

Convenient Flight Connections vs. Airport Congestion: Modeling the 'Rolling Hub'

by

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INTRODUCTION

In 2002, **American Airlines depeaked its hubs**, adopting a 'rolling hub' concept.

Lowered congestion and operating costs, but **lengthened** layover times.

Although **Delta and United** followed suit, the carriers are now abandoning the rolling hub, '**rebanking**' their hubs.

Scott Kirby, American CEO said:

“Although the continuous [rolling] hub lowered operating costs, the lost revenue outweighed the savings.”

Marilyn DeVoe, vice president of AA’s Miami hub said:

“Our hubs are all about connecting people, and rebanking allows us to do that more effectively.”

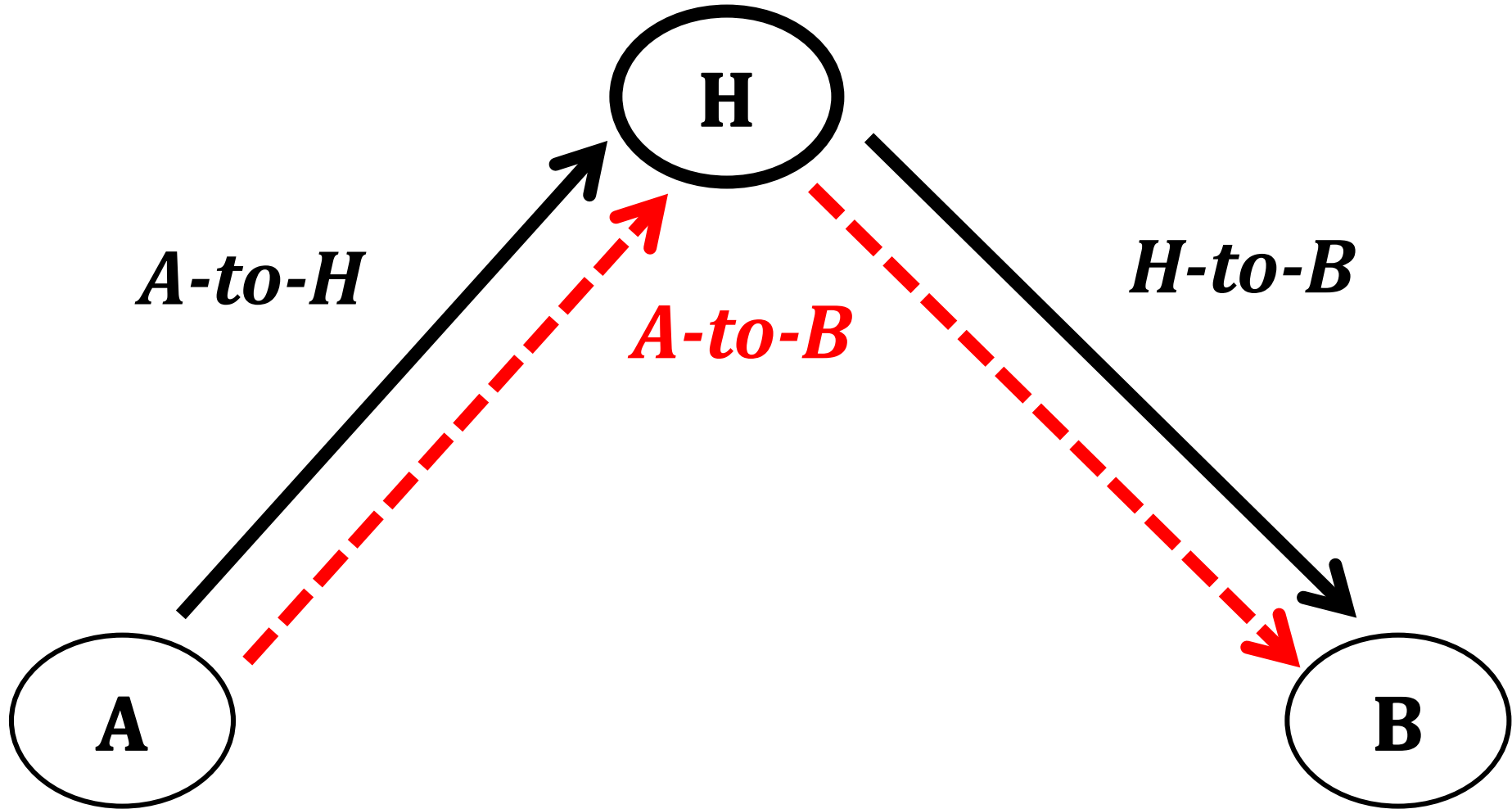
Lots of work has been done on the **economics of hub-and-spoke networks.**

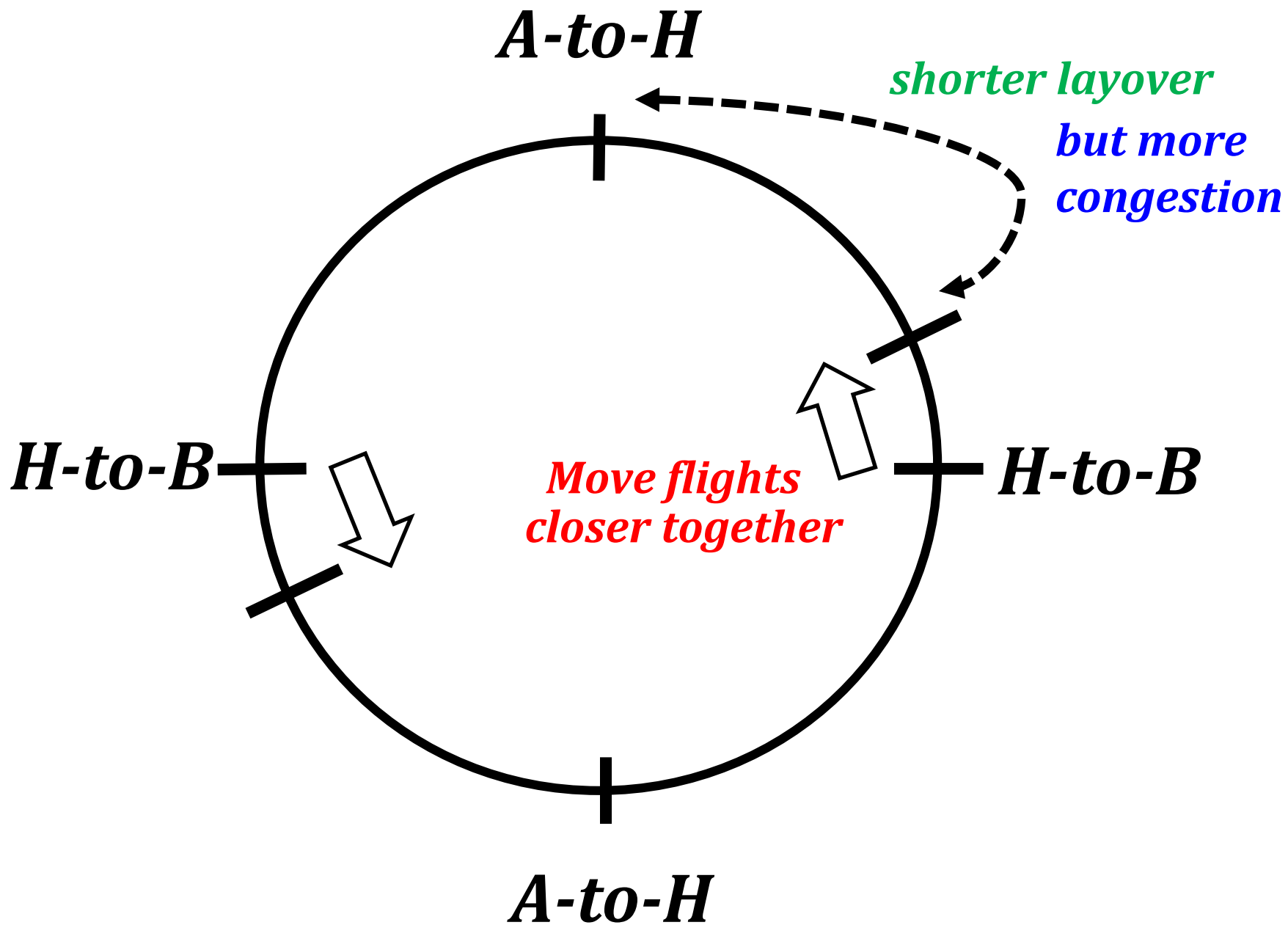
But the rolling-hub trade-off (convenient connections vs. airport congestion) **has never been analyzed.**

Paper **does so.**

It's technical, but the ideas can be **simply explained.**

CONTINUOUS MODEL





Airline **incurs costs** due to congestion.

So do passengers, which **reduces their willingness-to-pay** and **hence the fare** the carrier can charge.

For both reasons, **profit falls as congestion increases.**

But passengers are **willing to pay more for a shorter layover**, offsetting this effect.

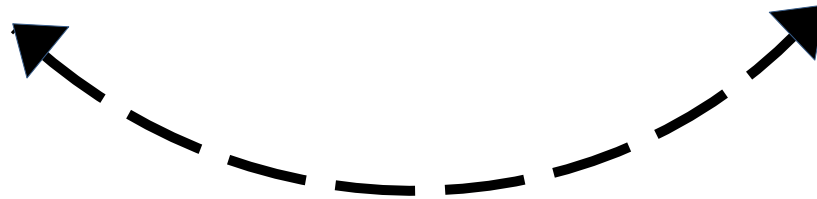
Airline **balances these two forces** in spacing its flights.

DISCRETE MODEL

Monopoly hub airline serves N endpoints over two periods (one flight to each)

period 0

period 1



*connecting passengers incur a **LAYOVER cost** if their endpoints are served in **DIFFERENT PERIODS***

BUNCHING FLIGHTS IN ONE PERIOD ELIMINATES LAYOVERS BUT WORSENS CONGESTION

MONOPOLY SOLUTION:

If layover cost is *high* relative to congestion costs:

period 0

0 endpoints served

period 1

N endpoints served

If layover cost is *low* relative to congestion costs:

period 0

N/2 endpoints served

period 1

N/2 endpoints served

Add M fringe carriers to airport:

HUB CARRIER

period 0



period 1



FRINGE CARRIERS

period 0



period 1



If hub carrier moves a flight from period 0 to 1



then a fringe flight moves from period 1 to 0 to equalize profit



*GOOD FOR HUB CARRIER since congestion unaffected
but layovers fall*

SOLUTION WITH FRINGE:

HUB CARRIER

period 0

X endpoints served

period 1

N - X endpoints served

FRINGE CARRIERS

period 0

M endpoints served

period 1

0 endpoints served

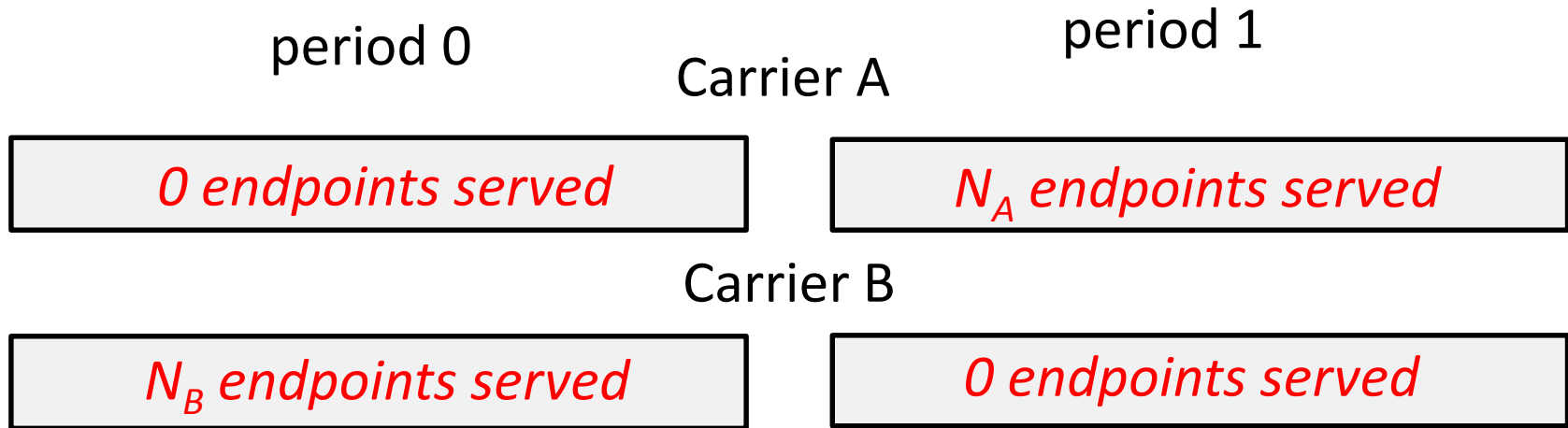
$$0 \leq X \leq (N - M)/2 \quad (\text{value depends on layover cost})$$

So hub carrier serves at least $(N + M)/2$ endpoints in period 1

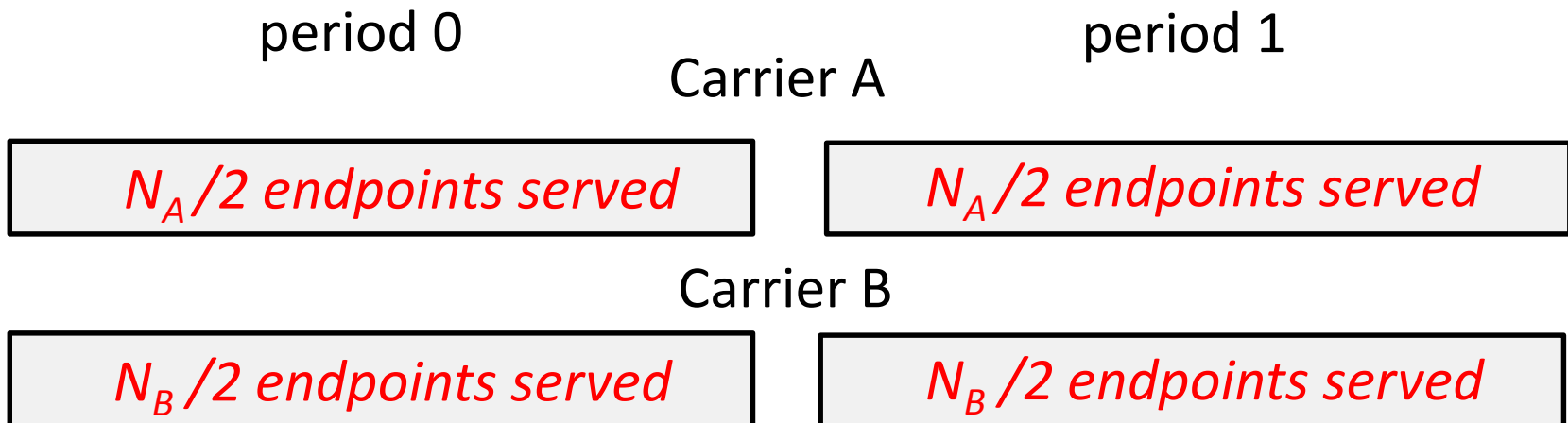
ITS FLIGHTS ARE MORE CONCENTRATED THAN IN MONOPOLY CASE

SOLUTION WITH TWO HUB CARRIERS (NO FRINGE):

If layover cost is *high* relative to congestion costs:



If layover cost is *low* relative to congestion costs:



SOCIAL WELFARE?

Are outcomes **socially optimal, minimizing the sum** of layover and congestion costs?

Answer is **YES** in monopoly case (monopoly has no market power).

But in any situation where **different** carriers both **operate flights in the same period**, outcome is **inefficient**.

In fringe case, hub carrier's flights are insufficiently concentrated (too many in period 0).

In two-hub-carrier case, if carriers are present in the same period, more separation is better (but not necessarily complete separation).

The reason is a **congestion externality**.

In moving a flight into a period, a carrier does not consider increase in **congestion cost of other airlines** operating there.

But the carrier does consider the effect on congestion **experienced by its own flights (internalization)**.

Congestion tolls can remedy this problem.

CONCLUSION

Analysis provides **some insight** into the rolling-hub trade-off.

Most-realistic case combines hub carrier with fringe.

Model says that the **fringe carriers avoid the hub carrier's period-1 bank**, while the hub carrier may operate some flights outside the bank (in period 0).

If so, **that number is too large** because of uninternalized congestion.

Does the model **help explain the rise and fall** of the rolling hub?

Various mechanisms in the model could possibly account for this pattern, but **none is compelling**.

Better explanation is **pure experimentation**: the airlines tried the rolling hub and eventually realized that it **wasn't beneficial**.