InterFAB

Cooperation for Single European Sky

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# CALCULATING THE TOTAL COST PER MINUTE OF DELAY IN EUROPE AND ADJUSTED DELAY INDICATOR

## POSSIBLE APPROACHES

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# QUESTIONS TO BE ANSWERED TODAY

::. CAN POST OPERATIONS DATA BE USED TO IMPROVE THE CALCULATION OF THE DELAY COST?

::. HOW MUCH OF THE INITIAL ATFM DELAY GETS ADJUSTED AFTER THE AIRPLANE REACHES ITS STAND?

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# POINTS TO TOUCH TODAY

## UNDERSTANDING THE DELAY:

::. WHAT IS THE DELAY?

::. TYPES OF DELAY

## INSIGHT OF THE DELAY COST

::. HOW IT IS USED WITHIN THE EU PERFORMANCE FRAMEWORK

::. HOW IT IS CURRENTLY CALCULATED

::. HOW IT COULD BE CALCULATED USING POST-OPS DATA

## DELAY ADJUSTMENT

::. ADUSTING THE DELAY FIGURES

::. PROPOSING A NEW INDICATOR

# UNDERSTANDING THE DELAY

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## A departing flight is delayed when:

- ☐ the aircraft **closes the doors** later than its scheduled time
- ☐ **leaves its stand** later than its scheduled time
- ☐ **takes off** later than its scheduled time
- ☐ none of the above

## An arrival flight is delayed when:

- ☐ it **touches down** later than its scheduled time
- ☐ **comes to a full stop** later than its scheduled time
- ☐ **opens** one of the doors and air bridge is connected later than its scheduled time
- ☐ none of the above

# DELAY DATA SOURCES

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At the beginning only **CODA** reporting on delay (from airport/airline sources)

Then a single source for ATFM delay data became available

Difficulties associated with the reporting process.

Delay data sources not directly mapped to ATFM data

Data not available for each flight

EUROCONTROL

Central Office Delay Analysis <=> NMIR

**As per Regulation (EU) 2019/317**

Airline Operators

- **Air transport operators** which operate more than **35,000** flights per year in European airspace Shall provide the data referred to in the Eurocontrol Specification document titled 'Air Transport Operator Data Flow — Data Specification' version 1.0, 2018"
- Data to be provided on a monthly basis"

Airport Operators

**As per Regulation (EU) 2019/317**

- **Airport operators** managing airports with **80,000** IFR Air Transport movements or more per year shall provide the data referred to in the Eurocontrol Specification document titled 'Airport Operator Data Flow — Data Specification' version 1.0, 2018
- Only 86 airports until May 2019
- Data to be provided on a monthly basis"

# TYPES OF DELAY

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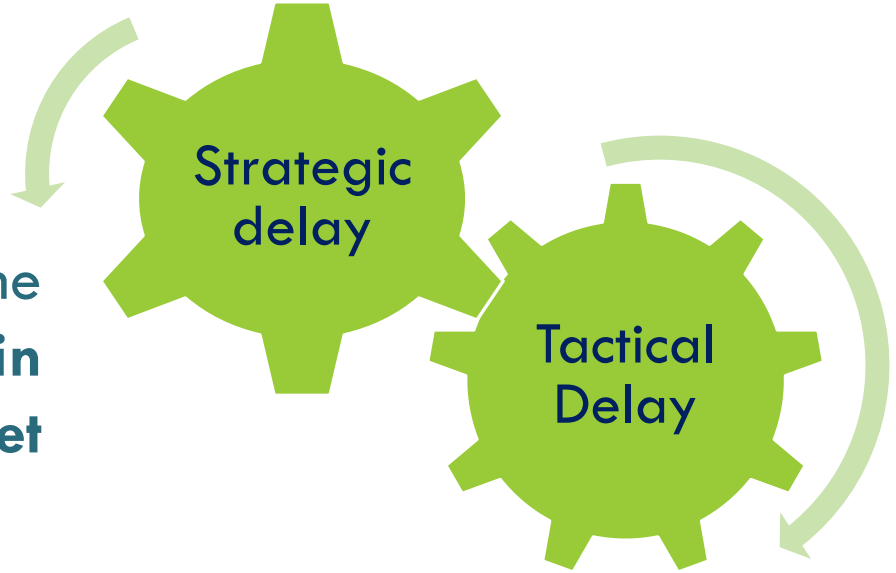


**Strategic delay** depends upon the schedule buffers which are applied **in advance** to operations in order **to offset** the tactical costs.

Example: increase of turnaround time from 45 to 60 minutes

**Tactical delay.** It depends upon **unexpected** operational reasons and applies to **delayed flights** only.

Example: late refueling or strong headwind enroute

# TACTICAL DELAY

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Tactical delay can be split between primary and reactionary delays

**a. Primary delay**. A delay other than reactionary

**b. Secondary delay (Reactionary or Knock-on)**. the result of an aircraft's late arrival from a previous flight which in turn affects the punctuality of its next flight. Two types of reactionary delays:

- ✓ **rotational delay** as a result of the same aircraft being delayed on its next flight
- ✓ **non-rotational delays** when another aircraft is delayed as a result of another aircraft typically through passengers, crew and load connection.

# UNDERSTANDING THE DELAY

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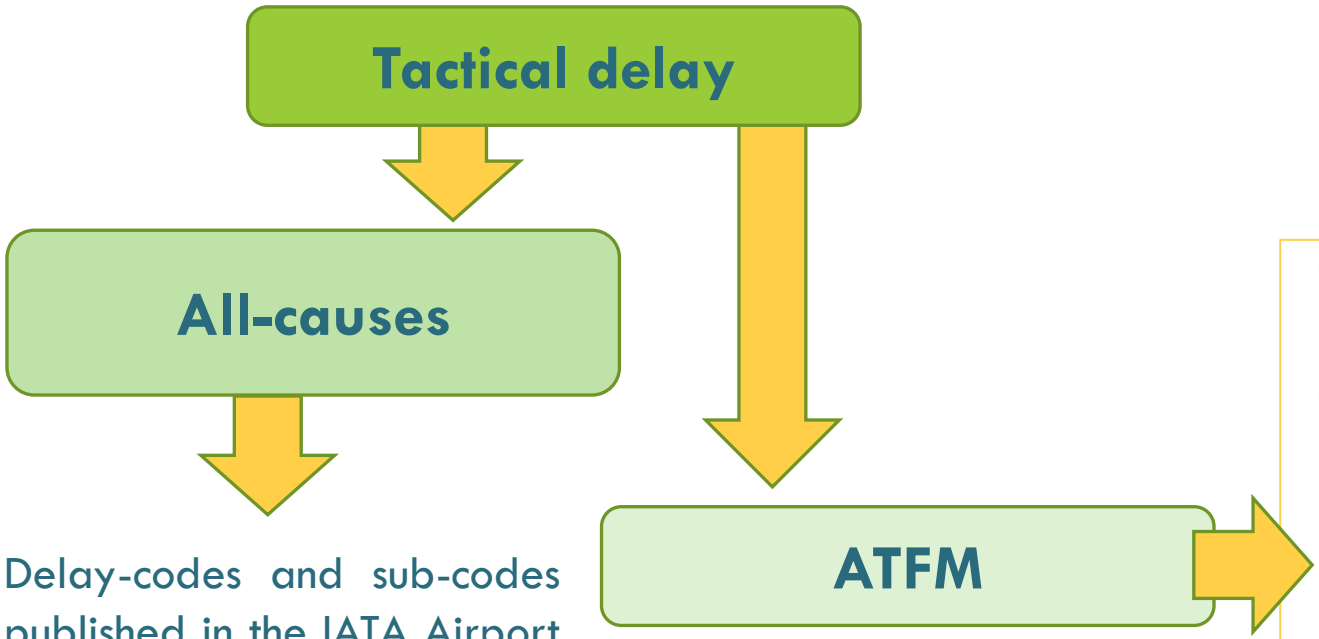


Delay-codes and sub-codes published in the IATA Airport Handling Manual 730 and 731

**Example**: passengers, baggage, airport and ramp handling issues

The ATFM delay is the difference between the Calculated Take Off Time (CTOT) and the Estimated Take Off Time (ETOT)

**ATFM delay = CTOT − (EOBT + Taxi time)**

- It is applied to a flight by preventing it to take off outside the assigned slot
- It is cheaper to allocate delay at ground than to the airborne phase


ROMATODAY

# WHERE THE DELAY COST IS USED

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## EUROPE (EUROCONTROL/PRU)

- First attempt to monetise the cost of one minute of **ATFM delay** by Transport Studies Group from the University of Westminster (2003).
- Successive revisions in 2011 and 2015 (more aircraft types, a gate-to-gate perspective of delay cost and some updates on the average cost of ATFM delay)
- Current value is **104 euros/minute** (2018)

PRB | Performance review body of the single european sky

PRB Monitoring Report 2019 and RP2 Overview

In addition to the amounts airlines paid as charges, they had to absorb the cost of delays which in 2019 amounted to 1.6B€$_{2009}$ (1.7B€$_{2009}$ in 2018).

REPORT COMMISSIONED BY THE PERFORMANCE REVIEW COMMISSION

ATM Cost-Effectiveness (ACE) 2018 Benchmarking Report

[15] The cost of ATFM delays (€104 per minute in 2018) is based on the findings of the study "European airline delay cost reference values" realised by the University of Westminster in March 2011 and updated in December 2015. Further details on the computation of the economic costs per composite flight-hour at ANSP and Pan-European system level are available in Annex 2 of this report.

# DELAY COSTS USING POST-OPS DATA

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***Paradigm**: the cost of the delay is an important indicator, the inaccuracy of data or methodology provides a wrong basis for the political decision makers*

***Question.** Is the average value cost of one minute of delay still a valid approximation to measure the cost of delay?*

***Answer.** Future publications should consider a more accurate calculation of the cost of delay based on a new function*

# DELAY COSTS USING POST-OPS DATA

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- **Our methodology to assess ATFM delay more accurately:**
  - ✓ Source: studies from the Westminster University on the cost of one minute of ATFM delay
  - ✓ Simulations used all of the ECAC flight data from 2012 to 2019
- **Calculate the total cost of delay** for any entity at ECAC level
  - ✓ Not all flights are subject to the same amount of delay
  - ✓ Need to check the distribution of delays and how they affect the total cost
  - ✓ Definition of a new set of delay cost functions

# DELAY COSTS USING POST-OPS DATA

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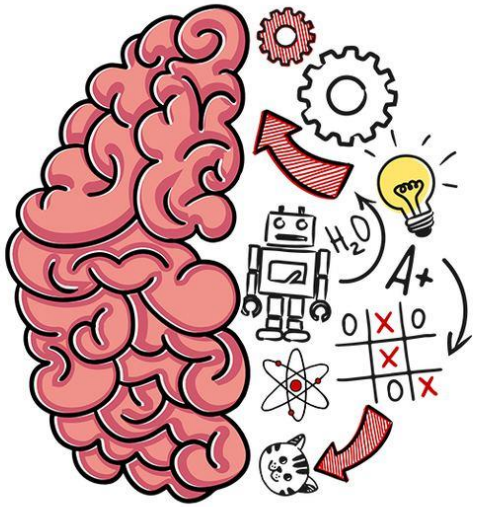
## Cost of delay = Minutes of delay x Cost per minute

- 3 delay ranges
- 10 delay ranges

*Source: EUROCONTROL*




*ATFM delay ranges and weighted costs – per minute –. 2017 Euros*

| Delay range (min) | 01-04 | 05-14 | 15-29 | 30-59 | 60-89 | 90-119 | 120-179 | 180-239 | 240-299 | 300+ |
|---|---|---|---|---|---|---|---|---|---|---|
| Average total cost (euros) | 40.3 | 264.5 | 1,096 | 4,873 | 15,036 | 32,187 | 50,005 | 67,017 | 88,714 | 101,082 |
| Average cost per minute (euros) | 16.12 | 27.84 | 49.80 | 109.51 | 201.82 | 308.01 | 334.48 | 319.89 | 329.18 | 336.94 |

*Source: own elaboration based on Cook & Tanner (2011) and Performance Review Unit (2019a)*

*ATFM delay ranges and weighted costs – per minute –. 2017 Euros. 3 delay ranges*

| Delay range (min) | 0-15 | 16-60 | 60+ |
|---|---|---|---|
| Average cost per minute (euros) | 21.98 | 79.66 | 305.06 |

*Source: own elaboration based on Cook & Tanner (2011)*

# DELAYED FLIGHT DISTRIBUTION USING POST-OPS DATA

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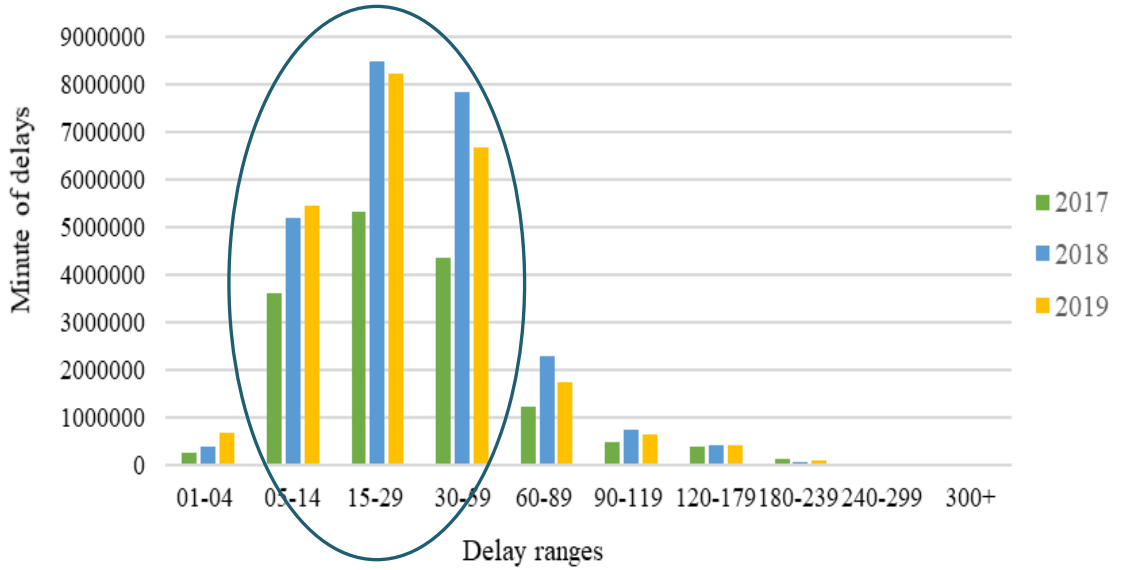
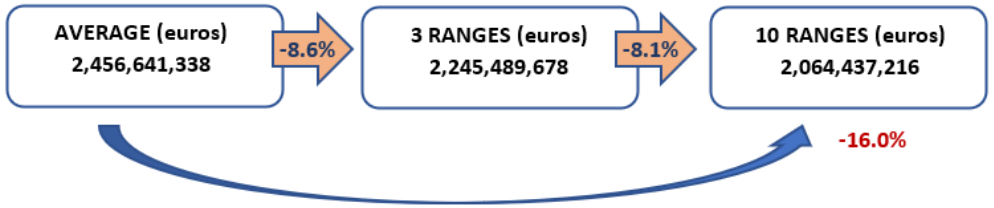
*Distribution of flights across the delay ranges*




*Source: own elaboration based on data from EUROCONTROL*

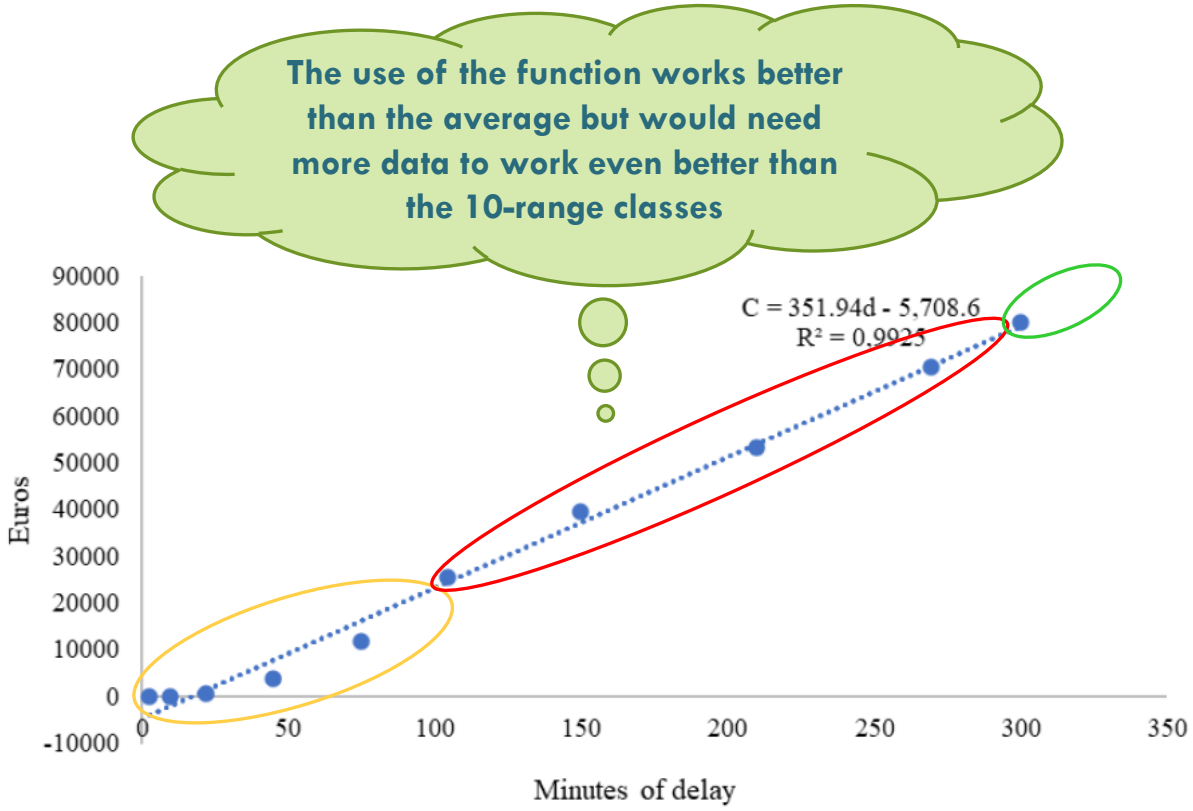



The use of an average value for the cost of one minute of delay tends to potentially coat the real value of the delay cost.

| 2019 | Average | 3 ranges | Var (%) | 10 ranges | Var (%) |
|---|---|---|---|---|---|
| **Baltic** | 26.865.678 | 17.542.992 | -34,7% | 15.678.144 | -41,6% |
| **Blue Med** | 195.498.810 | 199.126.984 | 1,9% | 185.379.881 | -5,2% |
| **Danish-Swedish** | 12.941.454 | 13.517.068 | 4,4% | 12.768.655 | -1,3% |
| **Danube** | 9.781.698 | 6.966.963 | -28,8% | 6.391.474 | -34,7% |
| **FAB CE** | 447.012.348 | 370.221.921 | -17,2% | 339.890.275 | -24,0% |
| **Fabec** | 1.244.319.318 | 1.132.220.437 | -9,0% | 1.039.111.985 | -16,5% |
| **NEFAB** | 8.375.424 | 6.441.663 | -23,1% | 6.133.197 | -26,8% |
| **SW_FAB** | 287.103.786 | 270.627.464 | -5,7% | 249.526.304 | -13,1% |
| **UK-IR_FAB** | 169.715.658 | 173.504.950 | 2,2% | 157.806.328 | -7,0% |
| **NOT_A_FAB** | 55.028.184 | 55.280.343 | 0,5% | 51.750.973 | -6,0% |
| **TOTAL FABs** | 2.456.642.358 | 2.245.450.785 | -8,6% | 2.064.437.216 | -16,0% |

# DELAY COSTS USING POST-OPS DATA

- **Curve function** per minutes of delay.




3 different trends:

- 0< d < 75min.: non-linear function
- 75 < d < 300 min.: linear function
- 300+ min.: ?

- **Improvements of methodology is possible if single-flight cost data are available.**
- **Data provision is not possible yet as this is a very sensitive issue for airliners**

* Note: C = total cost (€) and d = delay (minutes).

# ADJUSTED DELAY: METHODOLOGY

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***Paradigm***: *a flight which took off later than its Calculated Take Off Time not always is late upon landing*

***Question.*** *Given a time span, what is the number of flights that, being ATFM delayed on departure, have adjusted their initial ATFM delay at the arrival airports?*

***Answer.*** *A comparison between the estimated flight duration and the actual flight duration needs to be done and relate the difference to the assigned ATFM delay.*

# ADJUSTED DELAY: METHODOLOGY

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- **Define a new indicator for the adjusted ATFM delay.** It is the part of the ATFM delay that has been adjusted during the flight.

- **Our methodology to assess the Adjusted ATFM Delay indicator**
  - ✓ Source: Eurocontrol data of flights operated from 1.1.2015 to 31.12. 2020 over the BLUE MED skies
  - ✓ ATFM delay between 1 and 14 minutes (delayed flights and selection on ATFM delay magnitude) and FDD greater than 0 minutes
  - ✓ The selected sample consisted of 12.3% flights over the total number of ECAC flights

# ADJUSTED DELAY: METHODOLOGY

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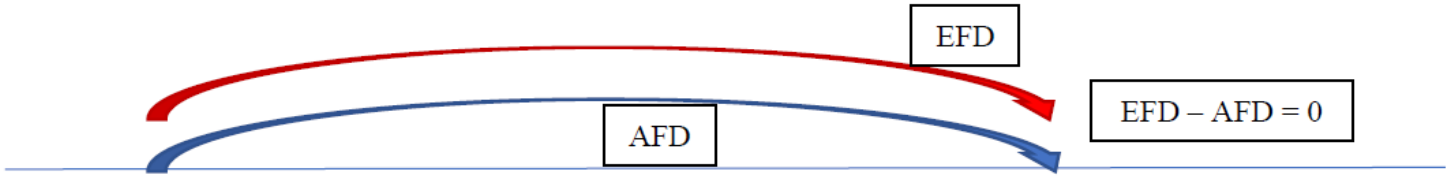
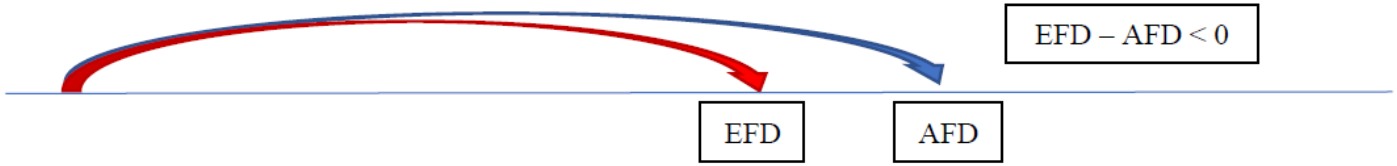
Compare the **Actual Flight Duration (AFD)** of each flight against its **Estimated Flight Duration (EFD).** Depending on the result, the initial [ATFM] delay can be:

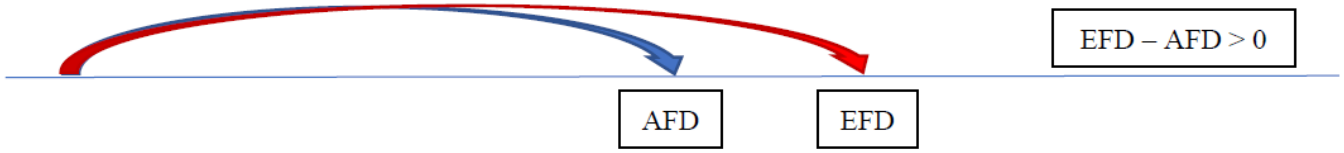
Unchanged delay




Increased delay




Reduced delay



# ADJUSTED DELAY: METHODOLOGY

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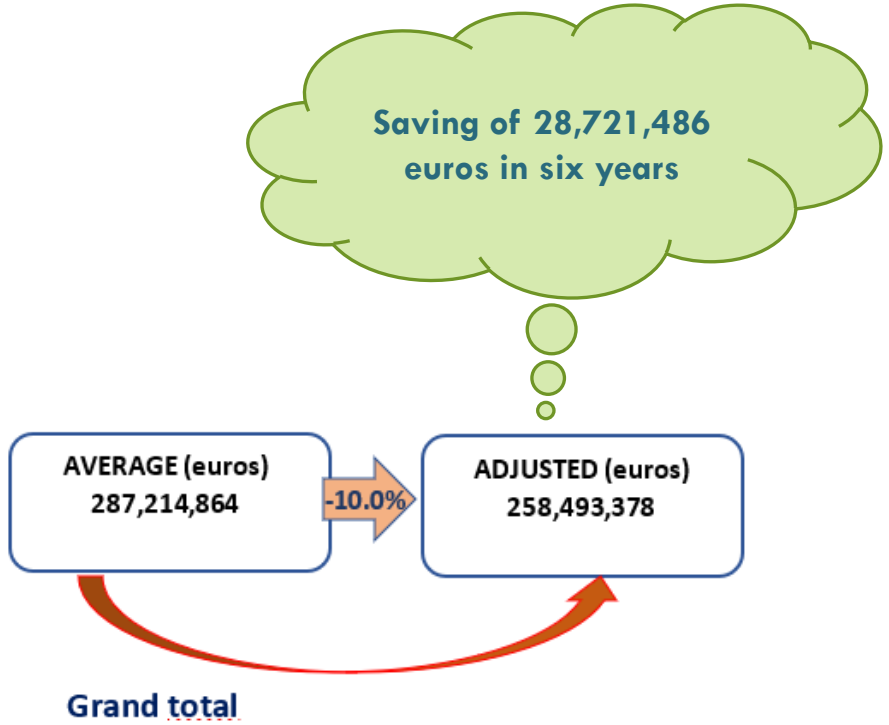
The following formula was used to calculate the indicator $AADi=(\Sigma AAD/\Sigma ATFM\ delays)*100$

| ATFM delay 1-14 min (FDD>0) | | | |
|---|---|---|---|
| **YEAR** | **Σ AAD (min.)** | **Σ ATFM delay (min.)** | **AADi (%)** |
| **2015** | -7475 | 313928 | -2% |
| **2016** | -5977 | 248476 | -2% |
| **2017** | 39497 | 376451 | 10% |
| **2018** | 116545 | 816211 | 14% |
| **2019** | 124218 | 995247 | 12% |
| **2020** | 15357 | 65519 | 23% |
| **Total** | 282165 | 2815832 | 10% |




*Source: own elaboration based on data from EUROCONTROL. Sample of Blue Med Flights from 2015 to 2020*

# CONCLUSION AND WAY FORWARD

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- The error of aggregation when calculating costs of delay is significant:
  - The average error in the 2017-2019 timeframe is 12.9%
  - In total terms the error in these three years is EUR 860 million
- The cost of delay is overestimated in official publications, potentially leading to biased conclusions in political decision-making
- Future calculations and publications should consider a more accurate calculation of the cost of delay based on ex-post flight data
- There is space for official ATFM delay reduction at the end of the flight because it might be adjusted in operations: splitting delay up in its tactical and strategic cost elements there may still be a significant improvement of the indicator
- The basics of the University of Westminster studies are some 10-15 years old: an update is needed

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# AND NOW … TIME FOR QUESTIONS