

# A COMPARISON OF MARKET-BASED MECHANISMS FOR CONGESTION MANAGEMENT



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# Fundamental Motivation for NEXTOR Congestion Management Project



*In January of 2007 of the legislation authorizing the existing slot rules governing operations at LaGuardia (LGA) and John F Kennedy International (JFK) Airports will expire. Without new government action, the current slot limitations will expire and there will be no constraints on the ability of air carriers to schedule operations at LGA.*

# Goals

1. Control of congestion and delays
2. Maintenance of a vibrant air transportation business environment,  
e.g. maintaining low priced services, reliance on actual competition, encouraging new entrants, strengthening small carriers, etc.
3. Support for certain societal and community objectives
4. Consistency with international obligations

**Note:** physical constraints → capacity expansion not possible so options include administrative measures, auctions, congestions pricing (and combinations of these)

# What about the two “easy” options??

- I. No action – let the law expire
- II. Status quo – continue under current rule

**Problem with I:** high risk of not meeting goal 1),  
i.e. could cause major congestion and delays.

**Problem with II:** evidence indicates goal 2) not  
currently being achieved –

- Aircraft gauge (num of seats) at LGA is “on the average” smaller than for the entire NAS.
- Secondary market does not work well.

# Basic Options and Tradeoffs



Administrative measure vs market mechanism

Slots (aka arrival or departure authorization) vs  
no slots

Market mechanism: auctions vs congestion  
pricing

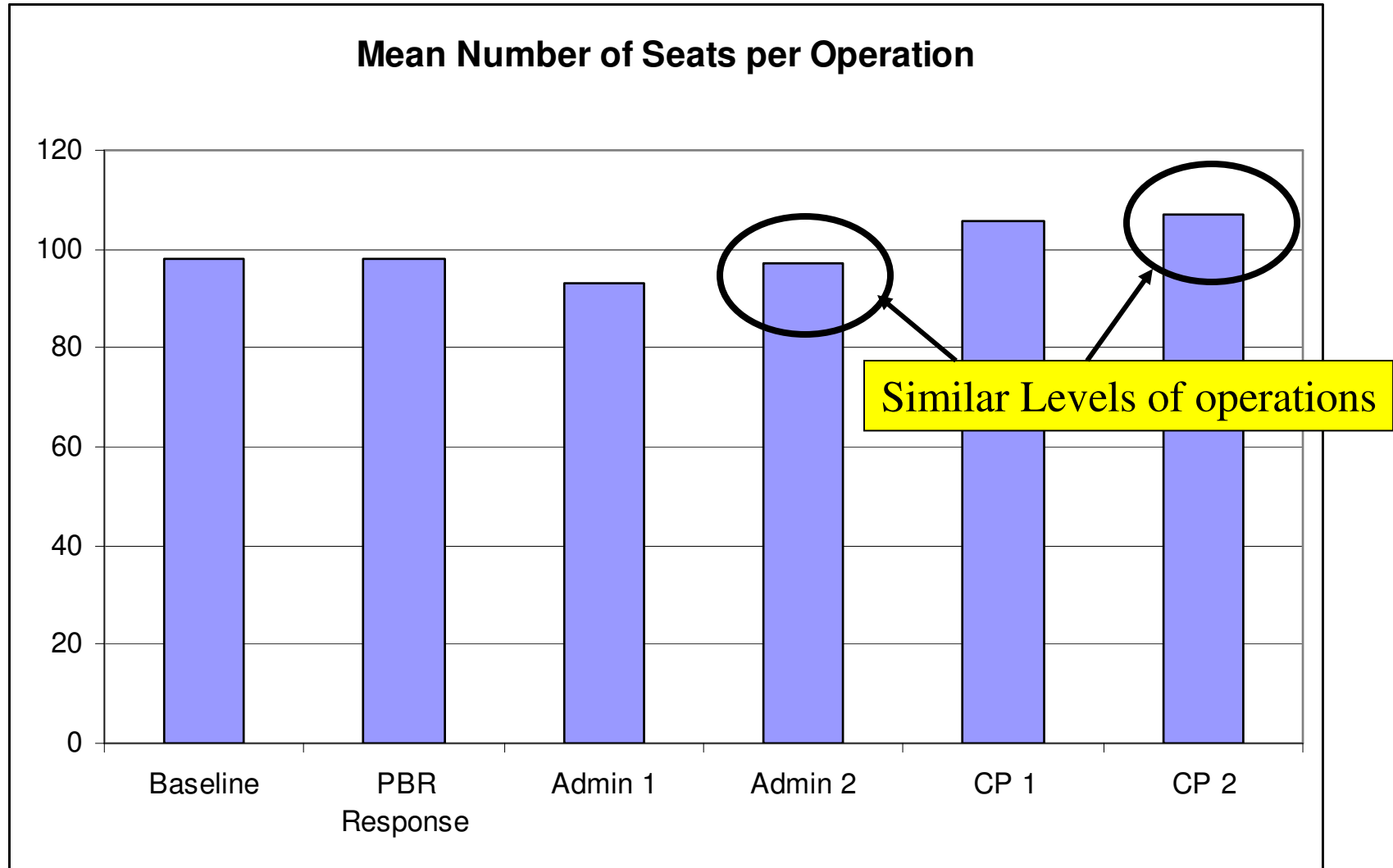
Should slots have finite lifetimes?

Administrative measure → slots

Slots + Market Mechanism → Auctions

No Slots → Congestion Pricing

# Results of Simulation 1: Market Mechanism (congestion pricing) Leads to Up-gauging When Compared to “Equivalent” Administrative Measures:



# Slots vs No Slots



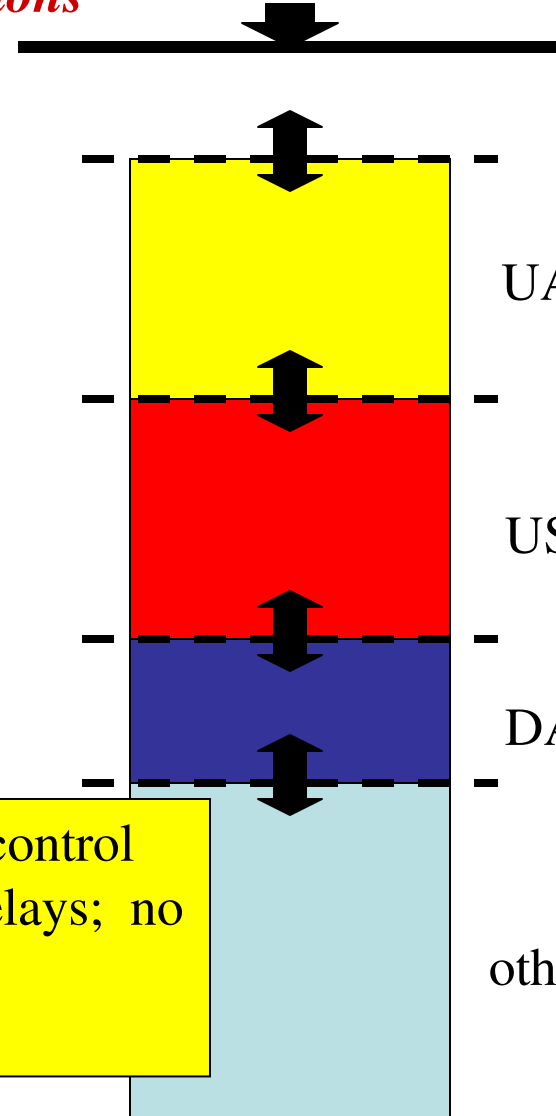
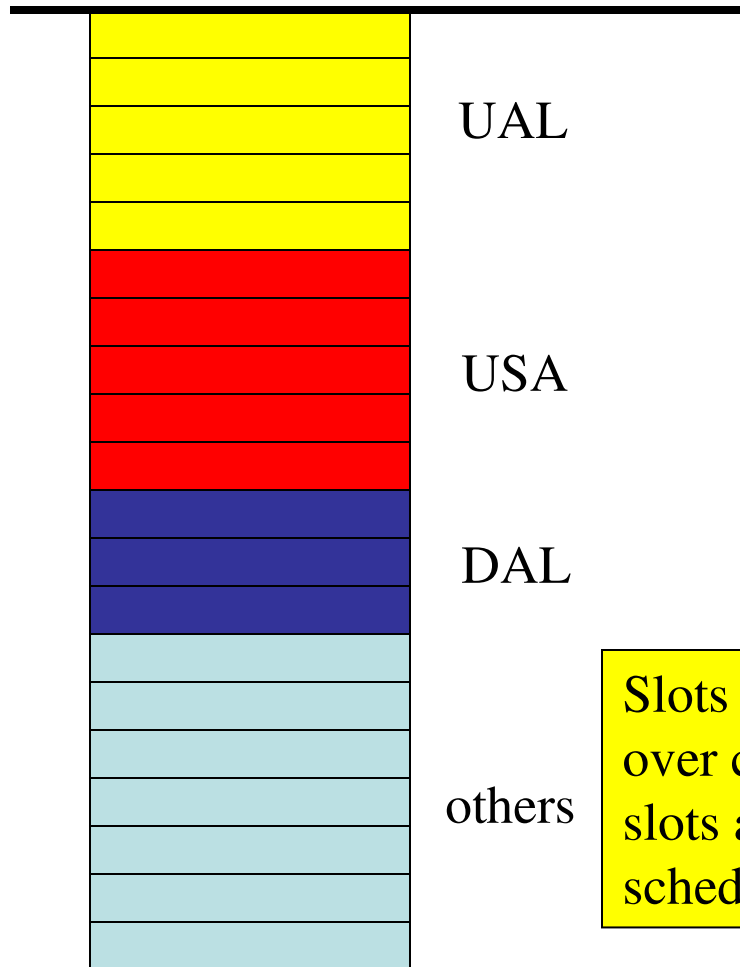
*(Congestion) Prices provide "incentive" to limit operations*

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**SLOTS**

*Fixed limit on number of operations*

**NO SLOTS**

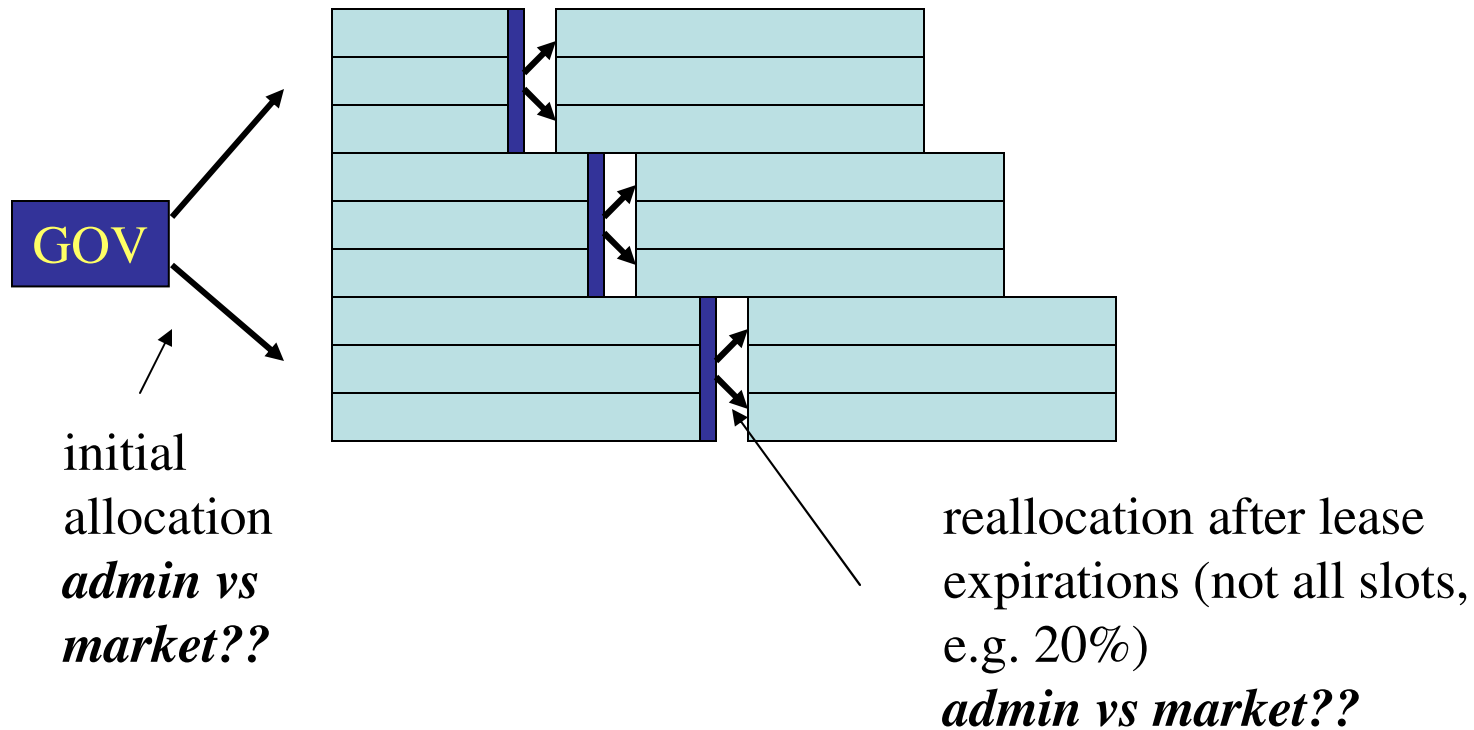


Slots allow for strong control over congestion and delays; no slots allow for carrier scheduling flexibility

# Initial Allocation vs Reallocations



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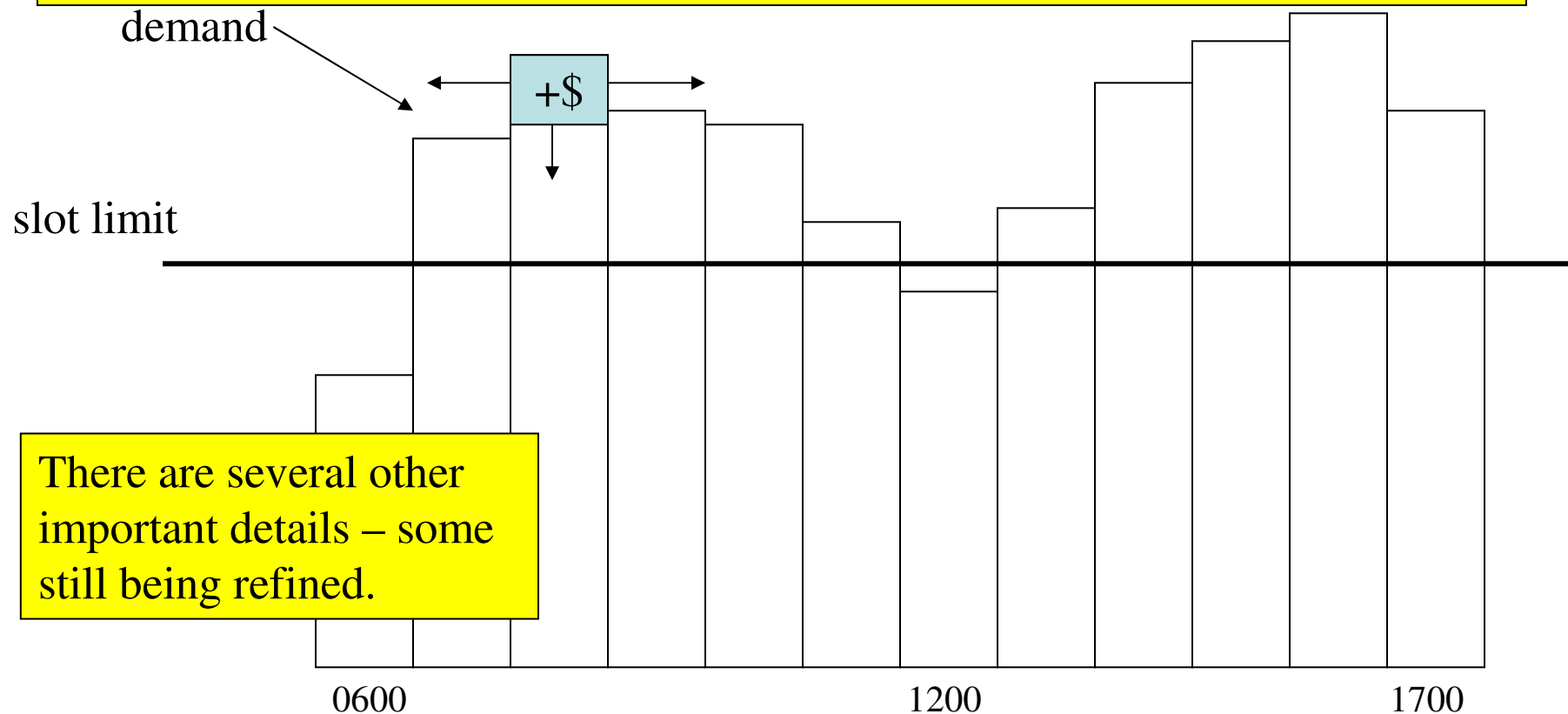


- Initial allocation and reallocations can be performed by different mechanisms.
- With staggered lease lifetimes reallocations will be “incremental”, e.g. deal with only 20% of slots.

# Auction Mechanism Design

## Simultaneous clock auction

- Basic iteration: prices announced by auctioneer; bidders respond with slot quantities desired in each time window
- As prices increase slot demand is decreased or spread across the day.
- Auction ends when demand  $\leq$  slot limit (appx) in all time windows



There are several other important details – some still being refined.

# Feedback from Mock Auction



Basic approach “works” and is technically feasible from a software and communications perspective.

Airline business models were too simplistic:

- Ability to use new slots is heavily dependent on ability to acquire other LGA resources, e.g. gate access, overnight parking, etc.
- Value of service to city-pair market depends not only on profitability of that market but also on network-wide contributions
- Time & type of service offered to market depends on a variety of fleet constraints.

Several carriers expressed desire to see competitors’ bids during course of auctions (this is generally considered to be undesirable since it encourages strategic and/or collusive behavior).

→ Airlines *may* approach slot valuation/bidding from a very strategic perspective, e.g. treat slots as fungible financial assets.

- New secondary market and existing swap market may become very important.
- Brokers and intermediaries may enter the picture.

# Complete Slot/Auction Proposal



- Slots with staggered 5-year lifetimes
- Initial allocation: administrative measure based on incumbency rights (initial lease lengths: 1+  $Y$  yrs, 2+  $Y$  years, 3+  $Y$  yrs, 4+  $Y$  yrs, 5+  $Y$  yrs :  $Y$  is transition increment)
- Reallocation via auction
- Secondary market that is “almost identical” to primary market
- Rebates on slot fees for use in designated small communities.

# Congestion Pricing Proposal



FAA defined delay targets identify two classes of airports: *type A* – (mildly) unacceptable congestion; *type B*: chronically congested. independent pricing board employed.

**Type A:** weight based landing fee replaced by flat fee – if this doesn't reduce delay sufficiently then pricing board would set higher fees.

## **Type B:**

Non-scheduled operations limited to fixed number per time period – pay same congestion fee as scheduled operators

Exempt operations identified – pay revenue neutral flat fee.

Carriers submit confidential proposed schedules 120 days in advance, including gate information.

Pricing board examines schedules and publishes proposed congestion fees within 3 days.

Carriers submit revised schedules within 3 days.

Process continues until pricing board determines that congestion target will be met.

Board shall have flexibility to allow some positive or negative deviation from final schedule on a case-by-case basis.

# Comparison



Both approaches provide “jolt” to system:

- AC: limited slot lifetimes, need to pay for slots
- CP: no slots

AC advantages:

- slots → control over congestion & delay;
- finite slot life + market-based reallocation → robust business environment

CP advantages:

- no slots → elimination of “slot overhead” (strategic behavior, secondary market, etc.);
- carrier scheduling flexibility (*note: the approach given only has partial flexibility since schedule changes are restricted*)

# Comparison (cont)



## AC disadvantages:

- slots → limitations on airline flexibility
- transition period may postpone impact.

## CP disadvantages:

- uncertainty regarding congestion & delays
- pricing inefficiency – too low or too high

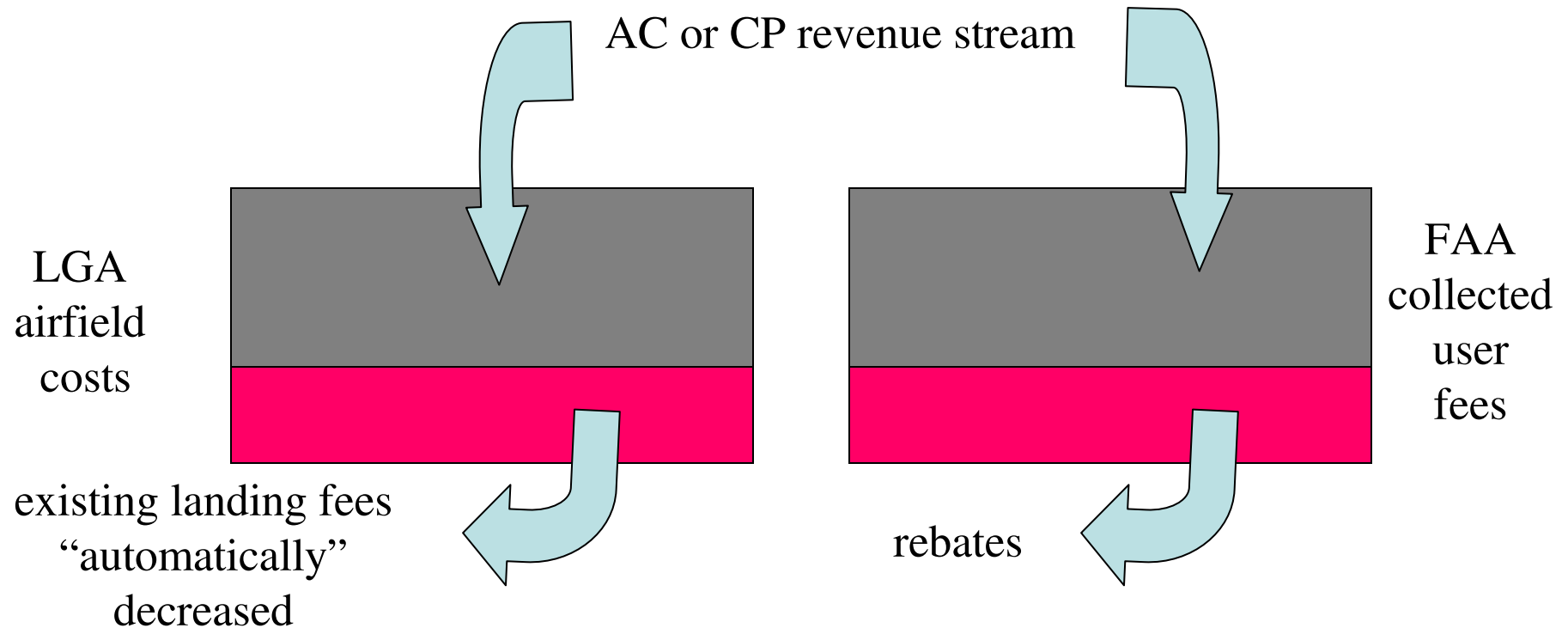
## AC & CP disadvantage:

new regulatory infrastructure

## New revenue stream:

- New financial burden on airlines.
- Could off-set existing distortionary fees.
- Could provide funds for capacity and useful investments.

# Using New Revenue Stream to Off-set Existing Distortionary Fees



The current fee structure is “distortionary”

- Cost imposed on system  $\neq$  fees paid  $\rightarrow$  fees encourage misuse of resources
- Consideration should be given to displacing existing fees, e.g. landing fees & FAA collected user fees.

# LGA Resources



- LGA is heavily resource-constrained, e.g. gates, overnight parking, baggage handling, etc.
- Historically, carriers have adjusted to schedule changes through gate trading, subleasing, etc; subleasing arrangements “work” but can be cumbersome and financially undesirable; PANY&NJ typically plays strong role in facilitating such changes.
- 2 common-use gates.
- Most gates subject to long-term leases; however, many have 30-day termination clauses.
- Carriers have typically made substantial investments (and incurred debt) in gates they lease; if PANY&NJ exercises 30-day clause, then they are liable for associated debt.
- ***Promising concept: exchange property rights ceded to carriers, e.g. initial slot leases, for gate reallocation flexibility.***



Status: FAA/DOT currently preparing  
NPRM