Free Flight Phase I: Metric Valuation

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Components of FFP1

- URET - User request evaluation Tool - Enroute
- pFAST - Passive final approach Spacing Tool - Terminal
- TMA - Traffic Management advisor - Enroute, Terminal
- SMA - Surface Movement Advisor - Terminal
- CDM - Collaborative decision-Making with Airline Ops center - Pre - flight, Enroute
  - > NAS Status Information(NASSI)
  - > Enhanced ground Delay Program (GDP-E)
  - > Collaborative Routing (CR)

Note: each component is a different production function in an integrated environment with affects on different attributes in the set.

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FFP1 Performance Metrics

Key Metrics going across components are:

- safety - operational errors
- access - actual arrival rate, number of unused slots, number of cancellations and substitutions
- delay - average taxi time, average gate delay, average time difference cross meter fix to time cross threshold
- predictability - variability in taxi times, average fuel usage, variability in flow rates, variability between scheduled and actual times of departure - arrival-pushback
- flexibility - time spent near or on desired route and/or altitude, number of restrictions eliminated, average flying distance
- productivity - average throughput per sector per unit time

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Essential Elements of Performance Measures

Four essential elements of performance measures

- Set out in simple way the rationale of each measure
- Set out the data requirements to obtain meaningful measures
- Quantify the overall performance of within the carrier or FAA system
- Map the index of performance to a large number of partial measures and contextual/operational factors

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NAS Performance metrics

- Quantify by airline by quarter - winter 95 through summer 97 (ASQP)
- use flight based approach to summarize data
- use principal component analysis to collapse 7 metrics into smaller number of factors

TABLE 1. PERFORMANCE METRIC DEFINITIONS

Variable (in Log form)	Definition
Average Arrival Delay	Difference between scheduled and actual arrival time, averaged over all flights.
Average Departure Delay	Difference between scheduled and actual departure time, averaged over all flights.
Average >15 min Arrival Delay	Sum of all arrival delays in excess of 15 minutes, divided by total number of flights.
Arrival Delay Variance	Variance of the difference between scheduled and actual arrival time.
Departure Delay Variance	Variance of the difference between scheduled and actual departure time.
Unreliability	Proportion of flights with an arrival delay over 15 minutes.
Cancellation Rate	Proportion of flights cancelled.

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Problems or Issues

- What is being maximized - total surplus?
- How handle trade-offs between different players - Pareto improvements?
- There is no market in which these services are bought and sold - how do establish value?
- Is the counterfactual a point or envelope?
- Measures do not distinguish passengers, cargo and passenger WTP
- marginal and average distinctions may be important
- program externalities (synergies) are not considered
- How are networks included?
- How are behavioral shifts due to underpricing considered?
- How is the marginal gain in attributes attributed across programs?
- Is the correct objective function to minimize the total of (pax/cargo costs+airport costs+FAA infrastructure costs+airline costs)

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Valuation

- Is ‘willingness-to-pay’ the correct concept for establishing value? - is value linked to traditional metrics (RPM, flight time)?

- Are improvements in [productive] efficiency sufficient for establishing value?
  - is this a rent transfer to the airlines?
  - how is productivity to be measured, TFP? Gross or net?

- Will we experience the ‘tragedy of the commons’ with FFP1 with no mechanism to transfer property rights?

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Approaches

- Cost or production functions for airline or airport systems
- Stated preference experiments to establish WTP
- Linking measures with performance attributes using micro analytics to tie individual metrics to a set of expected benefits.
  - > **Reliability** delay, variance in flight time missed connections impacts DOC (airline) and demand attribute (passenger valuation)
  - > **Predictability** fuel burn, variance in stages of flight from push-back to gate increases capital costs and reduces factor efficiency DOC (airline), fleet planning (airline) and demand attribute (passenger valuation)

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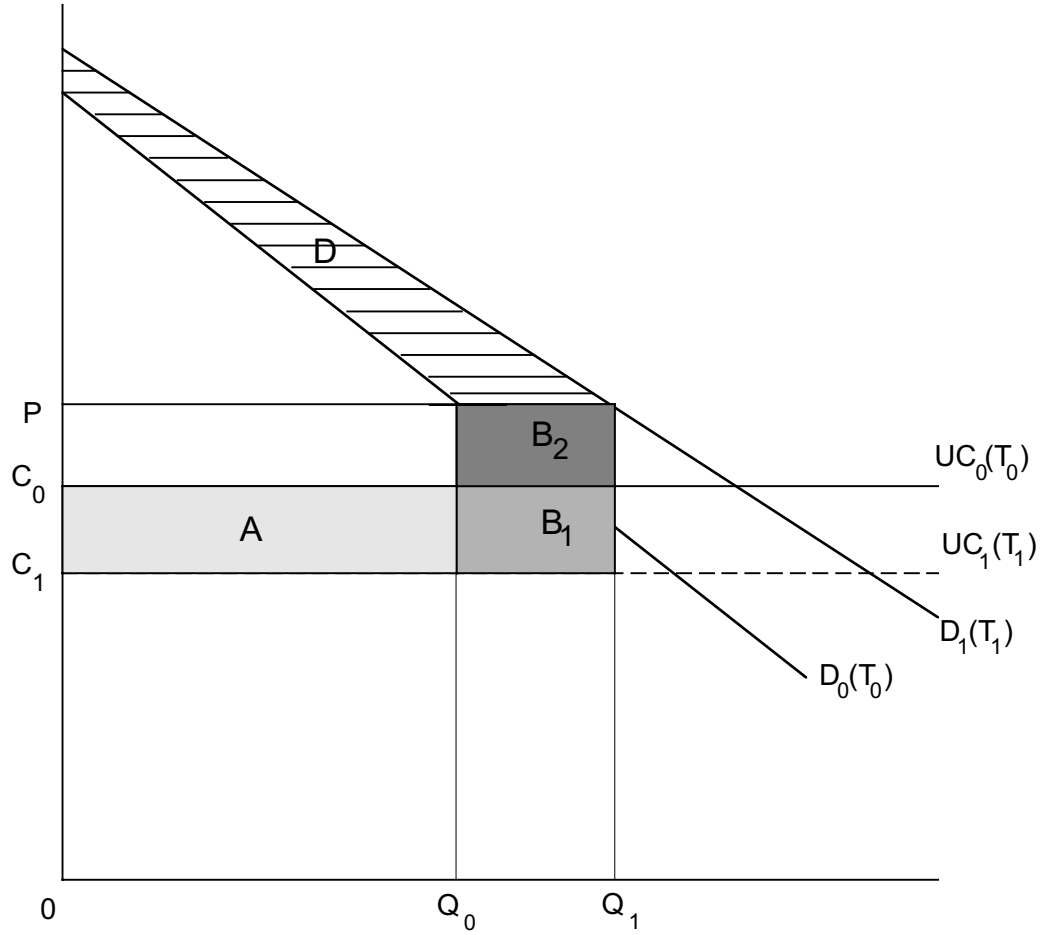
Examples using Delay



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Governance as Technological Change

- FFP1 represents a new way of using system capacity without [necessarily] investing in infrastructure (in the traditional sense)
- As a 'new technology' it is similar to the application of ITS in the roadway system
- To evaluate, and specifically to value, this new technology, we have to value the demand for airline service by passengers and shippers or we have to value the demand for infrastructure by carriers but not both
- FFP1 will affect airports differently and at different paces (inter-temporal differences)
- Need to distinguish scale, capacity utilization, factor price and technological change effects
- Governance can be modeled using transactions cost or contract theory (economics of information in a principal agent setting)

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Future Research

- Develop a set of micro-processes that link metric changes with benefits accruing to airlines, passengers and the aviation system
- Establish the linkage between the attribute affected and the management decision for the airline (e.g. if we improve flexibility by allowing airline to select rank order of importance of flights at arriving airport (one with greater number of connecting passengers) how does this impact passenger valuation of service and airline costs
- Examine which attribute is relatively more important and which component of FFP1 can provide it most efficiently.
- Simulate the expected gains to the aviation system with a realistic integration in FFP1 and identify the gainers and potential losers

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