

The impact of the
European Union
Emission Trading System
on the aviation sector

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Outline

1. Background
2. Literature review
3. Research question
4. Panel data regression
5. Conclusions

1. Background

The aviation sector is international by definition

→ It requires global environmental policies

- ❑ **Direct** emissions from aviation account for **3%** of **EU GHG emissions** and **2%** of **global GHG emissions**;
- ❑ Globally, they are expected to increase by **300%** by **2050**, compared to 2005 level.

Goals:

- EU: reducing GHG emissions by 20% compared to 1990 level within 2020 and by 40% (compared to 1990) within 2030;
- Paris Agreement: limiting the increase in global temperature to less than 2° Celsius above 'pre-industrial' levels.

1. Background



Rationale: Polluter pays' principle

Description:

- Market based measure
- 'Cap and trade' system
- Goals achievement in a **cost-effective** and **economically efficient** way
- Business can either **buy or receive for free** the allowances
- 1 allowance = 1 tCO₂**

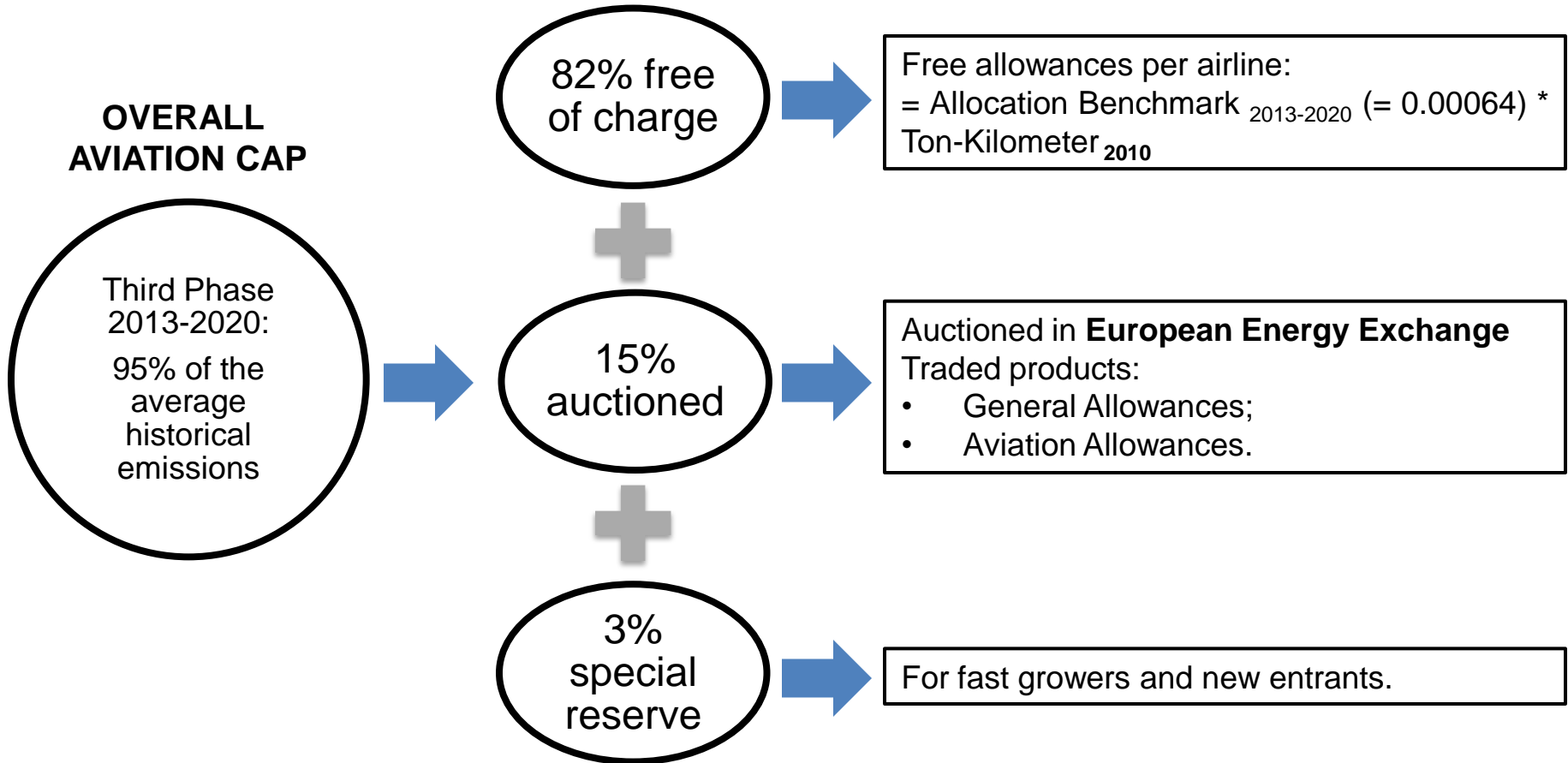
Covering: Since 2012, more than 600 **aircraft operators**

Scope: European Economic Area: 28 European Union Member States plus Iceland, Liechtenstein and Norway

'Stopping the clock' provision: Originally, all intra and extra EEA flights. Since 2013, has limited its scope to intra EEA flights.

1. Background

Aviation European Union Emission Trading System (2008/101/EC)



1. Background

Funds

- The **funds raised** through auctions go to Member States.
- Member States should spend **50% of the revenues** from auctioning:
 - on reducing climate change in the European Union and in 3rd countries;
 - on developing renewable energies and storage;
 - on funding research and development.
- Auction **revenues from aviation** should be used *‘in particular in the fields of aeronautics and air transport, to reduce emissions through low-emission transport and to cover the cost of administering the Community scheme’*.
- Member States must **report annually** on the use of these revenues.

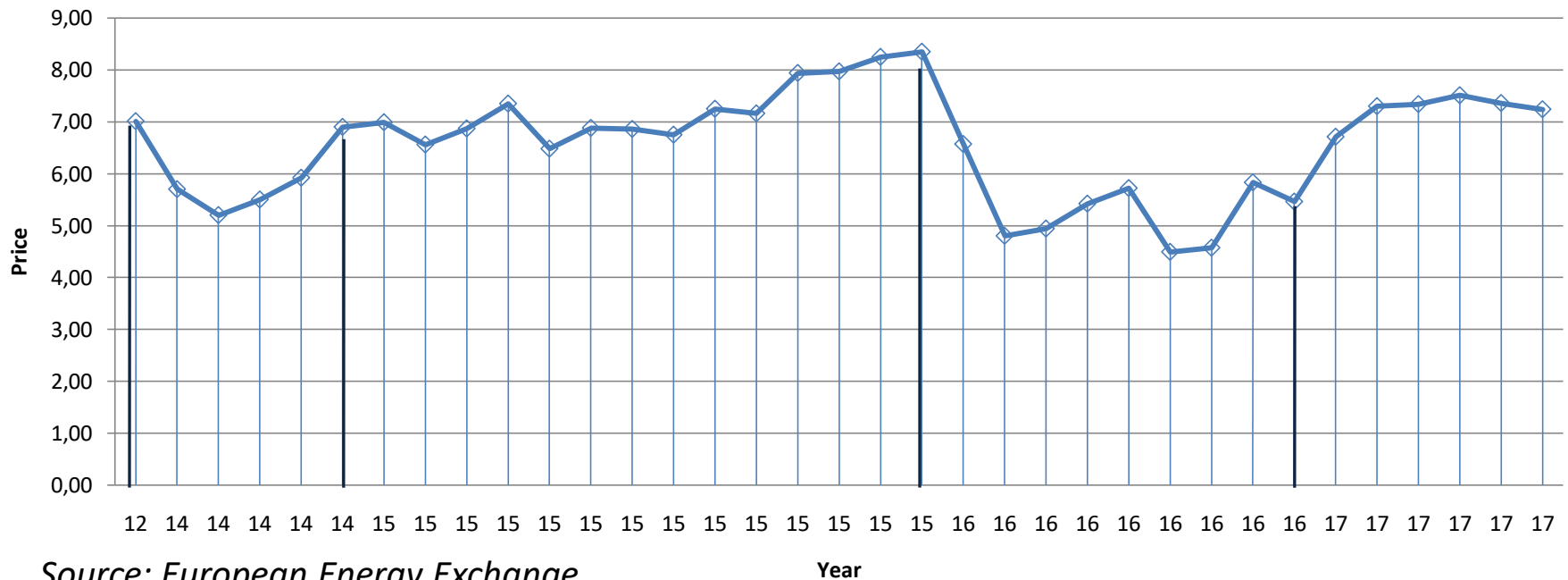
1. Background

EUAAs and EUAs prices

In the EEX there are 2 different kinds of allowances:

- **EUAAs** (EU Aviation Allowances): only used by aircraft operators;
- **EUAs** (EU Allowances): used by both aircraft operators and manufacturing plants and power stations.

European Union Allowances Aviation (EUAAs) Closing Price



Source: European Energy Exchange

1. Background



- Introduced by the International Civil Aviation Organization;
 - Goal: cap emissions **at their 2020 level** (sector considered as a whole)
 - The scheme offsets emissions by purchasing emission units, which are tradable certificates, created by emissions reduction in other sectors;
 - The scheme excludes the Least Developed Countries and those with little traffic.
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- ❖ Pilot phase and first phase from 2021 to 2026: on a volunteer basis;
 - ❖ Second phase from 2027 to 2035: mandatory.
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- ✓ CORSIA and EU ETS
- The best estimated option in terms of environmental benefits would include the EU ETS covering international and domestic flights and the CORSIA covering the non-EEA flights (Scheelhaase et al., 2018).

1. Background



Impact of the EU ETS
on market competition
(Barbot et al.,2014)

Environmental policies push incumbents to discourage new entrants in the market because of both **2010 production level** (baseline year) and **special reserve free allowances** shared between fast growers and new entrants → Incumbents can block the entry in the air transport market → potential solution: **auctioning all permits** and eliminating the allocation of free allowances.

In fact, the scheme affect competition and social welfare, which the EU committed to promote.

2. Literature review

General EU ETS

'Assessing the impact of the EU ETS using firm level data'
(Abrell, J., Ndoye Faye A., & G. Zachmann, 2011)

- The impact of the allowances' price in abatement behavior.
- - 3.6% decrease in emissions growth between the first and the second phase.

'Environmental Policy and Directed Technological Change: Evidence from the European carbon market'
(Calel & Dechezlepretre, 2012)

- The impact of the ETS on firms' patenting.
- 1% increase in the number of low carbon patents compared to a counterfactual scenario.

'Financial intermediaries and Emission Trading'
(Heindl, 2012)

- The role of financial intermediaries in the EU ETS auctioning market.
- 12.5% of firms that traded at the exchange traded 86% of permits.

2. Literature review

'Assessing the impact of the EU ETS using firm level data'

(Abrell, J., Ndoye Faye A., & G. Zachmann, 2011)

- The impact of the allowances' price in abatement behavior.
- - 3.6% decrease in emissions growth between the first and the second phase.

Dataset:

- Verified emissions from European Union Transaction Log;
- Firms' performance from Amadeus database.

The log-linear model applied, used to investigate whether or not the ETS led to emissions reductions in the second phase, is:

$$y_{it} = \alpha_0 + \alpha_1 d_{it} + \alpha_2 cv^1_{it} + \alpha_3 cv^2_{it} + \varepsilon_{it}$$

$$t = 2005, 2006, 2007, 2008$$

In 2008 the scheme entered in its second phase: **the differential in emission growth rates between 2005 and 2008 is - 3.6%** indicating that the reduction was due to the shift from the first (1€) to the second phase (22€) → Effective price

3. Research question

What factors affect the airlines' carbon dioxide emissions?

Regression Equation with Panel Data

$$y_{it} = \beta_0 + \beta_1 x^1_{it} + \beta_2 x^2_{it} + \beta_3 x^3_{it} + \beta_4 x^4_{it} + \beta_5 x^5_{it} + \beta_6 x^6_{it} + \varepsilon_{it}$$

t = 2013, 2014, 2015, 2016

y_{it} = verified emissions

x^1_{it} = fleet

x^2_{it} = turnover

x^3_{it} = total assets

x^4_{it} = employees

x^5_{it} = compliance dummy

x^6_{it} = price

4. Panel data regression

Prais-Winsten regression – Expected results

$$y_{it} = \beta_0 + \beta_1 x^1_{it} + \beta_2 x^2_{it} + \beta_3 x^3_{it} + \beta_4 x^4_{it} + \beta_5 x^5_{it} + \beta_6 x^6_{it} + \varepsilon_{it}$$

□ $\beta_1 = \text{fleet}$

If the coefficient is positive, the assumption is that the purchase is due to the fleet growth.

If the coefficient is negative, the assumption is that the purchased fleet is due to the fleet renewal.

□ $\beta_2 = \text{turnover}; \beta_3 = \text{total assets}; \beta_4 = \text{employees}$

The expectation is that the coefficients have positive signs because these are control variables catching the growth of the industry.

□ $\beta_5 = \text{compliance dummy (0 if compliant; 1 if not compliant)}$

The expectation is that when airlines are not compliant, verified emissions increase. The coefficient is expected to be positive.

□ $\beta_6 = \text{price}$

The expectation is that when the price increases, the verified emissions decrease.

4. Panel data regression

57 EU-based airlines accounting for **58%** of the total verified emissions

Group variable	id	No. of obs	228
Time variable	year	No. of groups	57
Panels (balanced)	Heteroskedastic (balanced)	Obs per group	4
Autocorrelation	Common AR(1)		
Estimated covariances	57	R-squared	0.73
Est. Autocorrelations	1	Wald chi2(8)	88.62
Estimated coefficients	7	Prob > chi2	0.00
Verified Emissions		Coef.	P> z
Fleet (#aircraft purchased)		30,138.5	0.09
Turnover (*100.000€)		52.1	0.00
Total Assets (*100.000€)		29.9	0.02
Employees (#employees)		-200.1	0.00
Compliance Dummy (0, in compliant)		0.5	0.95
Price (€/tCO ₂)		-18,105.7	0.09
constant		163,327.4	0.02

Rho = 0.43

4. Panel data regression

All countries' aviation emissions in tCO₂
(including companies excluded after 2012)

Year	Freely Allocated Allowances	Verified Emissions	Total Surrendered Units
2016	32,036,975	61,444,686	61,543,927
2015	32,152,526	57,082,472	57,010,057
2014	32,403,025	54,829,425	108,137,540
2013	32,455,312	53,498,684	101,768
2012	173,817,206	83,973,951	83,421,322

Source: European Environment Agency

5. Conclusions

Critical Issues

- ❑ The EUAAs market is a non-liquid market, thus the auction system is distorted.
- ❑ The aviation emission cap is not respected since aircraft operators can also purchase general allowances.
- ❑ The upcoming CORSIA could phase out the EU ETS, replacing it with a less ambitious system.

5. Conclusions

Positive Impacts

- The scheme is giving the expected results as, **when price increases, verified emissions decrease.**
- The MSs invest the revenues from auctioning in R&D.
- By monitoring and reporting emissions, the system provides certain historical data.

Thank you.

4. Panel data regression

Variance Inflation Factor

Variable	VIF	1/VIF
fleet	2.09	0.48
turnover	152.85	0.01
total assets	42.05	0.02
employees	86.43	0.01
compliance	1.22	0.82
price	1.40	0.72
Mean VIF	47.67	

4. Panel data regression

Table 6. Mean values of verified emissions, fleet, turnover, total assets, cash flow, employees, price from 2013 to 2016

Variable	Mean	Std. Dev.
Verified Emissions (tCO2)	620,552.00	1,294,432.0
Fleet (# aircraft purchased)	3.24	6.0
Turnover (€)	2,070,000,000.00	5,740,000,000.0
Total Assets (€)	1,970,000,000.00	5,740,000,000.0
Employees (# employees)	6,128.00	20,014.3
Price (€)	4.60	2.8