

# ATC regulation in a union bargaining model setting

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ACCHANGE



# Air traffic control: guide planes safely and efficiently (time + fuel)

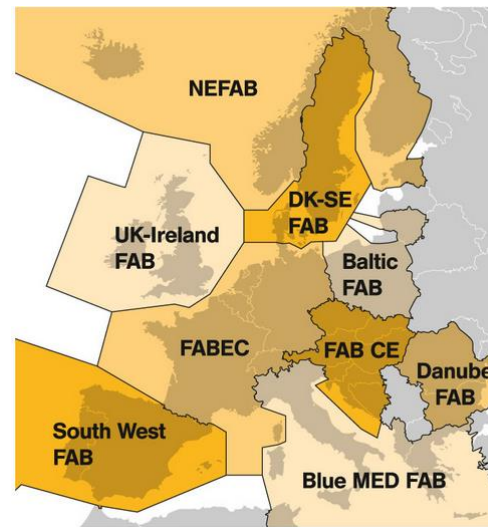
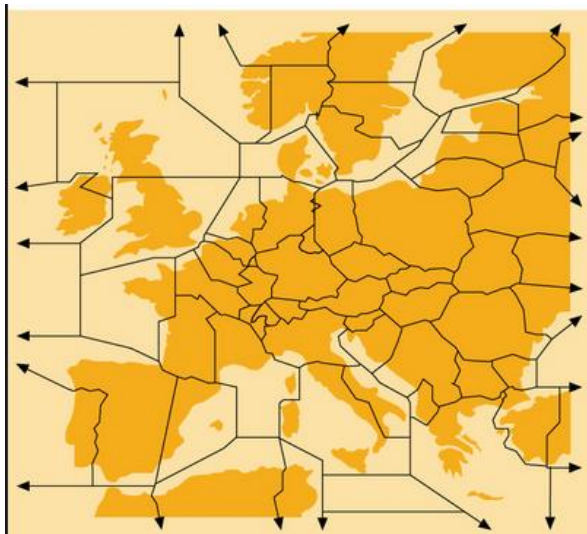


# What is the challenge?

- Cost-efficiency – SES targets for 2020
  - Provide ATM services to airspace users at a cost of at least 50% less
- Cost for ATM is around 6% of airline operating cost
  - Total cost of 6B € per year in Europe
- ATM cost is for about 60% made up of labor cost
  - Labor-intensive industry

# What is the problem?

- Fragmented airspace in Europe: 37 national ANSPs – regional monopolies
  - In US: only 1 ANSP, much lower ATM cost per flight



- ICAO guidelines on ANSP charges – targeted towards cost recovery

# What is the approach taken?

- Solution (“Single European Sky” policy of EU):
  - Performance regulation introduces a price-cap (determined costs)
  - Promote mergers between charging zones (FABs)
    - Economies of scale
  - Promote new technologies (SESAR PCP, SESAR Step 1, ...)
- But not much happens since 10 years...Why?

# Model approach

- Understand the behaviour of one air navigation service provider
- 2 different economic models :
  - Interest group theory
    - Lobby groups (equipment suppliers, unions of controllers) ‘buy’ favors from national government
      - Dixit, Grossman, Helpman (JPE,1997)
  - **Bargaining model**
    - **Union threatens to strike to push their solution**
      - Oswald (SJE, 1985)

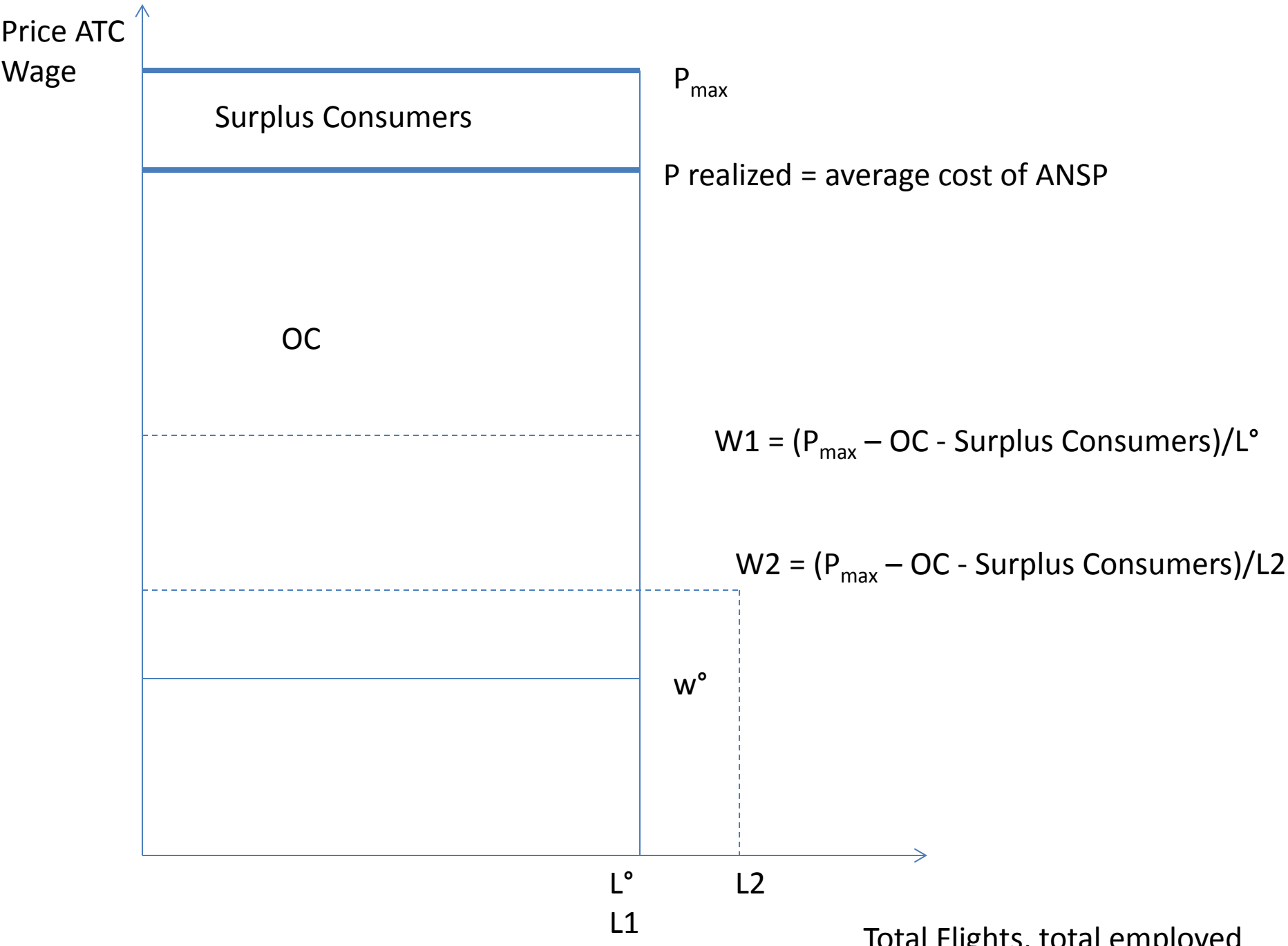
# Outline

- **Model set-up**
- Current equilibrium
- Effects of a price cap
- Adoption of simple innovations
- Adoption of drastic innovations
- Pricing of congestion
- Empirical illustration of union power
- Future research

# Model set-up 1

- One ATM charging zone
- Service supplied to standardized number of flights  $D$  run by competitive airlines
- Max Willingness To Pay (WTP) for ATM services of flight is  $P_{max}$
- Technology  $k$  requires minimum 1 unit of ATM labor per flight
- Other costs of ATM -> fixed OC
- Labor cost of 1 ATC =  $w$ 
  - $w \geq$  competitive wage  $w^0$
- Employment for 1 flight =  $L$ 
  - $L >$  efficient level  $L^0$





# Model set-up 2

- **ANSP management** maximizes Consumer Surplus of Flights (or ANSP profits)  $\equiv$  minimize costs of ATM
- **ANSP Unions** negotiate on wage  $w$  and on employment  $L$ 
  - They have utility or objective function ( $\alpha > 0$ )

$$U = (w - w^0)^\alpha (L - L^0)^{1-\alpha}$$

$w^0$  = competitive wage per ATM labor unit

$L^0$  = minimum number of ATM labor units needed per composite flight hour (in situation with technology  $k$ )

$w > w^0$  means better salary than market for same qualification

$L > L^0$  means more relaxed work conditions, less working hours per week etc.

# Model set-up 3

- Equilibrium of bargaining game is an asymmetric Nash bargaining solution
- Nash bargaining solution= divides total gain as a function of their fallback position and as a function of their bargaining power (strike threat, lock-out option, ..)

$$\varphi = \underbrace{(P_{max} \cdot D - W \cdot L - OC \cdot D)}_{\text{Management surplus}} \delta \underbrace{((w - w^0)^\alpha (L - L^0)^{1-\alpha})}_{\text{Union surplus}}^{1-\delta}$$

Management surplus

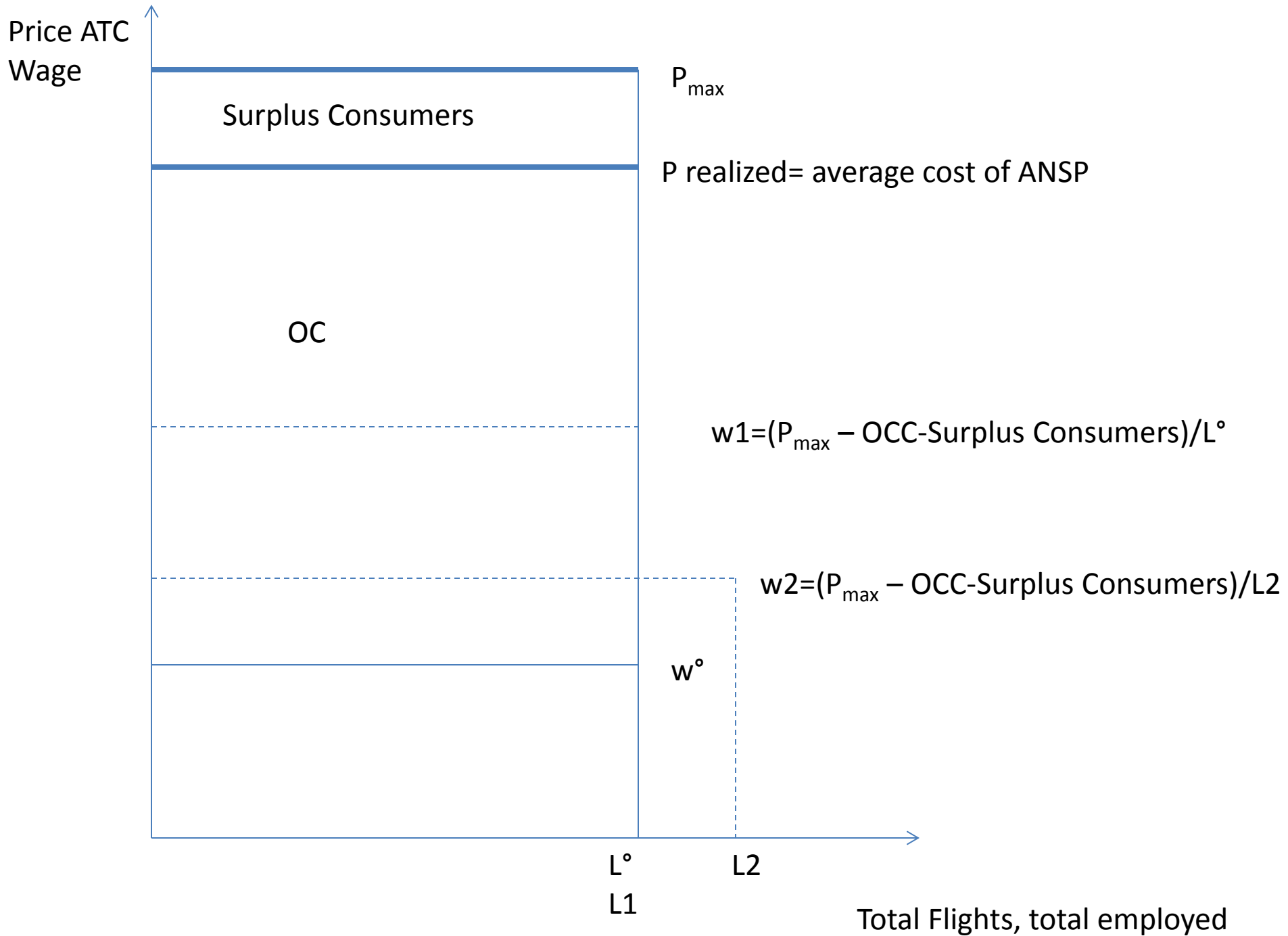
Union surplus

# Nash Bargaining solution

$$w = \frac{1}{\alpha + (1 - \alpha)\delta} \left[ w^0 + (1 - \delta)\alpha \frac{P_{max} \cdot D - OC}{L} \right]$$

$$L = \frac{1}{(1 - \alpha) + \alpha \cdot \delta} \left[ \delta \cdot L^0 + (1 - \delta)(1 - \alpha) \frac{P_{max} \cdot D - OC}{w} \right]$$

- If union is powerless ( $\delta = 1$ )
  - $w = w^0$  &  $L = L^0$
  - $p = \frac{OC + w^0 \cdot L^0}{D}$
- If union has all the power ( $\delta = 0$ )
  - high wages and/or high employment
    - If  $\alpha = 1$ , only high wages count,  $w$  is maximized,  $L = L^0$
    - If  $\alpha = 0$ , only high employment counts,  $w = w^0$ ,  $L$  is maximized



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# Explaining inefficiency in cost+ regime

- Inefficiency (high  $w$ , high  $L$ ) results from “strike” power of the ATC unions
- Assume there are domestic and foreign (or transit) users of air space, domestic ANSP management/government is attentive to Cons Surplus of domestic users not attentive to Cons Surplus of foreign users
  - Results in more surplus for unions or higher profits for ANSP
  - As profits for ATM are ruled out by international conventions, one ends up with high costs and prices

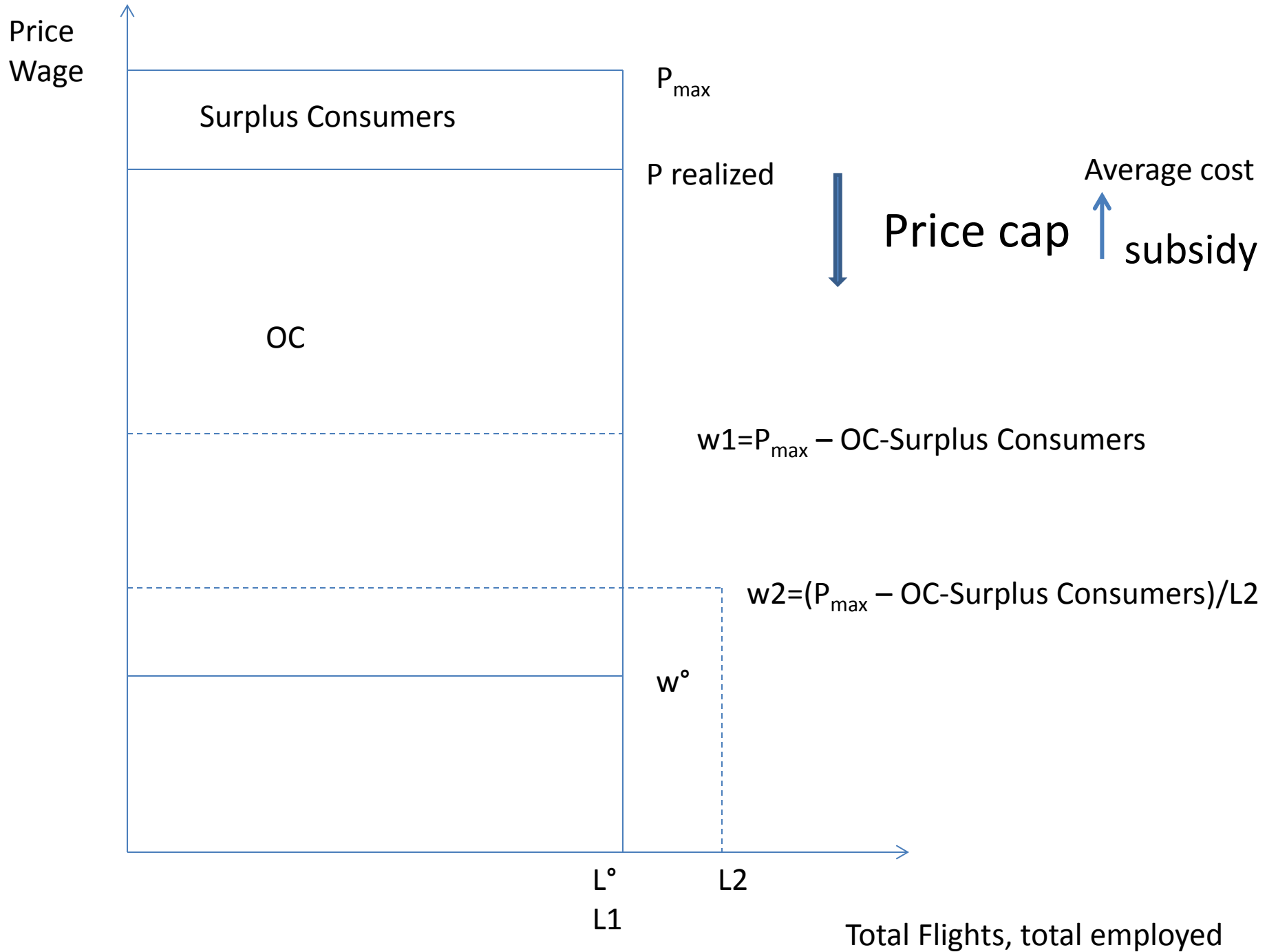
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# Will price-cap improve efficiency?

- EU regulator
  - Targets consumer surplus for the transit and domestic users
  - EU is less influenced by national strike actions as there is only one out of 28 that protests – things would be different if the ANSP unions became more European
  - Price cap forces the ANSP manager to lower costs:  $OC + w \cdot L$
- 3 Possible outcomes:
  - + Lower costs through higher efficiency (employment costs and other cost components)
    - Reduction in other costs and status quo for employment cost (eg. Postponing capital investments)
    - National governments start to subsidize the ATC operations when unions have a lot of power (cfr. Public transport subsidies, ..... ) – Belgium, France, ...



# Outline

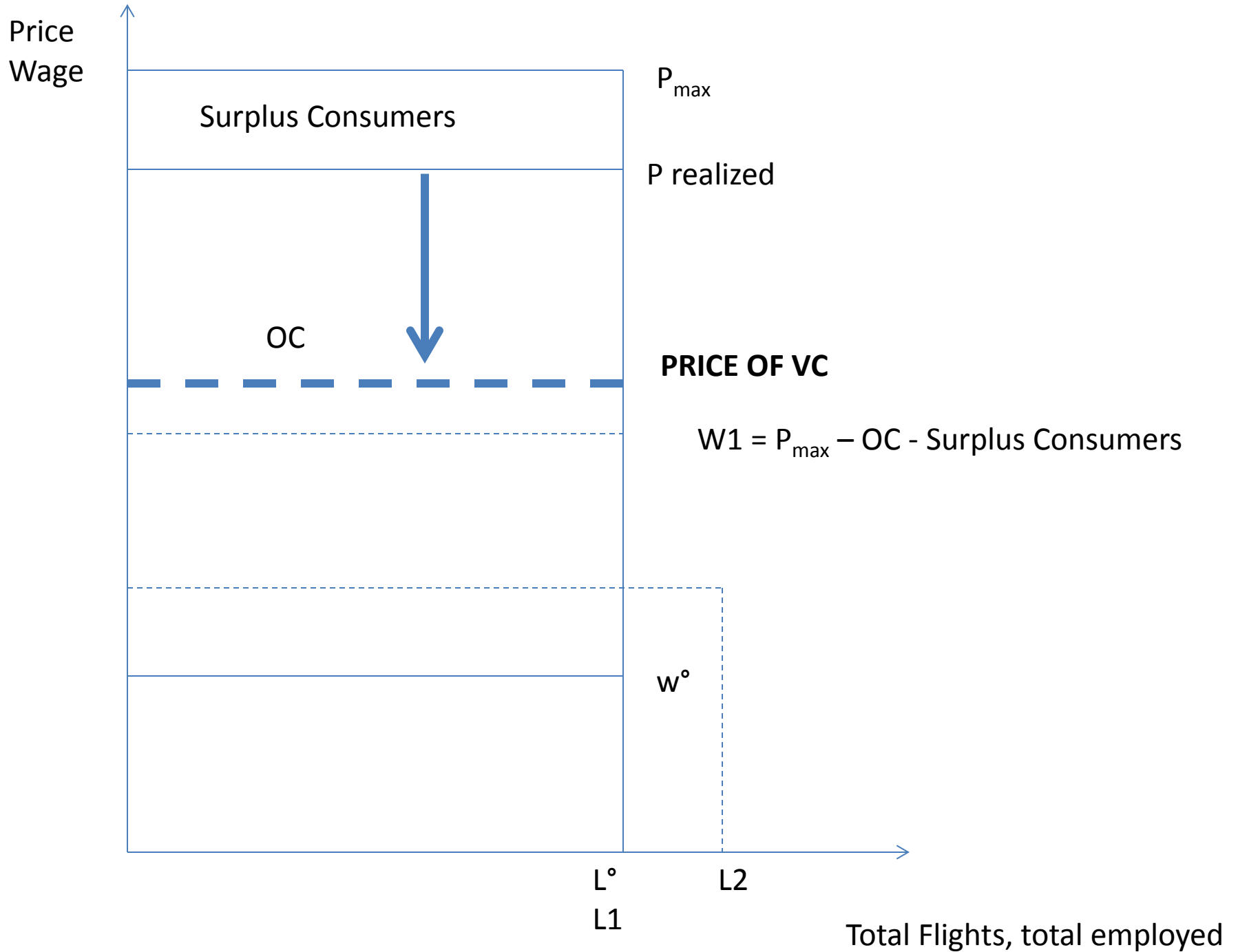
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# 'Small innovations'

- Will be accepted by unions as this increases the total surplus to be distributed
- But unions will be afraid of technologies that cut costs by standardization
  - as this may mean they are more easily replaced by training and hiring abroad (this would reduce their bargaining power  $(1 - \delta)$ )
- Risk of national coalition (local unions, local equipment manufacturers, etc.) to put pressure on home regulators/management not to standardize equipment

# Drastic innovation (“virtual center”)

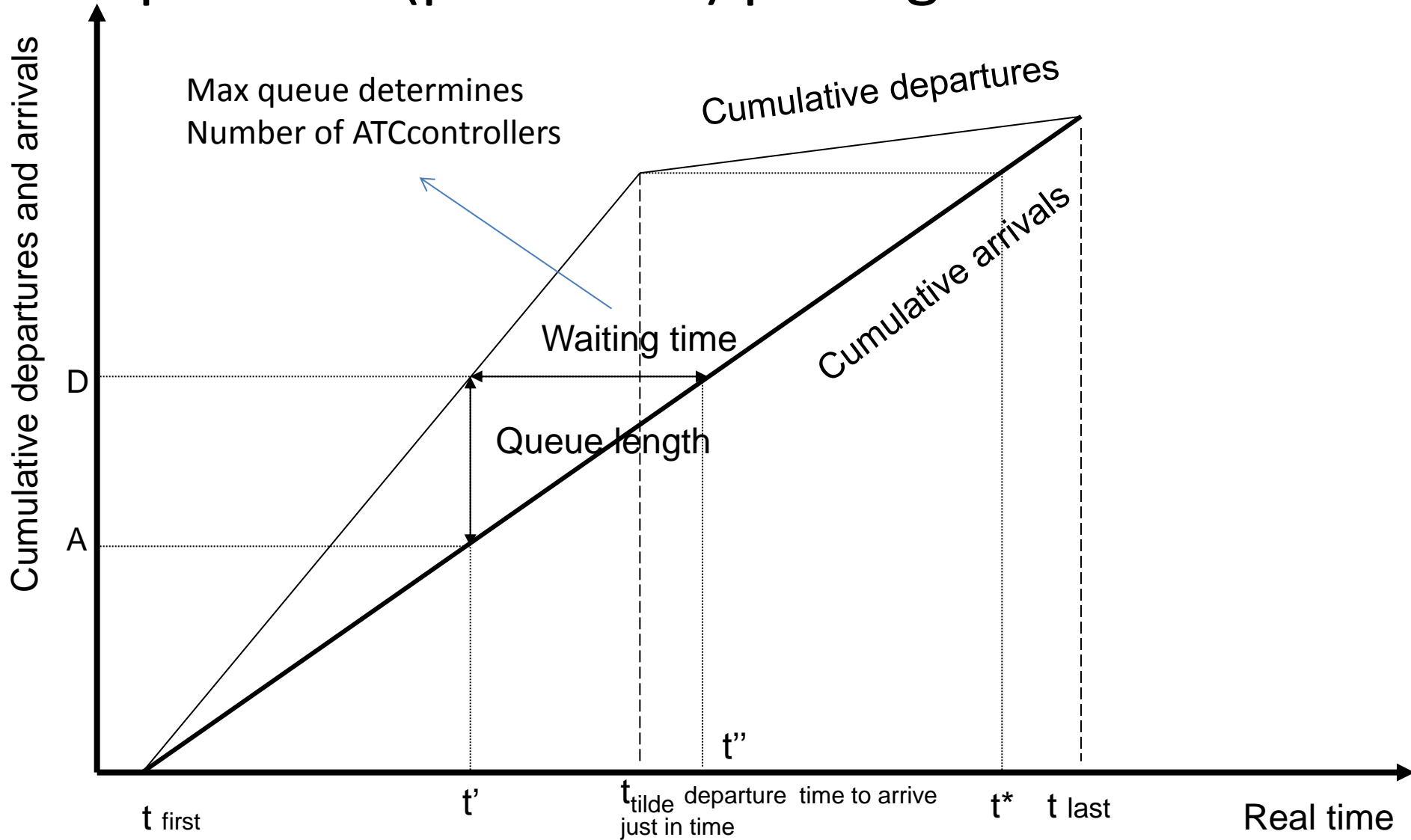
- A virtual center allows a foreign ANSP to take over a large part of the ATC operations
  - Technology: satellite-based navigation instead of ground-based navigation
- The virtual center gives ANSP management a much better fallback position in their negotiations with unions
- Maximum WTP for local ATC operations decreases from  $p_{max} \cdot D$  to cost of virtual center  $VC$  and  $wL + OC$  has to be cheaper than  $VC$
- Not their actual use but the threat of their existence may be sufficient
  - Preferable to have at least two virtual center suppliers to avoid monopoly position



# Incentives for ATC to adopt time of day pricing ?

- Capacity is limited – certainly if bad weather
- Two impediments for adopting “fine” (tuned) charging in a bottleneck model
  - In a no-union world, one reduces the “user cost” (including queuing costs) but increases the money cost to the user
    - this may not fit the cost recovery approach if quality of service is not correctly taken into account
  - In a unionized ATC world, there are two opposing factors
    - There are more revenues (waiting time is converted into toll revenues) that can be used to increase wages and/or profits
    - When queues go down, one needs less ATCOs and support personnel

# Bottleneck equilibrium without time dependent (peak load) pricing





# Empirical illustration

- “Union power” is difficult to measure directly as strikes are not a good indicator, it is the threat that counts
- Able to estimate relative bargaining power of government and unions
  - and preferences of the unions between wage and employment
  - using non-linear least squares on Nash bargaining solution

# Empirical illustration

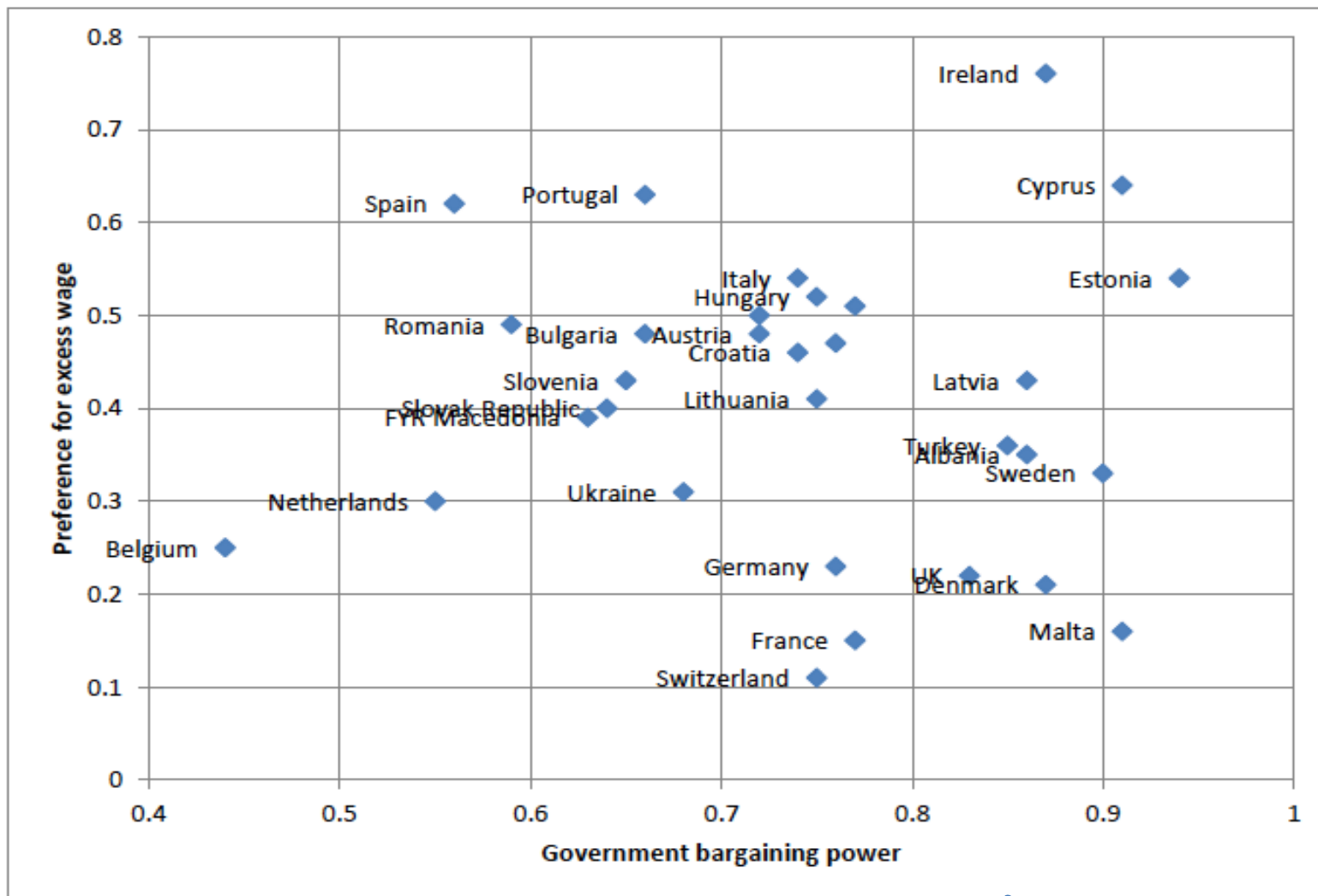
- Parameters needed:
  - Wage mark up ( $w - w^{\circ}$ ) can be estimated by comparison with national wages in other sectors for same qualification
    - Labor cost at ANSP is often significantly higher compared to similar professions in other sectors
  - ‘Excess Employment’ ( $L - L^{\circ}$ ) is estimated by comparing with the most efficient ANSP in one year in terms of FTE employees per composite flight hour (IAA Ireland, 2007)
  - ‘Maximum willingness to pay’  $p_{max}$  for flight control services is estimated by using the highest price in Europe per composite flight hour (Belgocontrol, 2005)

# Empirical illustration

- Data for 31 ANSPs with output (composite flight hours), Value added (yearly), wages, employment, wages in other sectors
  - Most data comes from ATM benchmarking reports
  - Time period: 2004 - 2011
- Example of comparison ANSP wage and 'outside option'
  - From ILOSTAT, Eurostat, national data sources
  - Similar profession based on ISCO (and NACE) classification

	Weighted average ANSP employment cost (€/year)	Weighted average outside employment cost (€/year)
Belgocontrol 2009	118 515	61 260
NAVIAIR 2009	99 000	70 500

# Bargaining power and union preferences



'LESS  
EFFICIENT'  
CONTROLLER



# Results

- Large differences across countries
- Union power
  - High union bargaining power in Belgium, NL, Spain
  - Low union bargaining power in Sweden, Denmark, Ireland
- Union power is used differently:
  - High wages in Ireland, Cyprus, Portugal, Spain
  - High employment in Belgium, Germany, France.

# Caveats

- Relatively simple ANSP production function
  - Limited account for ANSP heterogeneity and airspace complexity

# Future research

- Paper shows that union bargaining model is consistent with observations for the sector
- Need for more empirical validation:
  - Do countries with more union power have less standardization, easier subsidies...etc.
  - What determines union power? Social institutions, legal institutions, substitutability...

# Summing up

- Powerful ATC unions are one of the factors behind for observed inefficiencies of the ATM sector in Europe
- Potential implications:
  - price-cap could lead to state subsidies
  - Non-standardized procedures may be preferred by ANSPs because it protects the union power
  - Drastic innovations (virtual centers) may be a game changer and limit power of unions
  - Unions may not be in favor of time differentiated charges as this will reduce the number of controllers needed





# Thank you!

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