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# Lecture 9: Econometric Methods for Efficiency Analysis

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Quantitative Methods for Regulation and  
Competition

# Econometric methods

- **Deterministic approaches:**
  - all deviation from estimated frontier due to inefficiency
  - Corrected Ordinary Least Squares (COLS)
- **Stochastic approach:**
  - inefficiency is decomposed into inefficiency and measurement error
  - Stochastic Frontier Analysis (SFA)

# COLS

## ■ Step 1:

- Specify a (linear) relationship between output and costs

$$c_i = \beta_0 + \beta_y y_i + \varepsilon_i \text{ where}$$

$c_i$  are the operating costs of plant (or firm)  $i$

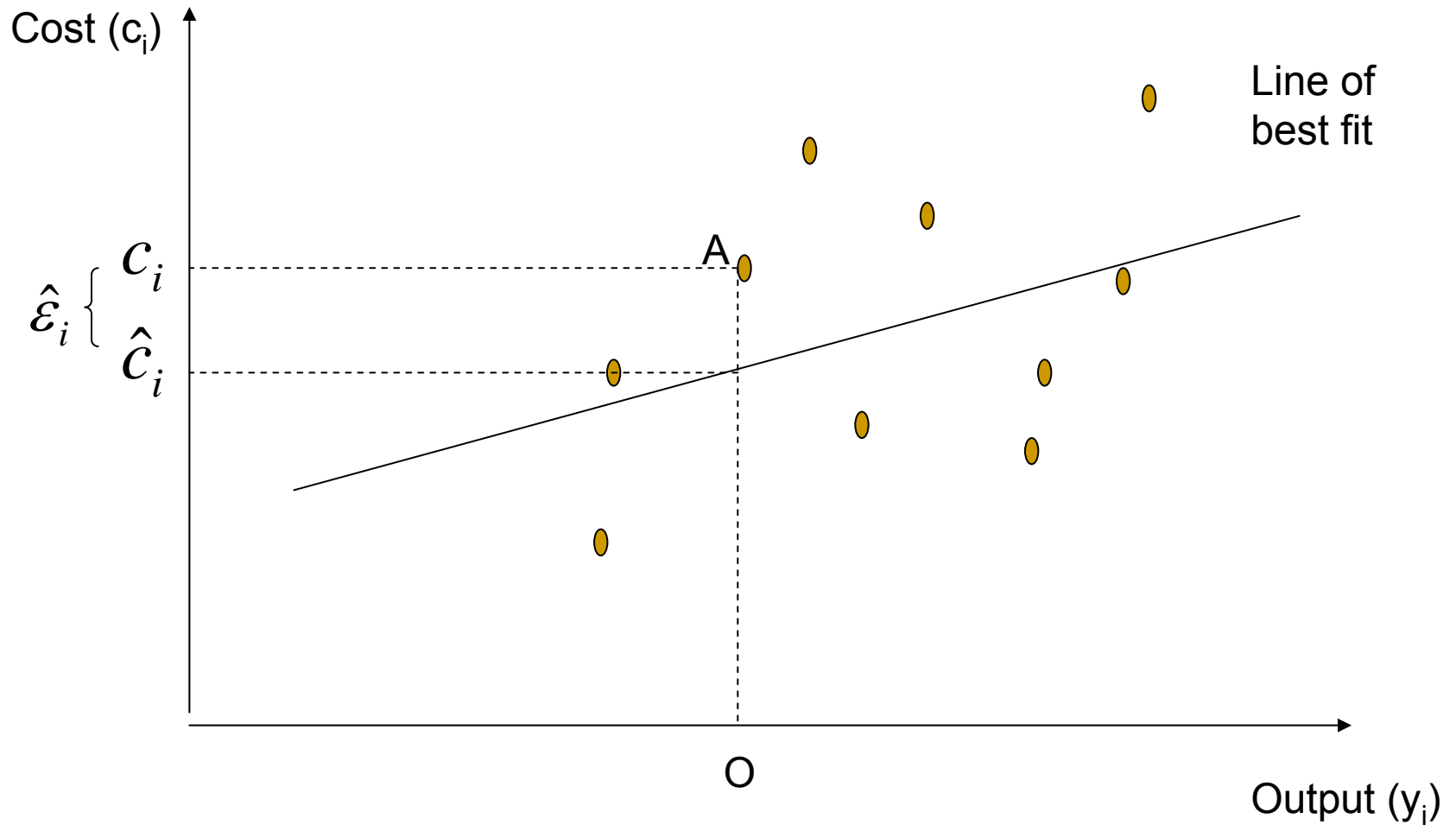
$\varepsilon_i$  is an error term (due for example to managerial efficiency)

$\beta_0$  and  $\beta_y$  are the **unknown** parameters to be estimated

## ■ Step 2:

- Best fit line shifted by adding absolute value of largest negative estimated error to that of the other errors
- So the efficient frontier passes through the lowest data point

# COLS: Step 1



# COLS: Step 1

$$c_i = \hat{c}_i + \hat{\varepsilon}_i$$

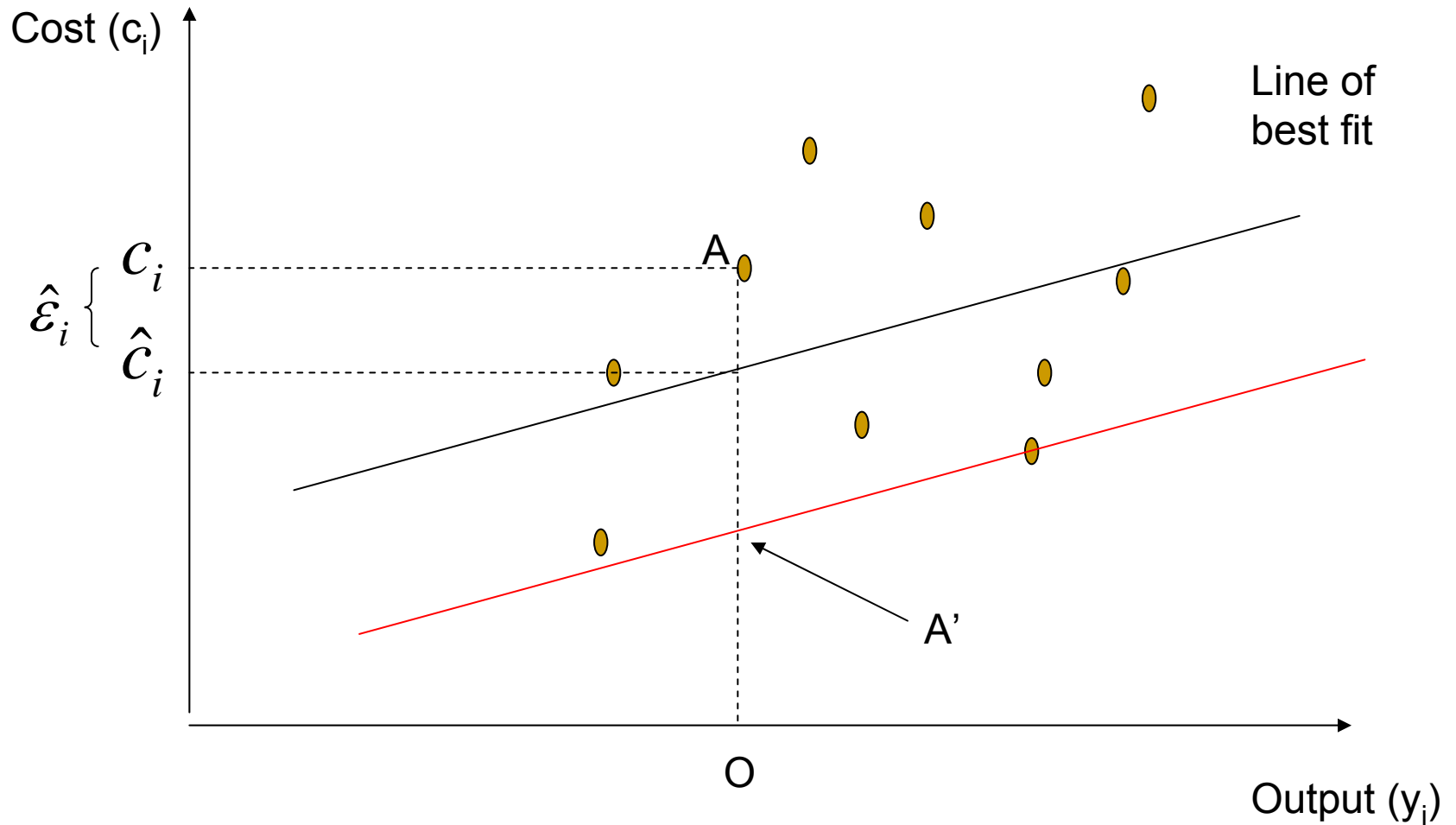
Where  $\hat{c}_i$  can be thought as an estimate of the costs of an average efficiency company producing the same output

And  $\hat{\varepsilon}_i$  estimates the efficiency difference between company  $i$  and this average company

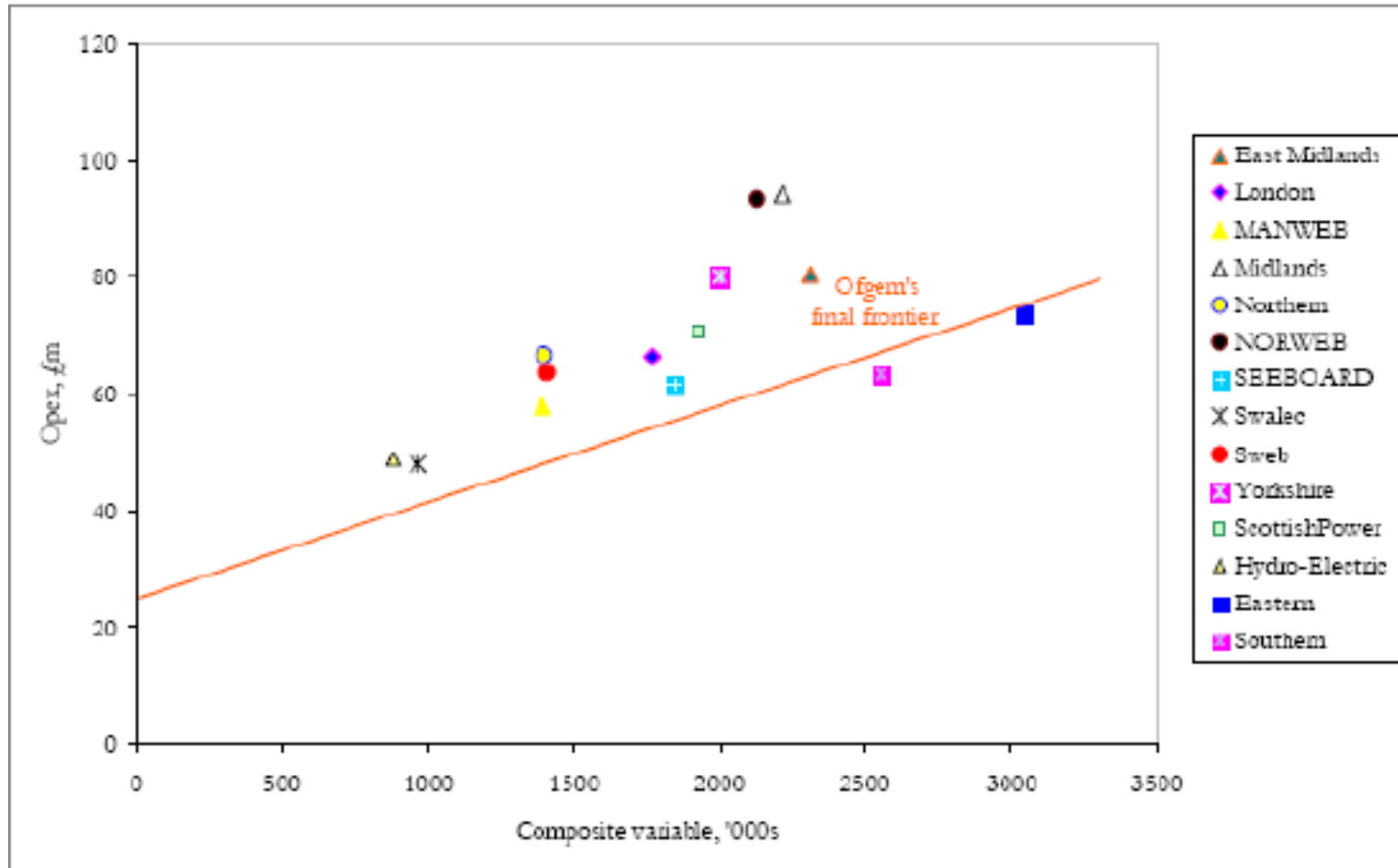
The company is more efficient than the average if  $\hat{\varepsilon}_i > 0$

The company is less efficient than the average if  $\hat{\varepsilon}_i < 0$

# COLS: Step 2



# Efficiency Frontier Elec DPCR 1999



-Ofgem chose the second lowest data point instead of the first  
-Intercept, which should reflect fixed costs, was considered appropriate

# Potential Opex Savings

*Figure 13: Potential opex savings implied by top-down analysis cited by Ofgem*

Potential opex saving		Potential opex saving	
Eastern	0%	SEEBOARD	13%
East Midlands	24%	Southern	-4%
London	19%	Swalec	18%
Manweb	20%	Sweb	27%
Midlands	36%	Yorkshire	30%
Northern	31%	ScottishPower	24%
Norweb	37%	Hydro-Electric	23%
Unweighted average			22%

*Source: Ofgem, December 1999*



# Stochastic Frontier Analysis (SFA)

- As in COLS, SFA...
  - requires specification of a production function based on input variables
- However, it...
  - does not assume that all errors are due to inefficiency
  - takes into account the possibility of measurement and specification errors
  - Needs to specify distribution of inefficiency and error

# SFA

