the Regulation in order to be able to assess the cost impacts on airlines. We also summarise changes to the Regulation being considered by the European Commission, in order to ensure that our cost framework is sufficiently adaptable to such changes and to gain an insight into the likely future regulatory emphasis, particularly where this has a financial implication for airlines.

1.2.2 Court of Justice ruling, November 2009

In November 2009, the Court of Justice of the European Union (CJEU) gave its ruling in the joined cases of Sturgeon and Böck (CJEU, 2009[6]). In these decisions, passengers arriving at the destination three hours or more after the scheduled arrival time were considered entitled to compensation unless the carrier could prove that the flight delay was caused by 'extraordinary' circumstances which could not have been avoided even if all reasonable measures were taken (Commission for Aviation Regulation, 2010). The CJEU's judgment in the cases of TUI Travel and Nelson (CJEU, 2012a) handed down in October 2012 confirmed the ruling in the Sturgeon and Böck cases; therefore, a right to compensation when flights are delayed (not expressly set out in Regulation 261) as well as cancelled has been defined in Europe, as a matter of settled law (Commission for Aviation Regulation, 2013). The Court of Justice found that passengers experiencing delay flights should be treated *in the same way as those whose flights are cancelled*, as regards their right to compensation (CJEU, 2012b), since the impacts of arrival delay on the passenger are not substantially different.

Haul	Delay duration			
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours
Short haul	🍽	🍽 €250	🍽 €250	🧾 🍽 €250
Medium haul		🍽 €400	🍽 €400	🧾 🍽 €400
Long haul		€300*	🍽 €600	🧾 🍽 €600

Key
🍽 Care (e.g. reasonable meals and refreshments) black: 2005
🧾 Reimbursement of ticket blue: 2009
€ Compensation (refers to *arrival* delay)
* For delays of 3 to 4 hours (see Paragraph 63 of CJEU ruling in Annex 1)

Figure 2. Improved passenger rights as a function of delay duration

[6] See also extracts of this important ruling, as set out in Annex 1.

Unlike the original Regulation 261 provision, these compensation rights refer to arrival delay. The compensation values shown in Figure 2 are as cited in European Commission (2014b) and are aligned with Article 7 of Regulation 261 (European Commission, 2004).

The continuing lack of clarity regarding exactly which circumstances may be deemed 'extraordinary' is reflected in a non-binding, draft list of such circumstances posted by the European Commission (2013a) following a National Enforcement Bodies meeting in April 2013, and in national rulings such as a case concerning Jet2, confirming that technical faults, such as component failure caused by wear and tear, did not count as 'extraordinary' and were not exempt from the Regulation (England and Wales Court of Appeal (Civil Division) Decisions, 2014a). Jet2 was later refused appeal by the United Kingdom's Supreme Court (UK Supreme Court, 2014).

1.2.3 Court of Justice ruling, September 2014

In September 2014, the Court of Justice (CJEU) made a ruling on Case C‑452/13 regarding the definition of the arrival time of a flight. The ruling was made that: "Articles 2, 5 and 7 of Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights, and repealing Regulation (EEC) No 295/91, must be interpreted as meaning that the concept of 'arrival time', which is used to determine the length of the delay to which passengers on a flight have been subject, refers to the time at which at least one of the doors of the aircraft is opened, the assumption being that, at that moment, the passengers are permitted to leave the aircraft." (CJEU, 2014). This resolved previous ambiguities, and established arrival time as significantly later than other options considered, such as touchdown or in-block time.

1.2.4 UK Supreme Court ruling, October 2014

The England and Wales Court of Appeal, in a case concerning Thomson, ruled in June 2014 that compensation should be made available for delays to flights within a period of up to six years after the event (England and Wales Court of Appeal (Civil Division) Decisions, 2014b.) The legal issue was whether the applicable limitation period for bringing a claim for compensation under the Regulation should be two years (pursuant to the Montreal Convention[7]), or six years (pursuant to the Limitation Act 1980[8]). An appeal from Thomson was rejected by the United Kingdom's Supreme Court (UK Supreme Court, 2014). This prompted media speculation that airlines would experience a substantial number of retrospective claims (Toogood, 2014.). This does not impact these calculations, however, where the objective is to assign delay costs to (future) aircraft delays.

1.2.5 Regulation 261 – planned revisions

The European Parliament identified a need for enhanced legal certainty and a more uniform application of European regulations in terms of passenger rights. A consultation on the potential revision of Regulation 261 was completed in March 2012, though with little consensus on the way forward, with responses from airlines and consumer/passenger organisations often directly opposed (European Commission, 2012b). On 29 March 2012, the European Parliament made a resolution on the functioning and application of established rights of people travelling by air (2011/2150(INI[9]); European Parliament, 2012a) trying to maximise passenger awareness of their rights and simplify and facilitate the complaint process. This resolution was followed by another on the 23 October 2012 on passenger rights in all transport modes (2012/2067(INI); European Parliament, 2012b).

[7] Regulation 2027/97 translates the Montreal Convention into EU law, making provisions with regard to compensation where baggage has been mishandled (European Commission, 2013c). The Montreal Convention is concerned with individualised damage to travellers, assessed on a case-by-case basis, with proof of burden on the passenger, and has no provisions with regard to denied boarding or cancellation. In theory, it provides a right to compensation in the event of delay, but the burden of proof issue, combined with the existence of Regulation 261, has resulted in relatively few successful claims (*ibid*.).

[8] This refers to an Act of Parliament that applies in England and Wales with regard to timescales within which action may be taken for breaches of law. The time limit for actions founded on simple contract "shall not be brought after the expiration of six years from the date on which the cause of action accrued".

[9] INI = 'own-initiative procedure'.

2011/2150(INI) (*ibid*.) advocates a greater improvement of passenger knowledge of the Regulation (i.e. implementation of effective complaint systems; information detailing passenger rights communicated by air carriers and tour operators, in the language used during the booking of the ticket; continuing the information campaign launched in 2010 to raise passengers' awareness of their rights and to update all sources of information that set out the rights of passengers, such as websites, documents and brochures). 2012/2067(INI) (*ibid*.) extends this passenger awareness to all transport modes (i.e. it welcomes the Commission's decision to maintain its information campaign on passenger rights up to 2014 and recommends that national consumer protection authorities and travel agencies should be involved in the campaign, suggesting that the list of rights common to all modes should be circulated widely, in a concise form and in all official EU languages; it also calls on carriers to provide information on passenger rights on travel tickets, especially contact details for help and assistance).

On 30 May 2012, the Commission and the European Economic and Social Committee co-organised a conference presenting the main results of its consultation, giving stakeholders the opportunity to respond to the results (European Commission, 2013c). Consumer and passenger representatives mainly focused on inadequate enforcement (especially in the case of the rights to financial compensation in case of delay) and poor compliance. Regarding airlines and their associations (*ibid*.), these bodies:

> […] mainly considered that the financial cost of the Regulation is excessive, particularly that airlines face unlimited liability for incidents which are not their fault (e.g. volcanic ash cloud crisis in April 2010). The airlines heavily criticised the consequences of the Sturgeon judgement – i.e. the right to financial compensation in case of long delay – on the grounds of alleged incompatibility with international law and excessive economic "burden".

In March 2013, a memo was released by the Commission (European Commission, 2013b) detailing the key proposed changes to clarify legal grey areas and introducing new rights. In February 2014, the following proposed strengthening of air passenger rights passed its first reading in the European Parliament (European Commission, 2014a):

- **Enforcement:** strengthening the oversight of airlines by national and European authorities, with more effective sanctions;
- **Right to care:** introduction of a right to care for passengers after a delay of two hours, for all flights irrespective of distance (thereby removing the current dependency on flight distance);
- **Complaint handling:** the introduction of a common complaint form; ensuring that passengers have a right to receive an acknowledgement within a week and a response to their complaint within two months (currently no time limit);
- **Right to information:** ensuring passengers have a right to information about their situation 30 minutes after a scheduled departure (currently no time limit); contact points in airports to inform passengers on the circumstances of their travel disruption and their rights;
- **Re-routing:** ensuring passengers have a right to be re-routed by another airline or transport mode in case of cancellation when the carrier cannot re-route on its own services; Parliament additionally suggested a lower limit of 8 hours compared with 12 hours proposed by the Commission;
- **Connecting flights:** clarifying that rights to assistance and compensation apply if connecting flights are missed because the previous flight was delayed by at least 90 minutes;
- **Other rights:** the right for passengers to correct spelling mistakes in their name without charge and giving national authorities enforcement powers over lost luggage rules.

The European Parliament's proposals also go further than those proposed by the Commission in strengthening air passenger rights (*ibid.*):

- **Compensation for delays (short and medium flights):** the Parliament proposes a three hour delay threshold for compensation[10]. In contrast, the Commission considers a five hour threshold to be in passengers' best interests, with a longer delay threshold reducing the financial incentive on airlines to cancel delayed flights to avoid paying compensation, and instead make every effort to repair technical problems and operate flights.

[10] This is consistent with the Court of Justice of the European Union ruling in the joined cases of Sturgeon and Böck discussed above (CJEU, 2009).

- **Extraordinary circumstances:** the Parliament backs the Commission's proposal to clearly define extraordinary circumstances (e.g. strikes, storms and operational problems) which are outside an airline's control, so excluding any compensation obligation. However, unlike the Commission's proposal, the Parliament proposes that technical faults can almost never be exempt. In addition, Parliament proposes an exhaustive list for exceptional circumstances, while the Commission argues for an 'open' list to take account of future unforeseen circumstances.
- **Liability limit:** currently there is no limit to liability placed on airlines, even in extraordinary circumstances (e.g. the 2010 Eyjafjallajökull eruption). The Commission proposes liability should be limited to three nights, giving airlines some predictability when budgeting for passenger rights, however the Parliament proposes a limit of five nights.
- **Bankruptcy:** the Parliament proposes to impose an obligation on airlines to take insurance in case of bankruptcy (insolvency), ensuring that passengers would be reimbursed the cost of their tickets and stranded passengers would be repatriated. However, the Commission is concerned that such a systemic measure would double the cost of the current Air Passenger Regulation for airlines, and that these costs would then get passed on to passengers through increased ticket prices.

Haul	Delay duration					
	≥ 90 mins	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours	≥ 8 hours
Short haul	©	© 🍽	© 🍽 €250	© 🍽 €250	© 🧾 🍽 €250	+®
Medium haul	©	© 🍽	© 🍽 €400	© 🍽 €400	© 🧾 🍽 €400	+®
Long haul	©	© 🍽	© 🍽 €300*	© 🍽 €600	© 🧾 🍽 €600	+®

Key

🍽	Care (e.g. reasonable meals and refreshments)	
🧾	Reimbursement of ticket	
€	Compensation (refers to *arrival* delay)	
©	Rights re. missed connecting flights	black: 2005
®	Better rights re. re-routing on other airlines	blue: 2009
*	For delays of three to four hours	red: 2016-17(est.)

Figure 3. Current, proposed and planned passenger rights as a function of delay duration

These effects are captured in Figure 3. The current rules regarding *compensation* for a missed connection are the same as for flight delays[11]. As the UK CAA details[12], passengers may be entitled to compensation if they miss a connection. The flight must be either be departing from an EU airport (and operated by any airline), or arriving at an EU airport and operated by an EU airline. This applies to through tickets only and the airline must be responsible for the cause of the missed connection. The right to claim compensation depends on how late the passenger arrives at the final destination.

Examining the General Conditions of Carriage for British Airways[13], it is stated in Clause 9(b)(3) that, if the operator causes the passenger to miss a connecting flight on which they hold a confirmed reservation, a choice of one of three remedies is available:

Remedy 1 - We will carry you as soon as we can to the destination shown on your ticket on another of our scheduled services on which a seat is available in the class of service for which you have paid the fare. If we do this, we will not charge you extra and where necessary, will extend the validity period of your ticket.

Remedy 2 - We will carry you to the destination shown on your ticket in the class of service for which you have paid the fare at a later date at your convenience and within the validity period of your ticket on another of our scheduled services on which a seat is available. If we do this, we will not charge you extra.

[11] See CJEU (2013) ruling on Regulation 261.

[12] http://www.caa.co.uk/default.aspx?catid=2211&pagetype=90&pageid=15462

[13] http://www.britishairways.com/en-gb/information/legal/british-airways/general-conditions-of-carriage

Remedy 3 - We will give or obtain for you an involuntary fare refund. We will give you additional assistance, such as compensation, refreshments and other care and reimbursement, if required to do so by any law which may apply. We will have no further liability to you.

The General Conditions of Carriage for Lufthansa[14], in Clause 10.2 on involuntary refunds, states that:

If we cancel a flight, fail to operate a flight reasonably according to schedule, fail to stop at your destination or Stopover, or cause you to miss a connecting flight which you hold a reservation, the amount of the refund shall be:
10.2.1.1. if no portion of the Ticket has been used, an amount equal to the fare paid,
10.2.1.2. if a portion of the Ticket has been used, the refund will be not less than the difference between the fare paid and the applicable fare for travel between the points for which the Ticket has been used.

The General Conditions of Carriage for KLM[15], on the other hand, do not explicitly mention missed connections, although the website search result for "missed connection" states that: "If you miss your connecting flight, we will automatically rebook you to the next available flight." Thus, no compensation or care *per se* is formally offered. Whilst airlines generally provide rerouting and assistance in cases of missed connections, this remains airline-dependent and is not universal (European Commission, 2013c).

The potential revision to Regulation 261 regarding the obligations for connecting flights would represent a new requirement on airlines. The revision process, overall, remains far from complete. The European Parliament will negotiate with the European Council (EU member states), after the latter has reached agreement on a common position; meanwhile industry views are amongst those being taken into consideration and adoption of the revised Regulation is expected in 2015 at the earliest, with the rules becoming law by 2016-17 (European Regions Airline Association, 2014).

1.2.6 Regulation 261 – passenger awareness

This section reports on passenger awareness of Regulation 261. Increased awareness is likely to drive up claim rates to airlines and thus increase the cost of a given disruption. Although evidence is mixed, it generally points to increasing awareness. In parallel, studies regarding the enforcement of the Regulation have shown gradual but slow improvements over time, although many member states still do not enforce the Regulation effectively and some are therefore deemed unlikely to do so in future, either (European Commission, 2013c). National Civil Aviation Authorities and the European Parliament have taken action to raise awareness of the Regulation. An example of this is the directions against Ryanair and Aer Lingus issued by the Irish Commission for Aviation Regulation in 2008 to ensure the display of the Regulation at check-in (Commission for Aviation Regulation, 2009). Passenger awareness and claim rates are also increased both through the Commission's passenger rights app[16] and commercial sites[17] helping passengers to make claims. Potentially, in some member states, provisions allowing collective action to claim compensation on the part of a group of passengers may be introduced (European Commission, 2013c).

[14] http://www.lufthansa.com/online/portal/lh/cmn/generalinfo?nodeid=1818501

[15] http://www.klm.com/travel/gb_en/customer_support/booking_conditions_carriage/index.htm

[16] http://ec.europa.eu/transport/passenger-rights/en/mobile.html

[17] To cite a few examples: http://www.getairhelp.com/gb; https://www.refund.me/en/; https://www.reclamador.es/en

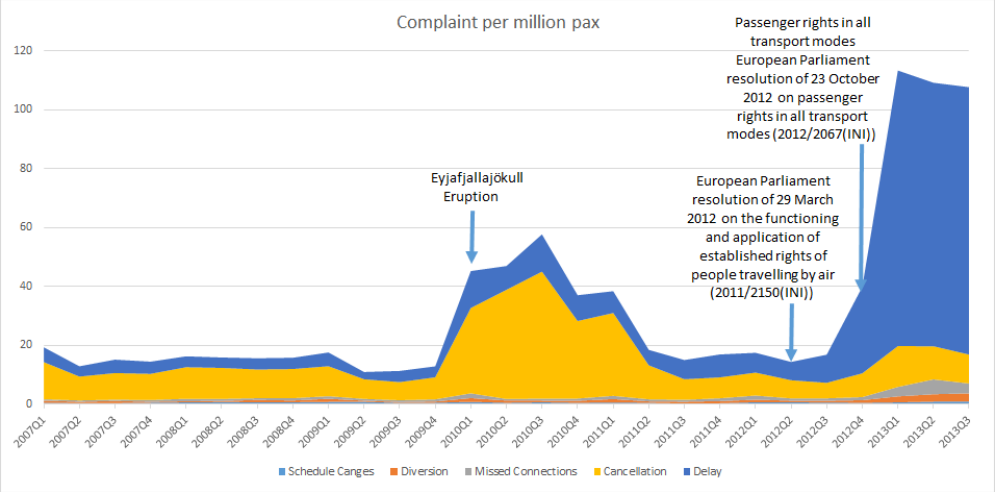

Figure 4. Complaints per million passengers reported to the UK CAA

The eruption of the Icelandic volcano Eyjafjallajökull in 2010 resulted in over 100 000 flight cancellations and affected more than 10 million passengers (EUROCONTROL, 2010). This disruption is illustrated in Figure 4. The number of complaints in the United Kingdom increased significantly due to the high amount of delays and cancellations; the Commission for Aviation Regulation of Ireland received in 2010 more than double the number of complaints than the previous year (Commission for Aviation Regulation, 2011). This major disruption also helped in the dissemination of passenger rights information and it might be one of the reasons for the higher number of complaints in the following year (2011 and beginning of 2012) with respect to the pre-eruption period (2007-2009). No worsening of the *aggregate* system performance that could otherwise justify this increment in complaints has been found (e.g. the average en-route ATFM delay per flight has been constant or even decreased in recent years (2011-2013 period) (EUROCONTROL, 2014).

Table 1. Complaints received by European NEBs, 2010- 2012

Year	Total complaints	Re. long* delays	Re. cancellations	Re. denied boarding
2010	91 726	16 334	50 461	3 140
2011	52 675	18 893	18 160	3 751
2012	56 478	21 710	21 330	3 757

* Of at least 2 hours, as defined to be in scope by the Regulation.

Table 1 shows the total number of complaints and the distribution thereof with regard to the Regulation (European Commission, 2014b) received by European National Enforcement Bodies (NEBs). Wider trends regarding total complaints are shown in Figure 5, and the distributions are plotted in more detail in Figure 6. Specific overall trends are difficult to identify, as so many factors affect the number of complaints received, including specific national events (such as the bankruptcy of a major airline, strikes, or changes in NEB reporting) and international events. Clearly, a major factor in 2010 was the Eyjafjallajökull eruption, although the exact number of complaints specifically associated with this is unknown. 2010 also saw numerous industrial actions and severe weather conditions. Notwithstanding the exceptional events of 2010, two observations are clear from Table 1: complaints regarding delays show a clear upward trend and those regarding denied boarding are relatively flat.

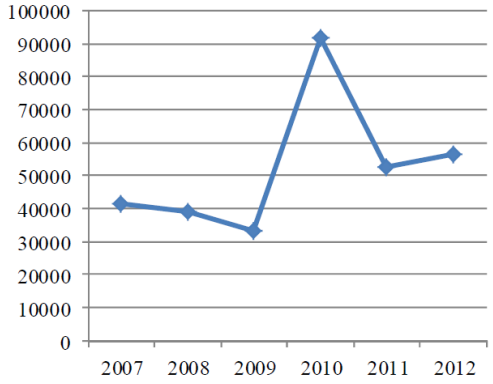

Figure 5. Total number of complaints received by European NEBs, 2007-2012

Source: European Commission (2014b).

At a high level, Figure 7 shows that: (a) all types of long delay frequencies fell from 2010, in 2011 and 2012; (b) long delay frequencies were relatively stable from 2011 to 2012. European traffic across this period was relatively stable between 2010 (9.49 million flights) and 2012 (9.55 million flights), with a modest increase in 2011 (9.78 million flights), still below 2008 levels (10.1 million flights) when the economic crisis started (EUROCONTROL: 2011, 2012, 2013). Although these figures are fairly crude they nevertheless underline an increase in delay complaints set in a context of improving or stable performance – i.e. the increase in delay complaints is indeed apparently not driven by worsening performance.

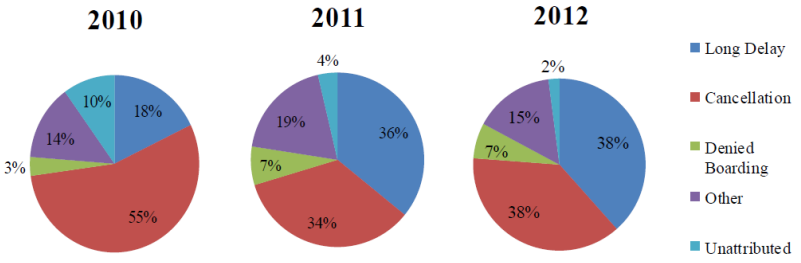

Figure 6. Distribution between grounds for lodging complaints, 2010-2012

Source: European Commission (2014b).

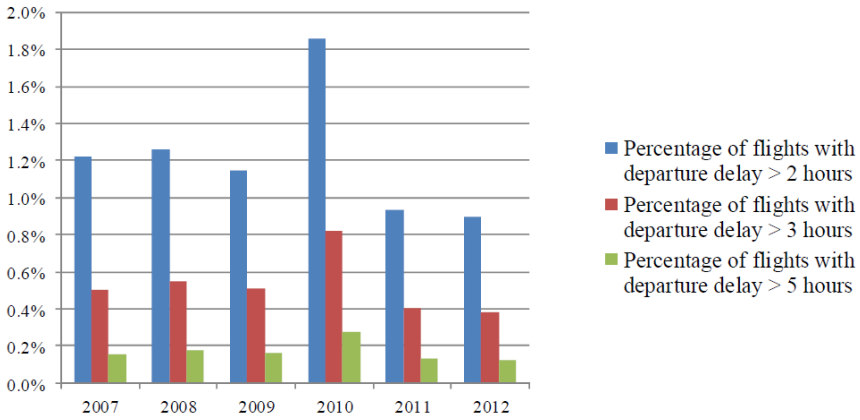

Figure 7. Crude distribution of flight delays by duration, 2007-2012

Source: European Commission (2014b).

Regarding direct survey evidence on passenger awareness, in a report commissioned by the European Commission (2014c) reporting on fieldwork undertaken in September 2014 across the 28 member states with some 28 050 respondents, respondents were evenly divided regarding air passenger rights: 37%[18] agreed that passengers were well informed by airlines about their rights, whereas an equal percentage disagreed. It is also reported (*ibid*.) that in the 2009 Special Eurobarometer on air passengers' rights, a similar question was asked. Although it is not possible to make rigorously direct comparisons due to changes in the question structures, the results in 2014 were pretty similar to those in 2009, i.e. no overall substantial increase in awareness was apparent. There was wide variation between the member states, however.

Surveys carried out in Germany, Denmark and the UK show that 75% of surveyed passengers facing problems for delays or cancellations were offered re-routing, but that care was offered in less than 50% of cases (European Commission, 2013b). It is further stated that the German survey showed that where passengers did complain, over 20% of them did not receive a response from the airline.

The European Commission (2013c) reports that data from airlines indicate that 5-10% of passengers entitled to compensation (in cases of cancellation or long delay) actually claim it. The Commission (*ibid*.) assumes that the claim rate will slowly increase over time, as a function of factors indentifed above. The total cost to airlines is predicted to increases slowly as a share of airline revenue, from 0.6% (over 2007-2009), to 0.7% in 2025. In assessing policy options, both 'low' (current, adopted claim rate of 10% for 2012, assumed to increase by 0.5% each year) and (theoretical) 'maximum' (all entitled passengers claiming) compensation claim rate impacts are explored (*ibid*.). A survey of 500 UK air travellers conducted on behalf of IRN Research during October 2014 (IRN Research, 2014) found that around 40% of air passengers with grounds to claim showed a reluctance to do so. It was concluded, however, that current trends suggest a moderate increase in claims in 2014, albeit with a "much higher rate of conversion. As the awareness grows that the claims process is easier this will stimulate more direct claims to airlines […]" (*ibid*.). These limited quantitative data will be taken forward in our delay hard cost models presented in Section 3.

[18] Averages are weighted by member state populations.

2 Wider market considerations and soft passenger costs

2.1 Previous calculations on the soft cost of delay

In general, passengers' and airlines' interests are relatively well aligned where airlines are operating in a well-functioning competitive market; if airlines do not offer prices and services attractive to customers they will lose market share. However, as airlines try to maximise their profits at the expense of passengers' convenience, in some cases, such as when airlines have market power, there might be a misalignment of interest (Cambridge Economic Policy Associates, 2010). This may apply to disruptions, i.e. delays, cancellations, diversions and reschedulings.

The passenger soft cost of delay is often a dominant component in the economics of airline unpunctuality. Nevertheless, it remains poorly understood, with almost no quantitative costs published. Soft costs can only be properly understood through market research. The relationship between airline unpunctuality and passenger tolerance, airline market share and corporate performance, has been discussed in our previous reporting adopted by EUROCONTROL (Cook and Tanner, 2011).

For distributing the soft costs of delay, a logit function was used to describe passenger dissatisfaction against various levels of delay. This curve is used to distribute the soft cost as a function of delay duration, and may be thought of as a proxy for the propensity of a passenger to switch from a given airline, to some other choice, after trips with given delay experiences.

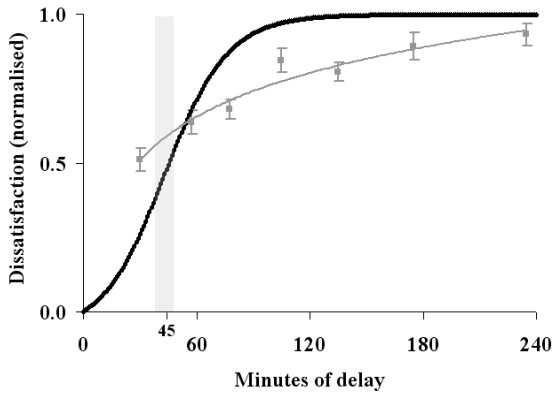

Figure 8. Passenger dissatisfaction as a function of delay duration

This is plotted in Figure 8 (black curve) and has the desirable characteristics of maintaining a low value for some time, then rapidly increasing through a zone of 'intolerance', before levelling off. Quantification of the saturation of delay inconvenience and crossovers in Kano customer satisfaction 'requirements' contributed towards the model. Relationships between market share, punctuality and customer satisfaction were also examined (*ibid*.).

Since soft costs refer to a loss in revenue to one airline as a result of a delay on one occasion, this loss may be considered to be largely the gain of another airline, gaining a passenger who has transferred their custom. When scalable costs (multiplied over a period of time or a network) are assessed, only some net loss to the airlines of the soft costs is likely (e.g. due to trip mode substitution, trip consolidation, trip replacement (e.g. teleconference) or cancellation). This is accounted for by using a reducing scalar (*ibid*.) We next examine whether there is any evidence of fundamental changes to the assumptions made in these previous calculations.

2.2 Passenger satisfaction and market share

It is generally challenging to identify clear links between passenger satisfaction and bottom-line impact, particularly in a market which is increasingly price-dominated, which is especially true on short-haul routes and with LCC penetration (Pearson and Merkert, 2013). Airlines with high customer satisfaction may achieve poor margins and vice versa (*ibid*.). Furthermore, in Europe, there is some degree of blurring between previously distinct airline business models. Differences between full-service airlines and LCCs is changing, as the former are adopting aspects of the latter, such as separate charges for seat choice, baggage or meals. Some charter airlines also operate a mixture of the two models, and sell seats as part of package holidays and on a seat-only basis (Cambridge Economic Policy Associates, 2010).

However, passengers not only consider fare levels when purchasing their ticket, but also other factors such as quality of service (as an example of a relatively recent discussion, see Yang *et al*. (2012)). Expectations of service quality are a significant predictor of complaint rates, and passengers are more likely to complain if actual service quality falls below their expectations (Forbes, 2008a). Dresner and Xu (1995) found that three measures of customer service (mishandled baggage, ticket over-sales and on-time performance) were all positively related to customer complaints. A significant correlation between complaints and actual service quality was detected in an analysis of Air Travel Consumer Report[19] data in the period 1988 and 2000 (Forbes, 2008a). A similar analysis by Steven *et al*. (2012) confirmed this relationship. As shown in Figure 9, the number of complaints tends to decrease as the percentage of on-time flights increases, whereas Figure 10 presents a linear relationship between cancellation and complaints. Steven *et al*. (*ibid*.) also found that this nonlinear relationship between customer service variables and customer satisfaction can be used to estimate the optimal levels of customer service that can be provided by airlines to maximise profitability.

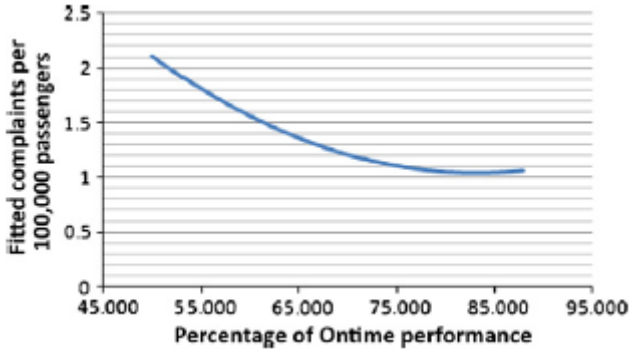

Figure 9. Relationship between on-time performance and complaints

Source: Steven *et al*. (2012).

[19] A monthly report generated by the US Department of Transport. Flight delays, mishandled baggage and oversales analysis are based on data collected by the Department's Bureau of Transportation Statistics. Consumer complaints are compiled by the Office of Aviation Enforcement and Proceedings' Aviation Consumer Protection Division and the Department of Homeland Security's Transportation Security Administration.

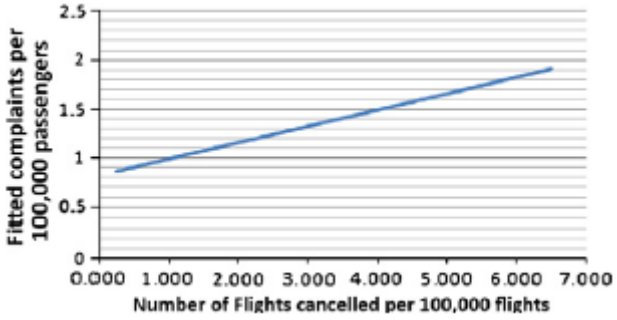

Figure 10. Linear relationship between flight cancellations and complaints

Source: Steven *et al*. (2012).

Also using Air Travel Consumer Report data and data from the Bureau of Transport Statistics to perform a regression analysis, Wittman (2014) shows that a one per cent increase in 'on-time' performance is associated with a reduction in the flight problem complaint rate of 0.028 complaints per 100 000 passengers, controlling for time and airline fixed-effects. (Based on the data sources, this is presumably counting flights on-time if operated less than 15 minutes after the scheduled time.)

The expectation of LCC passengers regarding quality of service may be lower because they pay less for their tickets. Passengers selecting LCCs primarily consider the fare, whilst passengers select full-service carriers partially for the additional product services they provide (O'Connell and Williams, 2005). It has been shown by Bhadra (2009) that air travellers may trade-off rights to complain in return for lower fares, even when faced with the same or higher levels of delays.

According to Lubbe and Victor (2012), only 24.3% of the corporate population could be considered frequent travellers, but they represent 63.5% of the substantial flight delays experienced; these frequent flyers are usually passengers flying on business. Different types of airline will experience different consequential impacts: travellers who assign a higher value to quality of service will be more willing to defect if the service falls below expectation (i.e. generating higher soft costs), even if this effect can be compensated for to some extent such as through frequent flyer program (FFP) benefits. However, in recent years more business travellers are using the services of low-cost carriers. A recent survey shows that almost 29% of Ryanair passengers were travelling on business (Cambridge Economic Policy Associates, 2010). Passengers selecting full-service carriers present a range of reasons for selecting such airlines (service reliability, quality, schedules, frequent flyer programs, etc.), whilst more than 75% of respondents stated that fare level was the main reason to select a LCC (O'Connell and Williams, 2005). LCC passengers are often far more sensitive to price than service (see, for example, a Chinese study (Chiou and Chen, 2010), based on 968 valid questionnaires disseminated in March 2007 to passengers flying Spring Airlines, the first LCC in China).

In some markets, airlines may try to compensate for the effect of market loss, due to passenger dissatisfaction, with economic tactics. Thus, prices may fall as flight delays increase, particularly in competitive markets. According to a study by Forbes (2008b), prices fall by USD 1.42 on average for direct passengers and by USD 0.77 on average for connecting passengers for each additional minute of delay. On competitive routes, the reduction can be up to USD 2.44 per minute of delay for direct passengers. This is strategic cost effect, rather than a tactical impact, however.

Ferrer *et al*. (2012) analysed 29 months of a major international airline's operations, including data from 348 468 passengers. The sample was partitioned into ten sub-periods, nine of three months long and the tenth of two months, and segmented chronologically as periods 1 to 10. The passengers who experienced delay greater than 60 minutes in the third period of the sample, but no delay in the rest of the data, were selected. Those passengers were grouped and compared with similar passengers who may or may not have experienced delay. The results show that delays have a negative impact on passenger behaviour (*ibid*.):

- passengers who experienced delays during the third period flew less than passengers in the control group (see Table 2);
- multiple delays have a more negative impact than a single delay (see Table 2);

- the marginal effect of additional delay is negative and convex (results show that the first delay has a greater impact on non-members of the FFP and a similar effect on FFP members with respect to the second);
- the negative effect of delays persists during the entire period studied;
- the negative financial effects of flight delays are stronger for members than for non-members, even though the relative effect of delays on the number of flights is the same for both groups.

Table 2. Trip reduction by passenger delay experience and FFP membership

FFP members		Non-members	
1 delay	**2 delays**	**1 delay**	**2 delays**
-0.58	-1.14	-0.17	-0.24

Source: Ferrer *et al*. (2012).

2.3 Reporting delay costs by delay duration and caps applied

The methodology previously deployed for EUROCONTROL (Cook and Tanner, 2011) reported delay cost values for various increments of delay duration (see Table 3, for example), up to a maximum of 300 minutes (5 hours). In theory, values could be reported for far higher delay durations, but it has been previously established that at higher delay:

(a) the costs *per minute* start to saturate;

(b) it often becomes more cost effective for the airline to cancel (or consolidate) flights;

(c) these levels of delay become very rare.

(a) Indications of the saturation of soft costs may be seen in Figure 8. Similar effects for hard costs (at higher delay durations) will be presented in Section 3.2.

(b) When allocating limits to how much reactionary delay could be realistically assigned to higher duration primary delays, caps of four hours (240 minutes) and five hours (300 minutes) have been previously assigned[20] to the narrowbody and widebody cases, respectively. Moreover, these cost thresholds have also been found to be in fairly reasonable agreement (*ibid*.) with narrowbody and widebody average cancellation costs (within 8% and 42%, respectively), as reported in EUROCONTROL's 'Standard Inputs' (EUROCONTROL, 2009)[21].

(c) Regarding the relative infrequency of delays greater than 300 minutes, EUROCONTROL reporting of ATFM and ACARS delays is truncated at this threshold. In 2014, delay durations greater than 300 minutes represented 0.001% and 0.1% of delays in these two categories, respectively[22]. See also Figure 12.

For these reasons, it is proposed to report delay costs up to and including durations of 300 minutes and to treat this duration as an effective threshold, or cap, in most reporting contexts.

[20] Simple models suggest that total reactionary delays of much more than four hours are difficult to allocate to typical narrowbody operational days, without making a significant change, such as cancelling one or more rotations. Reactionary costs have thus been capped in such models at the cost of four hours of total rotational minutes under any given scenario. Compared to the narrowbody case, with fewer rotations over which to distribute delay but longer layovers in which to potentially reduce them, a cost cap of five hours has been judgementally assigned to widebody cases. Reactionary costs are not dealt with in this report, however – see Cook and Tanner (2011) for details.

[21] These values are based on 2006 estimates with inflationary adjustments, and still form the basis of the most recent EUROCONTROL (2013) values, such that a new analysis is not performed here.

[22] Personal communication, EUROCONTROL (2015).

2.4 Updated soft cost of delay

Returning to the specifics of the soft cost calculations, we conclude that there is no substantive evidence to change the assumptions made in previous soft cost of delay calculations. Arguably, increasing passenger information and awareness of Regulation 261 rights (*inter alia*) could drive up sensitivities to performance, and hence soft costs. On the other hand, claim rates remain low, and airline competition high. Ideally, as flagged in Section 4.2, a substantive and dedicated research effort would be used to further quantify these costs and the parameters driving them. Until such time, we monitor the literature for new empirical insights and continue to use the methodology previously deployed (*ibid*.), using a simple inflationary increase (see Annex 2) on the 2010 costs (same fit as Figure 8) with the updated seat, load factor and passenger allocations described in Annex 3, to yield the 2014 values in Table 3 (shown to the nearest 10 Euros, except the first two columns). (As detailed in the previous section, these are reported up to 300 minutes; although the *per-minute* cost values saturate at lower delay durations, the absolute costs continue to increase, of course.)

Table 3. Soft costs by delay duration and aircraft type (base cost scenario)

Delay (mins)	5	15	30	60	90	120	180	240	300
B733	1	16	90	480	950	1 340	2 030	2 710	3 380
B734	2	18	100	550	1 080	1 520	2 310	3 090	3 860
B735	1	14	80	430	840	1 190	1 800	2 400	3 000
B738	2	20	110	620	1 220	1 710	2 600	3 470	4 330
B752	2	24	140	750	1 480	2 090	3 170	4 220	5 280
B763	3	30	170	940	1 840	2 590	3 920	5 240	6 540
B744	4	49	280	1 510	2 970	4 170	6 330	8 450	10 560
A319	1	16	90	510	1 000	1 410	2 140	2 860	3 570
A320	2	19	110	590	1 150	1 620	2 460	3 290	4 110
A321	2	23	130	710	1 400	1 970	3 000	4 000	5 000
AT43	0	5	30	160	320	450	680	910	1 140
AT72	1	8	40	230	460	650	990	1 320	1 640
DH8D	1	8	50	260	510	710	1 080	1 440	1 800
E190	1	11	60	350	680	960	1 460	1 950	2 430
A332	3	34	190	1 050	2 060	2 900	4 400	5 870	7 330

Euros (2014).

3 Hard costs of passenger delay

3.1 Deriving hard costs from Regulation 261 principles

The objective of this section is to review the costing of the hard cost of delay, by delay duration, drawing on the earlier discussion of Regulation 261 – since this significantly drives the airline hard costs of passenger delay. We explore the question: is there evidence to substantially adjust previously adopted values?

Table 4. Delay duration by current Regulation 261 estimated costs

Haul	Delay duration				
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours	≥ 10hours
Short haul	🍽	🍽 €250	🍽 €250	🗎 🍽 €250	(accommodation)
Medium haul		🍽 €400	🍽 €400	🗎 🍽 €400	(accommodation)
Long haul		€300	🍽 €600	🗎 🍽 €600	(accommodation)

Key
🍽 Care (e.g. reasonable meals and refreshments)
🗎 Reimbursement of ticket
€ Compensation (refers to arrival delay)

Table 4 reproduces the data captured earlier in Figure 2, further indicating the potential requirement of providing accommodation for passengers who cannot be rebooked/conveyed to their destination or returned to their origin during the operational day. In Table 5 and Table 6 these are fully converted into departure delay costs, making a number of assumptions. The former table assumes that the passengers associated with these costs wait for an onward flight (be that the delayed flight or as a rebooking). The latter table assumes the associated passengers abandon their trip and are refunded. To produce an overall cost estimate (by combining the tables), estimates of the ratios of these passenger types need to be made.

Table 5. Departure delay duration base scenario estimated costs – 80% of pax wait for flight

Haul	Departure delay duration				
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours	≥ 10 hours
Short haul	€6$^{80\%}$	€6$^{80\%}$ €250$^{11\%}$	€6$^{80\%}$ €250$^{11\%}$	€265$^{10\%}$ €15$^{80\%}$ €250$^{11\%}$	€265$^{50\%}$ €21 €250$^{11\%}$ €65
Medium haul		€6$^{80\%}$ €400$^{11\%}$	€6$^{80\%}$ €400$^{11\%}$	€345$^{10\%}$ €15$^{80\%}$ €400$^{11\%}$	€345$^{50\%}$ €21 €400$^{11\%}$ €65
Long haul		€300$^{11\%}$	€6$^{80\%}$ €600$^{11\%}$	€1170$^{10\%}$ €15$^{80\%}$ €600$^{11\%}$	€1170$^{50\%}$ €21 €600$^{11\%}$ €65

Key: Care, rebooking, compensation, accommodation

Table 6. Departure delay duration base scenario estimated costs – 20% pax opt for refund

Haul	Departure delay duration				
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours	≥ 10 hours
Short haul	€6$^{80\%}$	€6$^{80\%}$ €250$^{11\%}$	€6$^{80\%}$ €250$^{11\%}$	€265$^{90\%}$ €15$^{80\%}$ €250$^{11\%}$	€265$^{90\%}$ €21 €250$^{11\%}$ €65
Medium haul		€6$^{80\%}$ €400$^{11\%}$	€6$^{80\%}$ €400$^{11\%}$	€345$^{90\%}$ €15$^{80\%}$ €400$^{11\%}$	€345$^{90\%}$ €21 €400$^{11\%}$ €65
Long haul		€300$^{11\%}$	€6$^{80\%}$ €600$^{11\%}$	€1170$^{90\%}$ €15$^{80\%}$ €600$^{11\%}$	€1170$^{90\%}$ €21 €600$^{11\%}$ €65

Key: Care, reimbursement, compensation, accommodation

Regulation 261 allows for a reimbursement to be made when the delay is at least five hours, according to Article 8(1)(a)[23]. It is assumed in our calculations that there is no delay recovery (or worsening) across the thresholds, e.g. a 4.5-hour departure delay does not result in an arrival delay of less than 4 hours or more than 5 hours. This is not always entirely authentic, especially during more complicated situations relating to passenger itineraries involving connecting flights and for passengers who return to their origin and accept a refund. However, it allows us, at this aggregate level, to assign reasonable delay costs by departure delay duration, which is the objective of the calculations.

In 2012, a study was finalised by Steer Davies Gleave (SDG) in support of a Commission Impact Assessment (European Commission, 2013c), which studied the prevalent market situation, quantitatively assessing the impacts of numerous policy measures. In this section, we use several of these cost estimates, based on assumptions and calculations made by SDG. We will attempt to map these values to a cost of delay: (i) by delay duration, and; (ii) producing low, base and high cost scenario estimates, to compare them with the previously reported values adopted by EUROCONTROL. The objective of the SDG calulation was, however, focused on calculating total, network costs. The mapping of SDG costs into the framework required here has necessitated further simplifications and assumptions in some respects, although some additional complexity is introduced in other respects.

The superscript values in the tables indicate the assumed uptake (or claim rate) of the various costs. These are explained on a category-by-category basis. Where absent, a 100% value is assumed, or the rate is already included in the estimate. The Euro cost shown is without the discount. These vary across the low, base and high cost scenarios. The base scenario is considered first.

Article 9 (a) of Regulation 261 stipulates the provision of meals and refreshments “in a reasonable relation to the waiting time”. As per the SDG assumptions, it is assumed that a refreshment is offered at the first stipulated threshold, and every five hours thereafter. Meals are offered after five hours of delay, and every subsequent five hours. To simplify the calculations somewhat, we have used an upper band of ≥10 hours of delay. In this band, a further refreshment and meal is assumed. These costs are based on 2012 airport averages calculated by SDG, inflated to 2014 prices according to the inflation values of Appendix 2, and rounded to the nearest whole Euro. It assumed that uptake rates are 80% for the base scenario, whereas 20% of passengers either do not claim (or are not offered) the care (some of whom may be in invited lounges, with such provision available). At the highest delay threshold, it is assumed that the entitlement is taken up by all passengers.

The SDG assumption is that hotel accommodation is triggered at 12 hours. As a small departure from this, our assumption is that this is triggered by 10 hours of departure delay on average. This is partly to simplify the tables. (It is expected that further in-house simulation modelling will allow us to quantify this statistically more accurately in future.) A single room is assumed to be required for business purpose trips and a room to be shared for leisure purpose trips. It is assumed to be not required at all for passengers visiting friends and relatives and at the destination of the original journey. Connecting passengers and those stranded at their destination are assumed to require accommodation, whereas 50% at their origin are assumed to return home. Based on these assumptions, and journey purpose by carrier type cross-tabulations, statistical (probabilistic) accommodation charges were derived, to which we have added the same, common average local transport cost, and inflated the values as previously described to 2014 values, yielding: regional (EUR 65), ‘traditional scheduled’ (EUR 72), LCC (EUR 53), charter (EUR 47). The unweighted average of these values and the mean of the highest and lowest values, both gives EUR 60. The room sharing and non-requirement rates applied judgmentally may be a little conservative, however, such that we adopt the ‘regional’ value as our base scenario cost at EUR 65. (To be used in later tabulations, we also round the upper estimate to EUR 75 for the high cost scenario and the lower estimate to EUR 50 for the low cost scenario.) Since these values are already probabilistic, no percentage take-up rate is associated with them. We assume these costs apply to all passenger waits above 10 hours (whether for an onward flight, or

[23] Reimbursement […] of the full cost of the ticket at the price at which it was bought, for the part or parts of the journey not made, and for the part or parts already made if the flight is no longer serving any purpose in relation to the passenger's original travel plan, together with, when relevant […] a return flight to the first point of departure, at the earliest opportunity.

associated with a refund and return to origin: although this latter situation would less often put the passenger in a situation experiencing over 10 hours of delay, the associated accommodation and care costs would be triggered in such eventualities).

In contrast, we do not include the EUR 3.38 average communication cost. This SDG value is mostly derived from an assumption of just over EUR 5 for 50% of passengers wishing to send an e-mail. Instead, we take the view that most passengers would either internalise this cost, use (free) wifi or not require to notify anybody regarding their disruption. Reducing roaming charges for phone calls within the EU are likely to contribute to this effect. A Danish survey (*ibid*.) cited only 2% of delayed passengers being offered such communications, although diverse assumptions are possible here. Regarding baggage delay, our assumptions concur with the airline interviews (*ibid*.) reporting that compensation for delayed baggage is rarely paid under the Montreal Convention.

The cost of ticket reimbursements have been calculated by SDG as assumed to be the cost of the ticket purchased by the passenger, computed using airline financial data and combining the yield per passenger kilometre and the average distance, to produce average ticket prices for each route length and carrier type. Adopting a different approach, and based on previous in-house modelling (SESAR, 2013) using 2.9 million passenger itineraries for September 2010, we have modelled the likely reimbursements due to flight delays, assuming that delays of over 5 hours on early legs would trigger full ticket refunds. These values are inflated to 2014 values (as per Annex 2), and shown in Table 7. These are averaged across all fare types (i.e. including higher class fares) and assess costs for full itineraries (whereas the SDG calculations do not explicitly include connections). The values shown are thus rather higher than the SDG values. In our base cost scenario, 80% of passengers are assumed to wait for the delayed flight or accept a rebooking at delays of 5 hours or more, whilst 20% opt for reimbursement, and these ratios are delpoyed to produce the aggregate costs required, i.e. to combine Table 5 and Table 6. (The SDG ratios of 90%:10% are used in our low cost scenario – see Annex 4.)

Table 7. Average per passenger total reimbursements due by length of haul

Length of haul	Average total reimbursement due (EUR)
Short haul	265
Medium haul	345
Long haul	1170

For rebooking, we assume that most passengers are rebooked on the same carrier or using a within-alliance reciprocal agreement, for delays of less than 10 hours, with only 10% of passengers thus generating a rebooking fee for the carrier (i.e. 10% of the reimbursement values of Table 7 are applied as a cost). For delay durations greater than this, across all lengths of haul, in the base cost scenario it is assumed that after such high durations (and with an overnight assumed), 50% of passengers are booked on the same carrier, such that only half the reimbursement value is applied as a cost to the airline. (These fares are transferred through IATA proration rules.) Where the fares are reimbursed to the passenger (Table 6), we assume that the fares of Table 7 are repaid, but that the airlines recover some of the taxes. Taxes, fees and carrier charges vary very greatly as a percentage of the ticket price. Whilst they are typically fixed on a given route, they will usually comprise a much lower percentage of bookings made close to the travel date, since the airline fare is usually much higher. It is difficult to establish clear patterns by length of haul, although they may comprise 75% or more of the total ticket price on long-haul routes. Across all haul types, notwithstanding the substantial variability, we have assumed 20% as an approximate average value, and that one half of this (10%) is not consumed, and thus recoverable (e.g. from the destination airport). The 20% may also hold for LCC flights (whereby the airport charges are lower, but so are the fares), although these may even be below 5% on some routes. For LCCs, reciprocal agreements are less common and it is likely that rebooking onto another carrier would cost more than a fare reimbursement. We have assumed that this would be off-set by LCCs more persistently pursuing rebookings on their own flights and, unlike the SDG report, we have neither reflected higher rebooking costs for LCCs nor assumed 50% of passengers are rerouted on other carriers. Finally, compensation is assumed to be claimed by 10% of passengers in the SDG report, with an increase of 0.5 percentage points per year, rendering a value of 11% for 2014, which has been adopted as the baseline value here.

3.2 Updated hard cost of delay

In this section, we consider the extent to which the costs computed in the previous section can be compared with those of previous reporting adopted by EUROCONTROL (Cook and Tanner, 2011), and conclude with proposals for the 2014 values.

Evaluating the cells in Table 5 and Table 6 (multiplying the costs by the percentage 'rates') and combining these tables (80:20%, as explained) yields the costs of Table 8. The minimum time thresholds for Regulation 261 entitlements are shown in the column headings. Plotted as a cost per minute, the relative saturation of these costs is observed in Figure 11, further reflecting the discussion of Section 2.3.

Table 8. Departure delay duration per passenger costs by length of haul (base cost scenario)

	2 hours (120 mins)	**3 hours** (180 mins)	**4 hours** (240 mins)	**5 hours** (300 mins)	**10 hours** (600 mins)
Short haul	5	32	32	108	267
Medium haul	0	49	49	146	330
Long haul	0	33	71	382	831

Euros (2014).

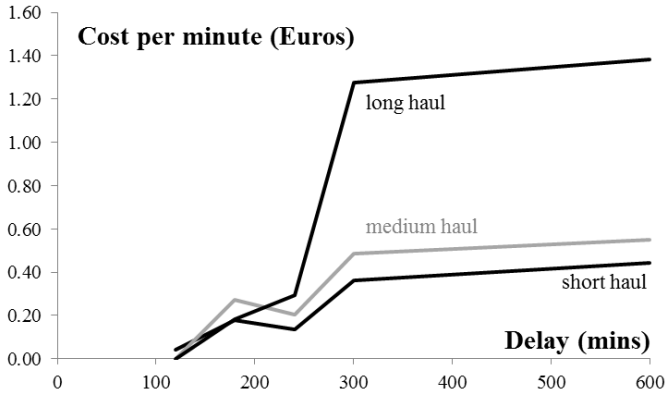

Figure 11. Hard cost per-minute saturation effects at higher delays

It will be noted that these costs are highly 'stepped', with very low or zero costs assigned even at two hours of delay. Airline-reported experience suggests that this is not the case in practice and that even small delays are (statistically) likely to produce small costs. For example, even a 15 or 30 minute delay could cause a passenger to miss a connection. We therefore 'smoothed'[24] the delays shown in Table 8 across the full range of delay values used in Table 3. Next, using the seat, load factor and passenger allocations described in Annex 3, and 2010 distributions of aircraft movements by length of haul[25], we produced raw delay cost values for each aircraft for each delay duration[26]. Table 9 compares these new assessment costs for 5, 15 and 300 minutes of delay, with those produced for 2010 (not inflated to 2014 values) in the previous reporting adopted by EUROCONTROL (*ibid*.) (Values for 2010 for the DH8D, E190 and A332 have been calculated retrospectively, using the previous methodology, for comparative purposes, since these aircraft were not included in the original set of aircraft evaluated.)

[24] Quadratic, least-squares, through-origin fits are used. Correlation coefficients (r^2) range from 0.93 to 0.97 across the 15 aircraft, with an average value of 0.96. Such fits, as opposed to linear fits, have been historically useful.

[25] Data not shown to avoid clutter.

[26] Data not shown to avoid clutter.

Table 9. Matching assessment hard costs with previous reporting (base cost scenario)

Delay (mins)	5	15	300
B733	156%	71%	20%
B734	170%	77%	20%
B735	152%	69%	19%
B738	176%	79%	21%
B752	220%	101%	32%
B763	207%	100%	44%
B744	205%	102%	52%
A319	154%	70%	20%
A320	166%	75%	20%
A321	177%	80%	21%
AT43	130%	59%	18%
AT72	131%	60%	18%
DH8D	131%	(60%)	(18%)
E190	138%	(63%)	(19%)
A332	206%	(100%)	(46%)
Average match	**168%**	**78%**	**26%**

We note that the new assessment values for 15 minutes of delay are often very similar to the previous values, although at 5 minutes they are considerably higher. It is also to be noted that this is in the region of peak delay distribution, i.e. where most delays are encountered, as shown in Figure 12 (positive delay values only included, ACARS delays include all delay types reported by airlines, albeit with incomplete European coverage[27]). However, since Table 8 has very low or zero cost values even at 120 minutes, aligning the values across the whole range with any type of fit is challenging.

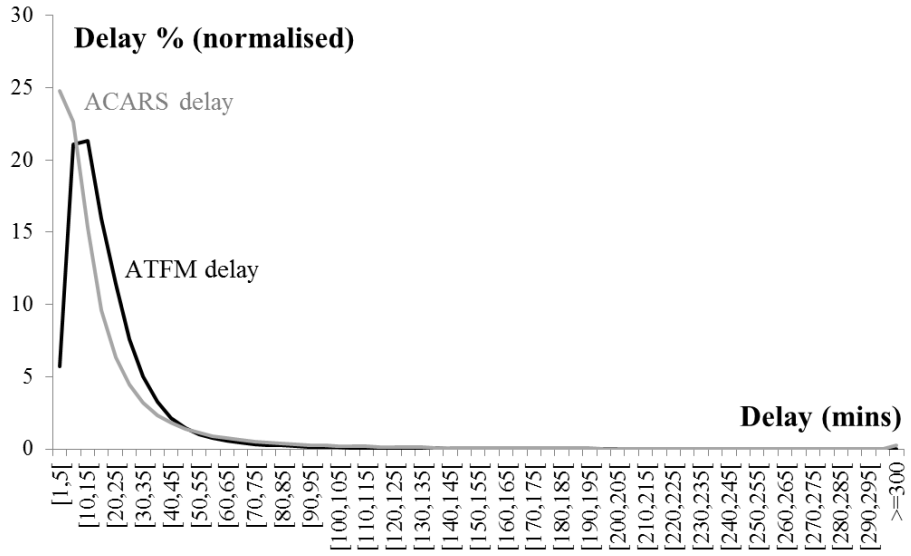

Figure 12. Delay duration by delay frequency (2014)

[27] Data provided through personal communication, EUROCONTROL (2015).

The main difference between the Commission Impact Assessment approach and the previous method, is the use of more explicit Regulation 261 data in the former. Despite an increase in almost all passenger numbers per flight[28], the new assessment costs at higher delay durations are considerably lower than the previous estimates. Since the cost values at 300 minutes are effectively used as cost caps in the EUROCONTROL-adopted model (see Section 2.3), it is particularly important that these values are robust. Before moving forward to the final values proposed for 2014, we thus consider further the discrepancies in Table 9 at higher values of delay.

Table 10 compares key features of the two approaches. Primarily, we note again that the Commission Impact Assessment was not focused on trying to allocate delay values by aircraft type and delay duration, which was the focus of the EUROCONTROL-adopted report. Attempts to map from the former to the latter have involved a number of assumptions, as detailed above. Nevertheless, the agreement at lower delay is broadly good. What factors might contribute to the discrepancy at higher delay? Whilst the previous (EUROCONTROL-adopted) method attempted to furnish passenger delay costs *beyond* the scope of Regulation 261 (e.g. airline hard passenger costs incurred beyond the duties imposed by the Regulation alone), the Commission Impact Assessment presents a much fuller assessment of the Regulation's cost impacts *per se*, and these are core drivers of the airline impact. (Note that the lack of alignment at higher delay values is not attributable to reactionary delay differences, as the values shown relate to primary delay only.)

Table 10. Comparison of methods

Factor	**EUROCONTROL** (Cook and Tanner, 2011)	**Commission Impact Assessment** (European Commission, 2013c)
Year of publication	2011	2013
Year of (initial) calculations	2010 (2003)	2012
Airline inputs	Two baseline studies; multiple feedback	Multiple (indirectly on costs)
Methodological focus	By aircraft type and delay duration	Network impacts; type of haul
Regulation 261 focus	Wider than Regulation 261	Main objective of study
Regulation 261 cost sources	Reported by airlines	Independently calculated
Regulation 261 cost details	Medium	High

Due to the fact that the Commission Impact Assessment had different objectives and scope, a detailed sensitivity analysis of how these results might be rendered to better alignment with the previously estimated (EUROCONTROL) values is not warranted. Nevertheless, some useful observations may be made regarding this alignment.

The low percentage values in the right-hand column of Table 9 are partly driven by under-estimation of the quadratic fit smoothing applied. Using the *raw* values (for 300 minutes of delay), three of the percentage matches (*viz*. the widebody values) rise to above 70%, i.e. the agreement with the previous values improves (although the average match only increases from 26% to around 40%).

With the costs at 300 minutes effectively used as cost caps, it is worth examining the values for 600 minutes of delay derived from the Commission Impact Assessment (the upper limit explicitly considered therein). Whilst the cost per minute does not rapidly increase between 300 and 600 minutes (see Figure 11), the values at 600 minutes give an average match of around 90% with the highest, previously estimated (EUROCONTROL) values (i.e. capped at 300 minutes), with several values (for the widebodies and B752) now exceeding these previous values.

Finally, for given care and accommodation costs, and fixed fare reimbursement values (Table 7), the costs derived from the Commission Impact Assessment are particularly sensitive to the assumed:

[28] See Annex 3.

- rates of compensation paid;
- distribution between rebooked and reimbursed passengers;
- proportions of passengers causing airline rebooking fees to be incurred.

Adjusting the first two of these[29], assuming a significantly higher compensation claim rate of 50% of passengers, and changing the distribution between rebooked and reimbursed passengers to 50:50, generates a new average match of around 95% at 300 minutes, although the widebodies and B752 are now between 120% (B752) and 200% (B744) of the previously estimated (EUROCONTROL) values. (These variations investigated at higher delay do not change the matching at lower delay, since, for example, compensation and reimbursements/rebookings do not take effect until delays of at least 3 hours.)

In conclusion, we have compared the hard cost of passenger delay to the airline in previous reporting adopted by EUROCONTROL (Cook and Tanner, 2011) and newer values derived from a Commission Impact Assessment (European Commission, 2013c), the latter using more explicit Regulation 261 data. The extent to which the two methods can be compared is limited. Nevertheless, fairly broad agreement has been demonstrated through a crude sensitivity analysis. Any method, such as the Commission Impact Assessment, focusing explicitly on passenger rights that take effect from 120 minutes, will inevitably yield (very) low cost of delay estimates for smaller delays, although it is known that such delays still incur costs for airlines (e.g. due to missed connections). When comparing the two methods at higher delay values, estimates derived from the Commission Impact Assessment suggest that previous reporting for EUROCONTROL may have produced higher estimates than the true costs to airlines. On the other hand, the former has focused exclusively on regulatory impacts, whereas multiple airline feedback on the latter over a number of years[30] suggests that these estimates are substantially robust. Therefore, the same approach is taken as with the soft cost adjustments reported in Section 2.4, i.e. using a simple inflationary increase (see Annex 2) on the 2010 costs, combined with the new passenger allocations of Annex 3, to yield the 2014 values. The results are shown in Table 11 (shown to the nearest 10 Euros, except the first two columns).

Table 11. Hard costs by delay duration and aircraft type (base cost scenario)

Delay (mins)	5	15	30	60	90	120	180	240	300
B733	34	239	820	2 840	5 850	9 770	20 150	33 660	50 130
B734	38	272	940	3 230	6 670	11 140	22 970	38 380	57 160
B735	30	212	730	2 520	5 190	8 680	17 890	29 890	44 510
B738	43	306	1 050	3 630	7 490	12 510	25 800	43 100	64 190
B752	53	373	1 280	4 430	9 130	15 250	31 440	52 540	78 240
B763	65	462	1 590	5 490	11 310	18 900	38 980	65 130	96 980
B744	105	746	2 570	8 850	18 250	30 500	62 890	105 080	156 490
A319	36	252	870	3 000	6 180	10 320	21 280	35 550	52 940
A320	41	290	1 000	3 450	7 100	11 870	24 480	40 900	60 910
A321	50	353	1 220	4 190	8 630	14 430	29 750	49 710	74 030
AT43	11	80	280	950	1 970	3 290	6 780	11 330	16 870
AT72	16	116	400	1 380	2 840	4 750	9 790	16 360	24 360
DH8D	18	127	440	1 510	3 120	5 210	10 730	17 930	26 710
E190	24	172	590	2 040	4 210	7 030	14 500	24 230	36 080
A332	73	518	1 780	6 150	12 680	21 190	43 680	72 990	108 700

Euros (2014).

[29] These assumptions are also varied in the low and high cost scenarios presented in Annex 4.
[30] Personal communications to the University of Westminster.

4 Total cost outcomes and further research

4.1 Total cost of passenger delay to the airline

Table 12 presents the total costs of passenger delay to the airlines, by delay duration and aircraft type, for the base scenario. It is the sum of Table 3 (soft costs) and Table 11 (hard costs), shown to the nearest 10 Euros.

Table 12. Total cost of passenger delay by delay duration and aircraft type (base cost scenario)

Delay (mins)	5	15	30	60	90	120	180	240	300
B733	40	250	910	3 320	6 800	11 110	22 180	36 370	53 520
B734	40	290	1 040	3 780	7 750	12 670	25 280	41 470	61 020
B735	30	230	810	2 950	6 040	9 860	19 690	32 290	47 510
B738	40	330	1 170	4 250	8 700	14 220	28 390	46 570	68 520
B752	50	400	1 420	5 180	10 610	17 340	34 610	56 770	83 520
B763	70	490	1 760	6 420	13 150	21 490	42 900	70 360	103 530
B744	110	790	2 850	10 360	21 220	34 670	69 220	113 530	167 050
A319	40	270	960	3 510	7 180	11 730	23 420	38 410	56 520
A320	40	310	1 110	4 030	8 260	13 500	26 940	44 190	65 020
A321	50	380	1 350	4 900	10 040	16 400	32 750	53 710	79 020
AT43	10	90	310	1 120	2 290	3 740	7 460	12 240	18 010
AT72	20	120	440	1 610	3 300	5 400	10 780	17 680	26 010
DH8D	20	140	490	1 770	3 620	5 920	11 810	19 380	28 510
E190	30	180	660	2 390	4 890	7 990	15 960	26 170	38 510
A332	80	550	1 980	7 200	14 740	24 080	48 080	78 860	116 030

Euros (2014).

Compared with the previously reported values, i.e. excluding the lower three rows for the new aircraft types, all values have increased. The average increase is 20%. Most of this increase has been driven by the increasing passenger densities on European flights, as reported in Annex 3.

The corresponding low and high cost scenarios are reported in Annex 5. They are also produced by the same simple inflationary increases of the previously adopted EUROCONTROL values using the Annex 2 inflation data and the *scenario-specific*, updated passenger allocation data of Annex 3.

4.2 Further research

Further research is required to provide a more robust estimate of passenger costs to the airlines as a function of delay duration and aircraft type. We recommend that a systematic review be conducted in future, across a range of airlines, which should include a full behavioural assessment through passenger market research. Soft cost estimates should include conjoint analyses (stated preference) techniques. Until such systematic research is implemented, airline feedback on the values presented above is particularly useful.

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Annex 1. CJEU, Joined cases C-402/07 and C-432/07.

[Extract from Court of Justice of the European Union ruling; non-source emboldening of text.]

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European Court Reports 2009 I-10923•ECLI identifier: ECLI:EU:C:2009:716

Summary of the Judgment

1. Transport – Air transport – Regulation No 261/2004 – Common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights
(European Parliament and Council Regulation No 261/2004, Arts 2(l), 5 and 6)
2. Transport – Air transport – Regulation No 261/2004 – Common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights
(European Parliament and Council Regulation No 261/2004, Arts 5, 6 and 7)
3. Transport – Air transport – Regulation No 261/2004 – Compensation and assistance to passengers in the event of cancellation of flights
(European Parliament and Council Regulation No 261/2004, Art. 5(3))

1. Articles 2(l), 5 and 6 of Regulation No 261/2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights must be interpreted as meaning that a flight which is delayed, irrespective of the duration of the delay, even if it is long, cannot be regarded as cancelled where the flight is operated in accordance with the air carrier's original planning.

A flight is delayed for the purposes of Article 6 of that regulation if it is operated in accordance with the original planning and its actual departure time is later than the scheduled departure time, whilst, according to Article 2(l) of that regulation, flight cancellation is the result of non-operation of a flight which was previously planned.

(see paras 32-33, 39, operative part 1)

2. Articles 5, 6 and 7 of Regulation No 261/2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights must be interpreted as meaning that **passengers whose flights are delayed may be treated**, for the purposes of the application of the right to compensation, **as passengers whose flights are cancelled** and they may thus rely on the right to compensation laid down in Article 7 of the regulation when they suffer, on account of a flight delay, a loss of time equal to or in excess of three hours, that is, where they reach their final destination three hours or more after the arrival time originally scheduled by the air carrier. Such a delay does not, however, entitle passengers to compensation if the air carrier can prove that the long delay was caused by extraordinary circumstances which could not have been avoided even if all reasonable measures had been taken, namely circumstances beyond the actual control of the air carrier.

(see para. 69, operative part 2)

3. Article 5(3) of Regulation No 261/2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights must be interpreted as meaning that a **technical problem** in an aircraft which leads to the cancellation or delay of a flight **is not covered by the concept of 'extraordinary circumstances'** within the meaning of that provision, unless that problem stems from events which, by their nature or origin, are not inherent in the normal exercise of the activity of the air carrier concerned and are beyond its actual control.

(see para. 72, operative part 3)

[…]

Judgment of the court (Fourth Chamber)

[…]

63. It is important to point out that the compensation payable to a passenger under Article 7(1) of Regulation No 261/2004 may be reduced by 50% if the conditions laid down in Article 7(2) of the regulation are met. Even though the latter provision refers only to the case of re-routing of passengers, the Court finds that the reduction in the compensation provided for is dependent solely on the delay to which passengers are subject, so that nothing precludes the application *mutatis mutandis* of that provision to compensation paid to passengers whose flights are delayed. It follows that the **compensation payable** to a passenger whose flight is delayed, who reaches his final destination three hours or more after the arrival time originally scheduled, **may be reduced by 50%**, in accordance with Article 7(2)(c) of Regulation No 261/2004, **where the delay is** – in the case of a flight not falling under points (a) or (b) of Article 7(2) – **less than four hours**.

~*~

Article 7 of Regulation (EC) No 261/2004

Right to compensation

1. Where reference is made to this Article, passengers shall receive compensation amounting to:

(a) EUR 250 for all flights of 1500 kilometres or less;

(b) EUR 400 for all intra-Community flights of more than 1500 kilometres, and for all other flights between 1500 and 3500 kilometres;

(c) EUR 600 for all flights not falling under (a) or (b).

In determining the distance, the basis shall be the last destination at which the denial of boarding or cancellation will delay the passenger's arrival after the scheduled time.

2. When passengers are offered re-routing to their final destination on an alternative flight pursuant to Article 8, the arrival time of which does not exceed the scheduled arrival time of the flight originally booked

(a) by two hours, in respect of all flights of 1500 kilometres or less; or

(b) by three hours, in respect of all intra-Community flights of more than 1500 kilometres and for all other flights between 1500 and 3500 kilometres; or

(c) by four hours, in respect of all flights not falling under (a) or (b),

the operating air carrier may reduce the compensation provided for in paragraph 1 by 50%.

Annex 2. Average European inflation rates.

The table below shows the annual average rate of inflationary change (%) for the European Union (changing composition), for 2010 to 2014. The value cited is the Harmonised Index of Consumer Prices (HICP), designed for international comparisons of consumer price inflation. It is used by the European Central Bank for monitoring inflation in the Economic and Monetary Union and is sourced from eurostat:

http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tec00118&plugin=1 (accessed 01MAY15)

Average European inflation rates

Year	Inflation rate (%)	2014 compound rate on 2012 (%)	2014 compound rate on 2010 (%)
2010	2.1		
2011	3.1		
2012	2.6		
2013	1.5		
2014	0.6	3.1	8.8

Source: eurostat (2015).

For the compound rates (used in the main text), half the total annual values are used for the base and target years, as a crude method of producing mid-year estimates.

Annex 3. Seat, load factor and passenger allocations.

Aircraft seats for the 15 supported aircraft have been reviewed using Innovata global seats file (2010 data). The typical seating ranges (excluding outliers) are shown in the table below.

Typical seat range and allocated aircraft seats by scenario

ICAO aircraft designation	Typical seat range[1]	Allocated seats		
		Low[2]	Base[3]	High[4]
B733	116-148	148	134	134
B734	134-168	168	152	152
B735	96-132	132	119	119
B738	144-189	189	171	171
B752	160-232	232	209	209
B763	192-270	270	243	230
B744	275-436	436	393	371
A319	118-156	156	141	141
A320	136-180	180	162	162
A321	169-220	220	198	198
AT43	42-50	50	45	45
AT72	62-72	72	65	65
DH8D	70-78	78	71	71
E190	93-106	106	96	96
A332	211-303	303	273	258

[1] Typical seat range for the global fleet 2010 (Innovata); aircraft with unusual seat configurations excluded.

[2] Low cost scenario seats allocated using 100% of the maximum typical number of seats.

[3] Base cost scenario seats allocated using 90% of the maximum typical number of seats.

[4] High cost scenario seats allocated using 90/85% (narrow/wide-bodies) of the maximum typical number of seats

Small differences are observed between the previous reporting for EUROCONTROL (Cook and Tanner, 2011) and the updated *typical* seat ranges. These changes can be explained by a new more rigorous selection process, i.e. excluding a greater number of unusual configurations (e.g. disregarding B734 ‘quick change’ and B744 ‘combi’ airframes fitted with only 72 and 275 seats respectively), and intervening airline fleet composition changes. The notable changes comprise an increase in the minimum number of A319, A320 and A321 seats (an additional 36, 26 and 20 seats respectively) and a decrease in the maximum number of B763 and B744 seats (reduced by 58 and 38 seats).

Low, base and high cost scenario seats have been allocated using the maximum typical number of seats per aircraft type; the low cost scenario having the maximum number of seats to reflect a single-class cabin configuration. From this, 90% of the maximum number of seats has been allocated to the base and high cost scenarios to allow for business- and economy-class seating. The widebody high cost seating scenario has been allocated using 85% of the maximum number of seats (i.e. three-class layout). (In contrast, the previous (*ibid*.) seat allocation was based on 100%, 85% and 85%/75% for low, base and high cost scenarios.) It should also be noted that in some cases, a change in the number of allocated seats has an effect on the modelled crew costs carried out in parallel (requiring ±1 flight attendant if the cabin crew to seat threshold is crossed).

Low, base and high cost scenario passenger loadings have been allocated using scenario-specific load factors. The starting point is an 80% average load factor covering 2014. This average is based on industry load factors published by AEA (80.4% derived from 'total scheduled' monthly average load factors) and IATA (79.7% 'total market') (AEA, 2015; IATA, 2015). Passengers have been allocated to the low cost scenario using a load factor of 65% (an increase from the 60% used with the previous (*ibid*.) delay cost model) and to the high cost scenario using 95% (up from 90% previously). Narrowbody base cost scenario passengers have been allocated using the industry average 80% with the corresponding widebody passengers from an 85% load factor (both up from 75% and 80% previously). The table below shows the final allocation for each aircraft type.

Allocated passenger loadings by scenario

ICAO aircraft designation	Allocated passengers		
	Low[1]	Base[2]	High[3]
B733	96	107	127
B734	109	122	144
B735	86	95	113
B738	123	137	162
B752	151	167	199
B763	176	207	219
B744	283	334	352
A319	101	113	134
A320	117	130	154
A321	143	158	188
AT43	33	36	43
AT72	47	52	62
DH8D	51	57	67
E190	69	77	91
A332	197	232	245

[1] Low cost scenario passengers allocated using 65% load factor.

[2] Base cost scenario passengers allocated using 80% (narrowbodies) or 85% (widebodies) load factor.

[3] High cost scenario passengers allocated using 95% load factor.

Compared with the previously reported (*ibid*.) values, almost all passenger allocations have increased. The net effect is that such passenger increases have added to the inflationary increases independently applied to the passenger hard and soft costs, when these are reported per aircraft type. Notable exceptions are decreases of 21 and 16 passengers for the low and base cost scenarios of the B763, respectively. This has resulted in a net decrease of 3% of the low cost scenario hard and soft passenger costs for this aircraft, and almost no change for the base scenario (i.e. the relatively small base scenario decrease in passengers on-board approximately off-sets the small inflationary increase per passenger).

Annex 4. Low and high hard cost scenario tabulations.

Low cost scenario assumptions

Departure delay duration low scenario estimated costs – 90% of passengers wait for flight

Haul	Departure delay duration				
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours	≥ 10 hours
Short haul	€6$^{50\%}$	€6$^{50\%}$ €250$^{5\%}$	€6$^{50\%}$ €250$^{5\%}$	€265$^{0\%}$ €15$^{50\%}$ €250$^{5\%}$	€265$^{10\%}$ €21 €250$^{5\%}$ €50
Medium haul		€6$^{50\%}$ €400$^{5\%}$	€6$^{50\%}$ €400$^{5\%}$	€345$^{0\%}$ €15$^{50\%}$ €400$^{5\%}$	€345$^{10\%}$ €21 €400$^{5\%}$ €50
Long haul		€300$^{5\%}$	€6$^{50\%}$ €600$^{5\%}$	€1170$^{0\%}$ €15$^{50\%}$ €600$^{5\%}$	€1170$^{10\%}$ €21 €600$^{5\%}$ €50

Key: Care, rebooking, compensation, accommodation

Departure delay duration low scenario estimated costs – 10% passengers opt for refund

Haul	Departure delay duration				
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours	≥ 10 hours
Short haul	€6$^{50\%}$	€6$^{50\%}$ €250$^{5\%}$	€6$^{50\%}$ €250$^{5\%}$	€265$^{90\%}$ €15$^{50\%}$ €250$^{5\%}$	€265$^{90\%}$ €21 €250$^{5\%}$ €50
Medium haul		€6$^{50\%}$ €400$^{5\%}$	€6$^{50\%}$ €400$^{5\%}$	€345$^{90\%}$ €15$^{50\%}$ €400$^{5\%}$	€345$^{90\%}$ €21 €400$^{5\%}$ €50
Long haul		€300$^{5\%}$	€6$^{50\%}$ €600$^{5\%}$	€1170$^{90\%}$ €15$^{50\%}$ €600$^{5\%}$	€1170$^{90\%}$ €21 €600$^{5\%}$ €50

Key: Care, reimbursement, compensation, accommodation

Key assumption changes relative to base cost scenario

Setting	Low cost assumption	Base cost assumption
Rates of compensation paid	5%	11%
Passengers waiting for flight (instead of refund)	90%	80%
Passengers rebooked on other carrier at 5-10 hours	0%	10%
Passengers rebooked on other carrier beyond 10 hours	10%	50%
Care provision at 2-10 hours	50%	80%
Statistical accommodation cost (see main text)	€50	€65
Passengers on-board scenario (see Annex 3)	Low	Base

Departure delay duration per passenger costs by length of haul (low cost scenario)

	2 hours	3 hours	4 hours	5 hours	10 hours
Short haul	3	16	16	44	131
Medium haul	0	23	23	59	153
Long haul	0	15	33	143	312

Euros (2014).

Average cost relative to base scenario = **42%**.

High cost scenario assumptions

Departure delay duration high scenario estimated costs – 75% of passengers wait for flight

Haul	Departure delay duration				
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours	≥ 10 hours
Short haul	€6[85%]	€6[85%] €250[15%]	€6[85%] €250[15%]	€265[15%] €15[85%] €250[15%]	€265[60%] €21 €250[15%] €75
Medium haul		€6[85%] €400[15%]	€6[85%] €400[15%]	€345[15%] €15[85%] €400[15%]	€345[60%] €21 €400[15%] €75
Long haul		€300[15%]	€6[85%] €600[15%]	€1170[15%] €15[85%] €600[15%]	€1170[60%] €21 €600[15%] €75

Key: Care, rebooking, compensation, accommodation

Departure delay duration high scenario estimated costs – 25% passengers opt for refund

Haul	Departure delay duration				
	≥ 2 hours	≥ 3 hours	≥ 4 hours	≥ 5 hours	≥ 10 hours
Short haul	€6[85%]	€6[85%] €250[15%]	€6[85%] €250[15%]	€265[90%] €15[85%] €250[15%]	€265[90%] €21 €250[15%] €75
Medium haul		€6[85%] €400[15%]	€6[85%] €400[15%]	€345[90%] €15[85%] €400[15%]	€345[90%] €21 €400[15%] €75
Long haul		€300[15%]	€6[85%] €600[15%]	€1170[90%] €15[85%] €600[15%]	€1170[90%] €21 €600[15%] €75

Key: Care, reimbursement, compensation, accommodation

Key assumption changes relative to base cost scenario

Setting	High cost assumption	Base cost assumption
Rates of compensation paid	15%	11%
Passengers waiting for flight (instead of refund)	75%	80%
Passengers rebooked on other carrier at 5-10 hours	15%	10%
Passengers rebooked on other carrier beyond 10 hours	60%	50%
Care provision at 2-10 hours	85%	80%
Statistical accommodation cost (see main text)	€75	€65
Passengers on-board scenario (see Annex 3)	High	Base

Departure delay duration per passenger costs by length of haul (high cost scenario)

	2 hours	3 hours	4 hours	5 hours	10 hours
Short haul	5	43	43	140	312
Medium haul	0	65	65	189	389
Long haul	0	45	95	498	976

Euros (2014).

Average cost relative to base scenario = **123%**.

Annex 5. Low and high total cost scenario tabulations.

Total passenger costs by delay duration and aircraft type (low cost scenario)

Delay (mins)	5	15	30	60	90	120	180	240	300
B733	20	130	470	1 680	3 440	5 690	11 550	19 130	28 330
B734	20	150	540	1 900	3 910	6 460	13 120	21 720	32 170
B735	20	120	420	1 500	3 080	5 100	10 350	17 140	25 380
B738	20	170	610	2 150	4 410	7 290	14 800	24 510	36 300
B752	30	210	740	2 640	5 420	8 950	18 170	30 090	44 560
B763	30	250	870	3 070	6 310	10 430	21 180	35 080	51 940
B744	60	400	1 400	4 940	10 150	16 780	34 050	56 400	83 510
A319	20	140	500	1 760	3 620	5 990	12 150	20 130	29 810
A320	20	160	580	2 040	4 200	6 940	14 080	23 320	34 530
A321	30	200	710	2 500	5 130	8 480	17 210	28 500	42 200
AT43	10	50	160	580	1 180	1 960	3 970	6 580	9 740
AT72	10	70	230	820	1 690	2 790	5 660	9 370	13 870
DH8D	10	70	250	890	1 830	3 020	6 140	10 160	15 050
E190	10	100	340	1 200	2 470	4 090	8 300	13 750	20 360
A332	40	280	970	3 440	7 070	11 680	23 710	39 260	58 140

Euros (2014).

Total passenger costs by delay duration and aircraft type (high cost scenario)

Delay (mins)	5	15	30	60	90	120	180	240	300
B733	50	370	1 310	4 750	9 740	15 940	31 900	52 410	77 190
B734	60	420	1 490	5 390	11 040	18 070	36 170	59 420	87 520
B735	50	330	1 170	4 230	8 660	14 180	28 390	46 630	68 680
B738	60	470	1 670	6 060	12 420	20 330	40 690	66 850	98 460
B752	80	580	2 050	7 450	15 260	24 970	49 990	82 120	120 950
B763	90	630	2 260	8 190	16 790	27 480	55 010	90 370	133 100
B744	140	1 020	3 630	13 170	26 990	44 170	88 420	145 250	213 940
A319	50	390	1 380	5 010	10 270	16 820	33 660	55 290	81 440
A320	60	450	1 590	5 760	11 810	19 330	38 680	63 550	93 600
A321	70	540	1 940	7 030	14 410	23 590	47 230	77 580	114 260
AT43	20	120	440	1 610	3 300	5 400	10 800	17 740	26 130
AT72	20	180	640	2 320	4 750	7 780	15 570	25 580	37 680
DH8D	30	190	690	2 510	5 140	8 410	16 830	27 650	40 720
E190	40	260	940	3 400	6 980	11 420	22 860	37 550	55 310
A332	100	710	2 530	9 170	18 780	30 750	61 540	101 100	148 900

Euros (2014).