Assessing consumer welfare impacts of aviation policy measures

Airline responses, lumpy capacity and hub rationalization

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Presentation for ITF Round Table:
Assessing regulatory changes in the transport sector

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Message for today

1. **Assessment of economic impacts of aviation investments and policy measures recurrent topic**
   - E.g. Deregulation, aviation taxes, increases in competition, airport charges
2. **Within a CBA framework, important part of effects are consumer welfare gains/ losses due to changes in travel costs and passenger demand**
3. **Generally, these are *first order* impacts. *Second order supply effects* generally not taken into account**
4. **But airline seat capacity is lumpy: airlines cannot adapt seat capacity continuously to changing demand.**
   - Capacity adjustments: aircraft type changes, frequency changes, route closures/ openings, base closures/ openings
   - Second order impacts can be substantial as lumpiness may leverage initial demand effects
5. **Policy makers and regulators should be aware of potential second order supply effects**
6. **We present a model to take into account first and second order consumer welfare impacts**

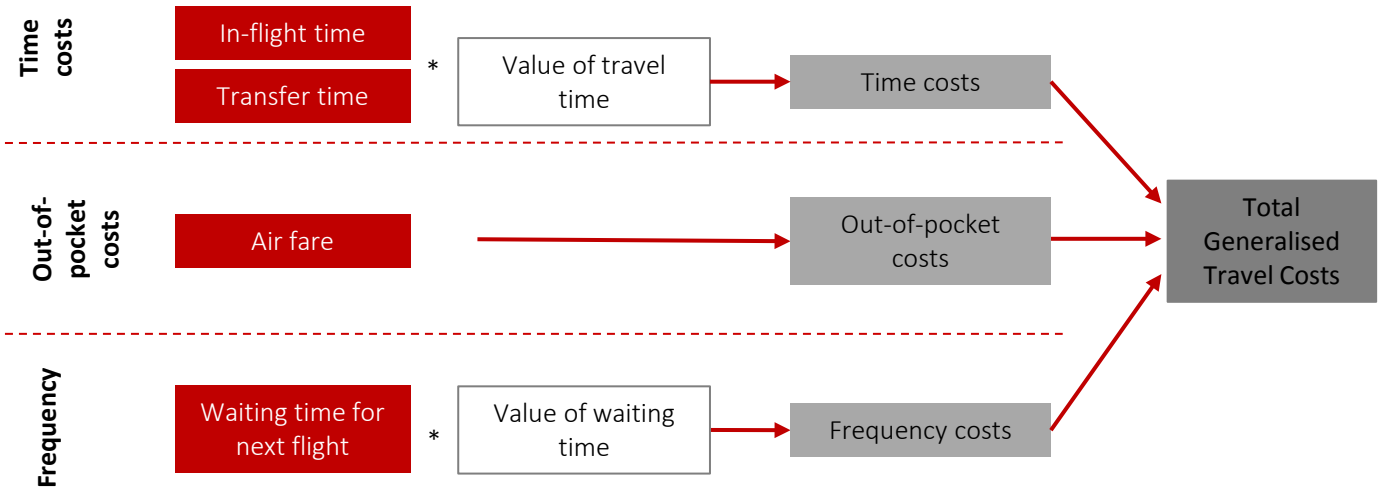
Outline

- Consumer welfare impacts
- Airline supply responses
- The Hub Network Rationalization Model
- Case study: hypothetical rationalization of the Amsterdam hub
- Conclusions

CBA and consumer welfare impacts

- **Investments in aviation infrastructure as well as policy measures increasingly assessed with Cost-Benefit Analysis (CBA)**
- **Direct consumer welfare impacts/ consumer surplus generally important part of the equation**
  - Relate to the changes in generalized travel costs for getting from A to B as a result of a certain policy intervention, as well as the change in demand (market (de)generation)
  - Generalized travel costs: out-of-pocket costs (e.g. ticket fare) + valuation of time

Generalised Travel Cost of an air trip



NetCost model estimates changes in generalized travel costs, demand and consumer welfare

- **Identifies all direct and indirect travel options in a certain market**
- **Measures all *inconveniences* (=generalized travel costs) to get from initial origin to final destination**
  - In the base case (=reference situation) and in a policy scenario

- **NetCost estimates changes in:**
  - Generalized Travel Cost
  - Total passenger demand
  - Demand distribution over various travel options
  - Consumer welfare

See Lieshout & Matsumoto (2012); Lieshout (2012)

Illustration market distribution with NetCost

Paris CDG - Singapore market:

Origin	Hub	Dest.	Carrier	Frequency		Seats		Generalised travel costs (€)				Est. share
				Leg 1	Leg 2	Leg 1	Leg 2	Fare	Time	Sch. delay	Total	
CDG		SIN	SkyTeam	7		363		995	474	4	1473	**27%**
CDG		SIN	STAR	7		409		1009	474	3	1486	**24%**
CDG	CPH	SIN	STAR	22	5	156	282	676	878	3	1557	**5%**
CDG	KUL	SIN	OneWorld	7	48	459	158	750	841	6	1597	**5%**
CDG	MUC	SIN	STAR	44	7	136	278	748	852	3	1603	**4%**
CDG	AMS	SIN	SkyTeam	81	6	164	341	746	857	4	1606	**4%**
CDG	SGN	SIN	SkyTeam	7	15	315	182	715	897	4	1616	**3%**
CDG	ZRH	SIN	STAR	41	12	129	335	812	850	3	1665	**3%**
CDG	RUH	SIN	SkyTeam	9	2	196	341	564	969	4	1537	**3%**
CDG	BKK	SIN	STAR	8	65	448	307	767	881	3	1651	**3%**
CDG	CAI	SIN	STAR	11	3	258	285	606	963	3	1572	**2%**
CDG	CMB	SIN	Srilankan Airlines	4	14	272	141	650	936	14	1600	**2%**
Other indirect travel alternatives												**19%**

Note: for illustration purposes only

Example: consumer welfare impacts of allocation additional traffic rights to a third country carrier

	Reference situation	Change	Scenario
Third country carrier			
Flights/ year	365	365	730
Passengers / year	146 553	58 060	204 613
Of which are:			
Direct origin-destination pax	45 041	8 572	53 613
Beyond the hub pax	101 512	49 488	151 000
European carrier			
Passengers/ year	595 351	-26 969	568 382
Consumer welfare impacts			
Consumer welfare impact all passengers travelling from/to the European country		EUR 19.7 million	
Consumer welfare impact residents European country		EUR 9.9 million	
Impact on revenues European country carrier		-22%	

Source: OAG; NetCost; Note: for illustration purposes only

Other issues to consider when estimating first order consumer welfare impacts

- **It is a network industry!**
  - Direct and indirect (transfer) travel options should be taken into account when assessing the impacts in a certain market
- **The level of *pass through***
  - To which extent do airlines pass through cost changes to their clients?
- **Airport capacity constraints**
  - When demand is larger than supply, scarcity rents may arise in the aviation value chain
  - Policy interventions that enlarge capacity at constrained airports may lead to reduction of scarcity rents and lower user prices
  - Increases in airline costs at constrained airports may be absorbed by the airlines at the expense of scarcity rents

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But what if airlines adjust capacity?

- **GTC modelling can be used to estimate *first order* consumer welfare impacts**
- **However, airlines may react to changing demand and route profitability**
  - Such supply reactions will affect generalized travel cost in the market, and again, demand
- **Supply reactions are important to consider because airline seat capacity is lumpy at various levels**
  - Airlines find it difficult to adjust capacity continuously to changing demand
- **Ergo: airline supply function is not smooth but discontinuous (Starkie & Yarrow 2013)**

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Second order impacts?

Source: OAG; NetCost; Note: for illustration purposes only

Airlines can adjust capacity in various ways

- Use of different aircraft
- Adjust route frequency
- Route closure/ opening
- Base closure/ opening
- Hub rationalization/ building

- But:
  - Flexibility within the own fleet generally limited
  - Minimum competitive frequencies may be necessary to keep routes profitable

➢ Eventual impact on demand/ welfare may be larger than the initial demand/ supply impacts

➢ Or, as Starkie & Yarrow (2013) put it: *elasticities at airports can be leveraged because of the lumpiness of airline seat capacity*

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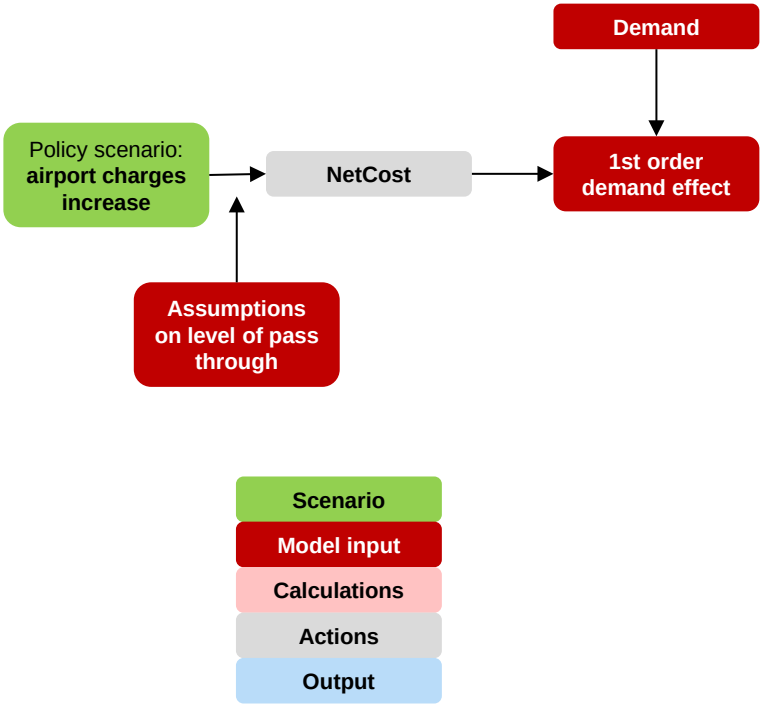
Hub Network Rationalization (HNR) Model to include the impact of lumpy airline supply decisions on consumer welfare

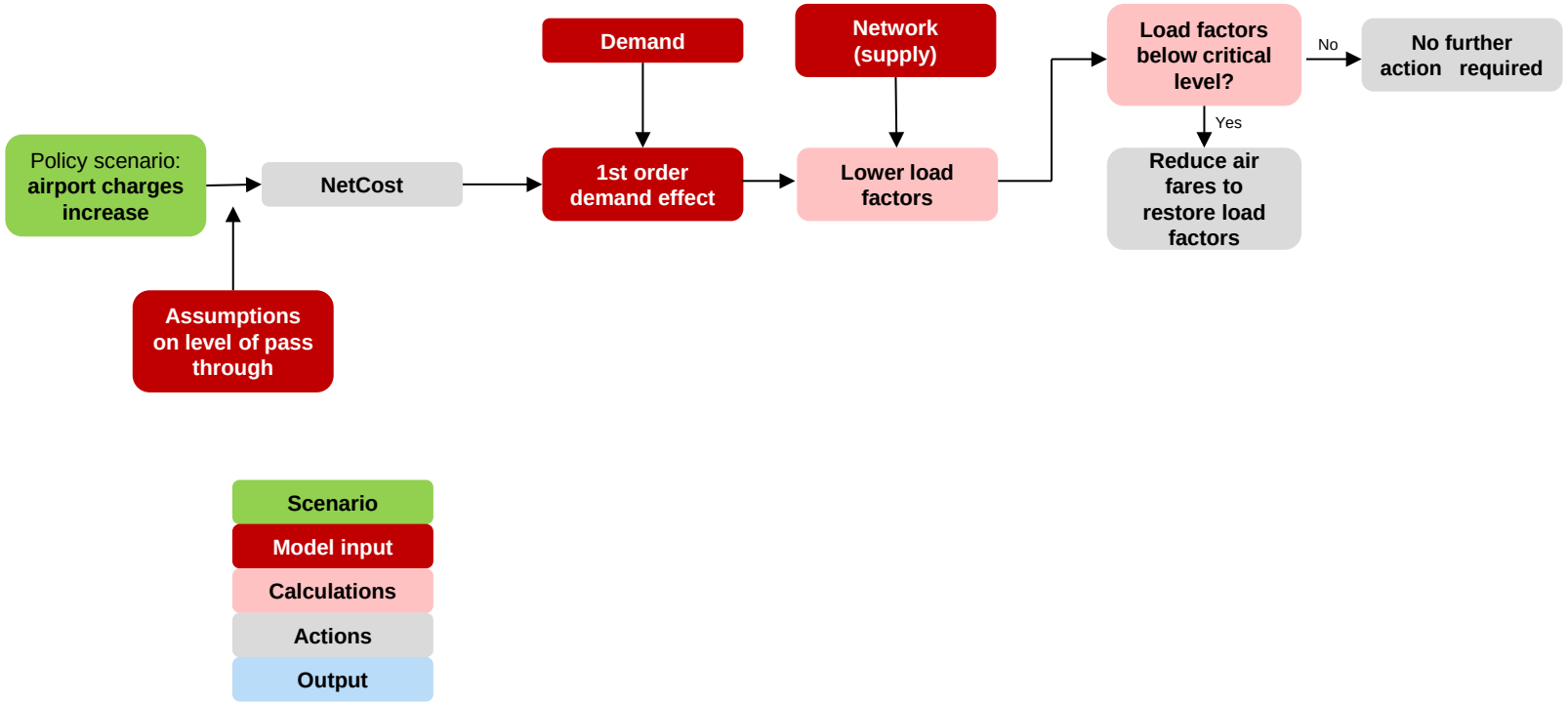
1. **Demand impacts of a policy intervention are estimated using NetCost (or are exogenously given)**
2. **HNR model then simulates iteratively supply reactions of a (hub) carrier when it is confronted with lower passenger demand**
   - Fare, frequency and route adjustments (including route closure)
   - HNR model simulates new airline entry (if feasible)
3. **When a stable situation is reached, the model estimates impacts on demand, connectivity, generalized travel costs and consumer welfare (in comparison to a reference situation)**

- **HNR model can be used for any airport/ airline, but shows its real value at transfer hubs**
  - Frequency reductions at one route affect passenger numbers at other routes

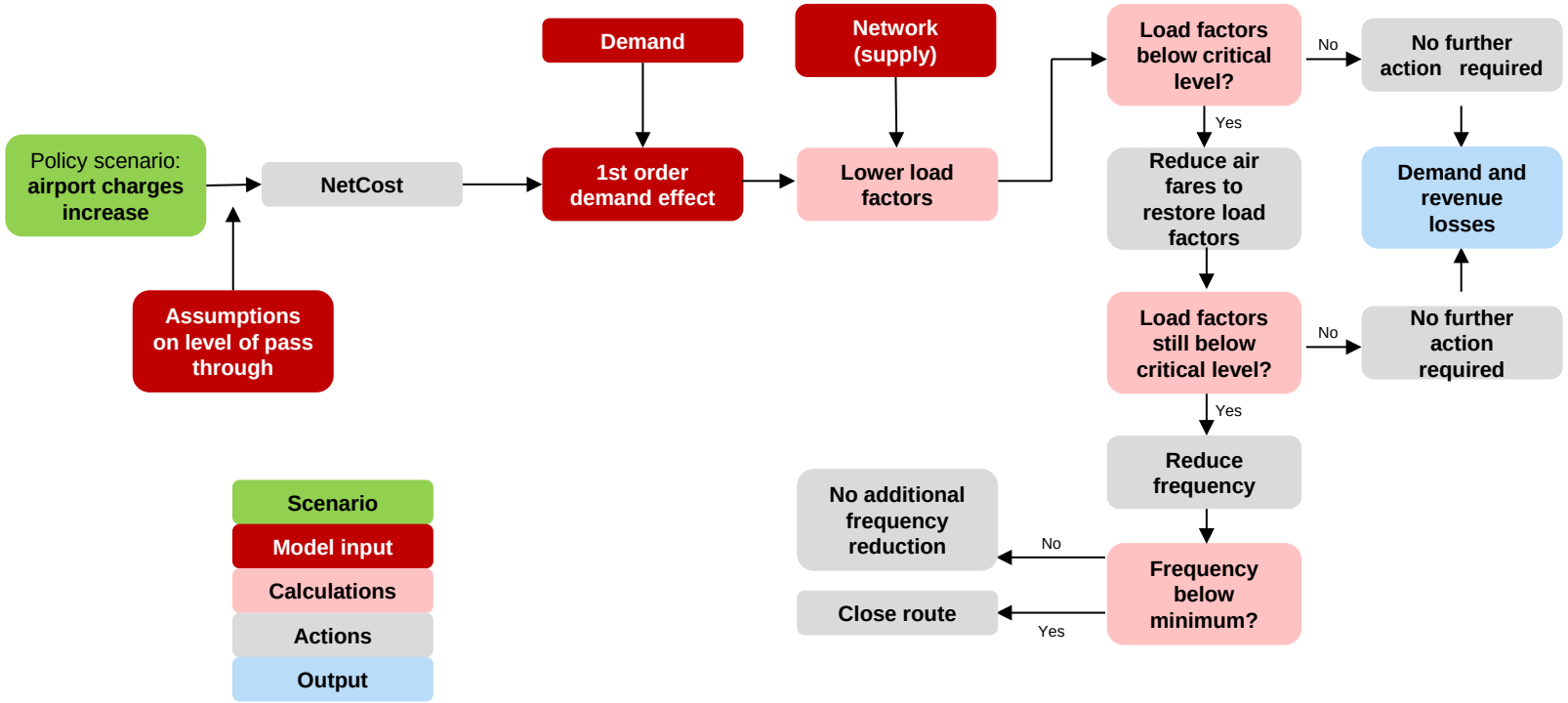
HNR-model: estimate initial demand impacts



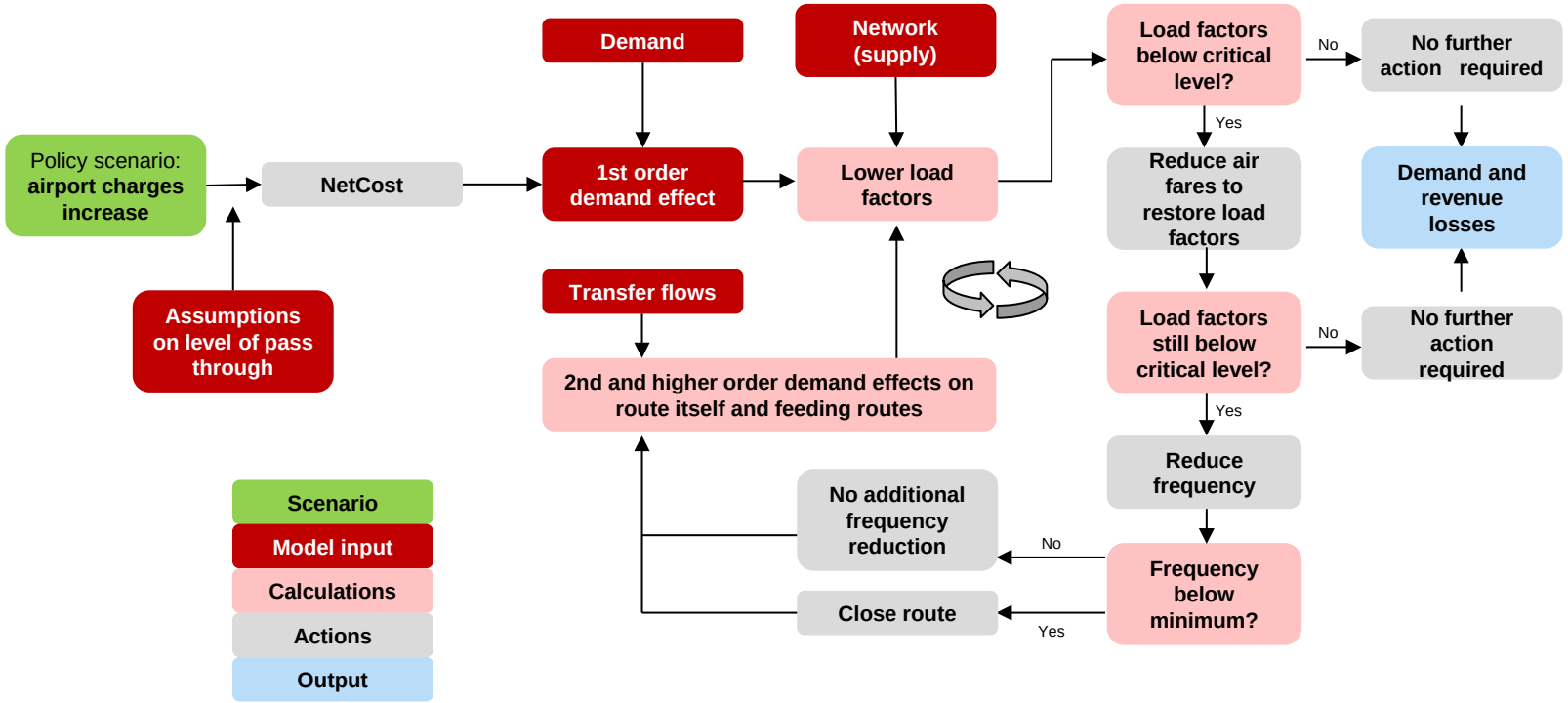
HNR-model: assess potential airline responses



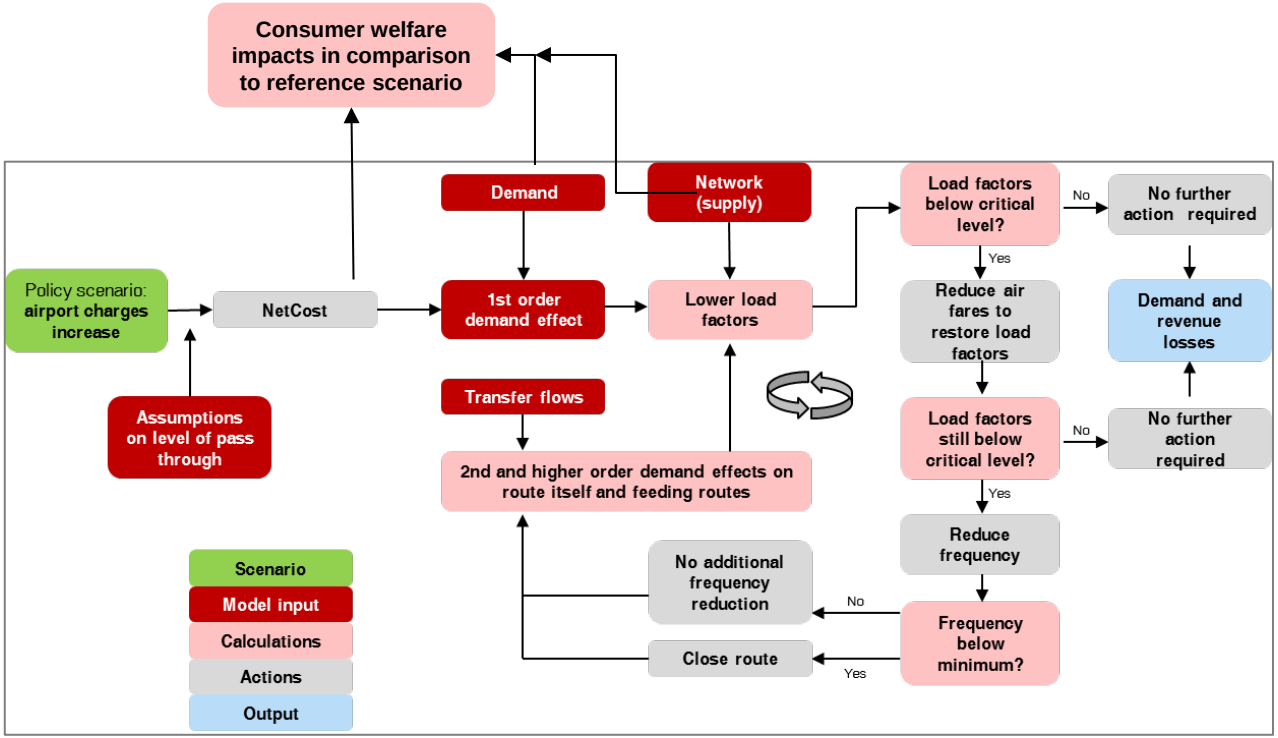
HNR-model: assess potential airline responses and impact on demand



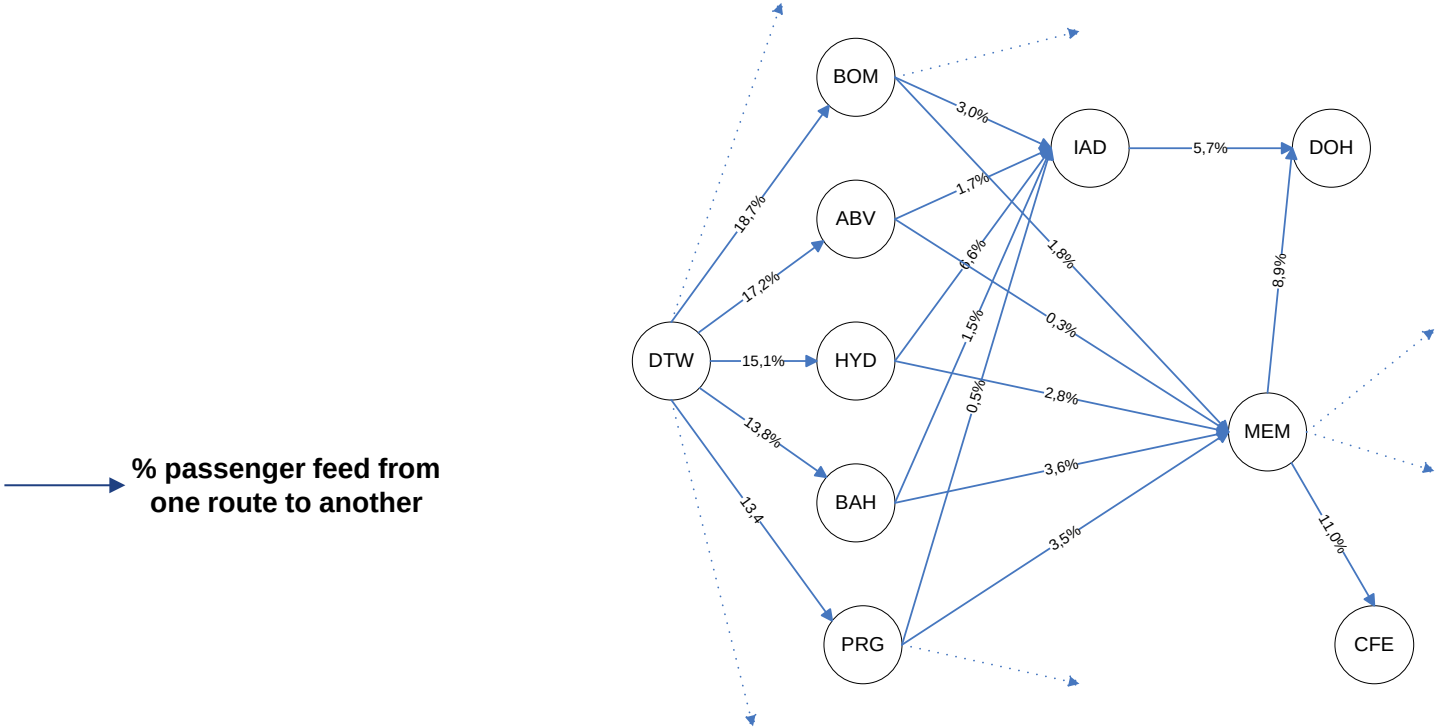
HNR-model iterates until stable situation is reached



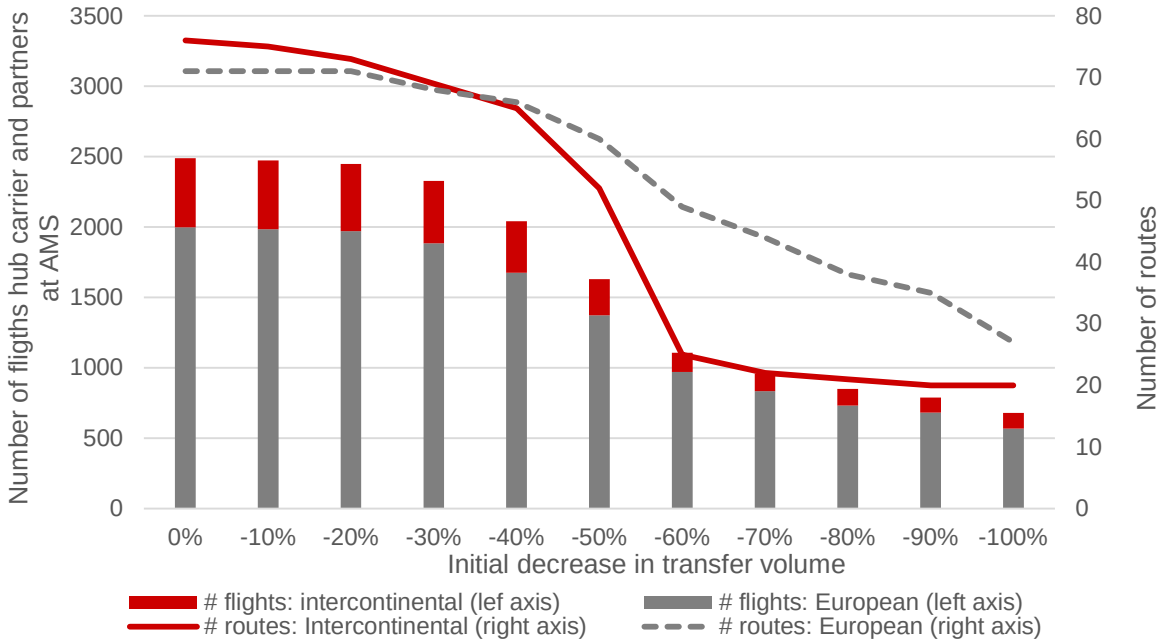
Calculate consumer welfare impacts in comparison to reference situation



HNR-model in particular suitable for hub airports: feeder relations of the Amsterdam-Detroit (DTW) route



Hub networks robust for rationalization up to a certain point, but there is risk of a ‘domino effect’



Source: HNR-model; MIDT adjusted passenger booking data for Amsterdam Schiphol; OAG data; SEO (2015)

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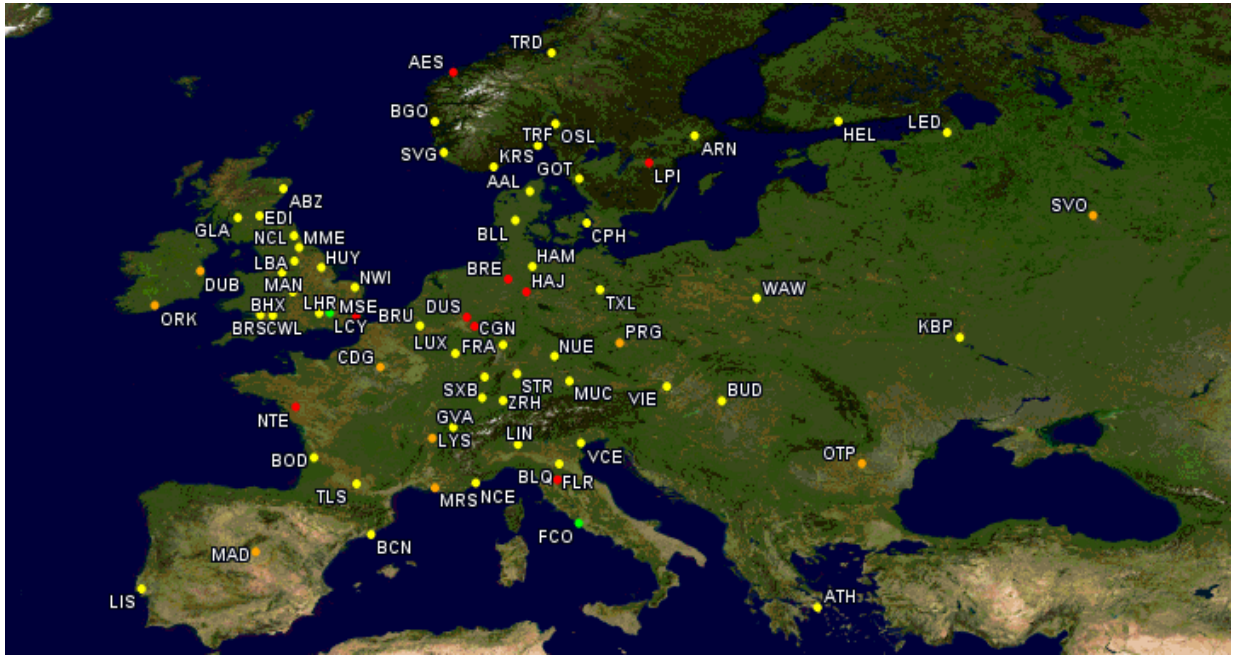
Example: rationalization of the SkyTeam hub at Amsterdam to illustrate HNR-model

- **Welfare and network impacts of the *hypothetical* rationalization of the SkyTeam network at Amsterdam**
- **Non-hub scenario: hub carrier and partners decide to close entire hub operation at Amsterdam**
- **Remaining network will be supported mainly by local OD traffic**
- **New airlines may enter the market**

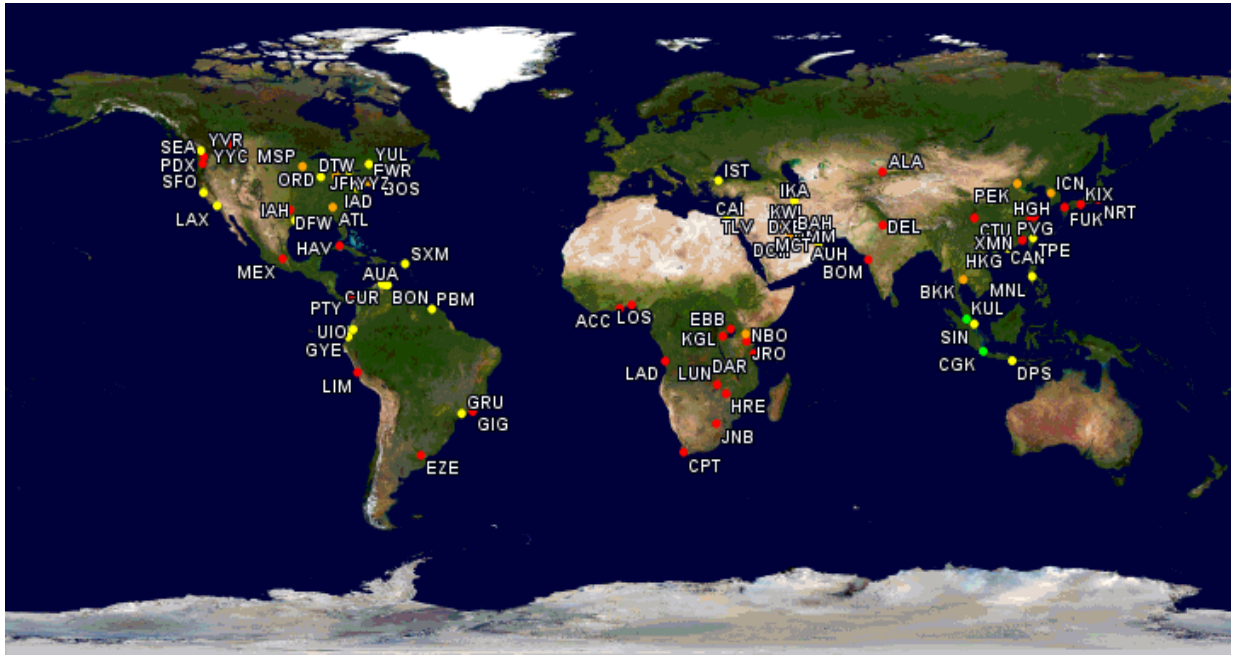
- **Using the HNR-model, what network will remain and what are the consumer welfare impacts?**

European network in a non-hub scenario



- SkyTeam frequency maintained
- Direct AMS service cancelled
- Destination served by other airlines
- SkyTeam frequency decreases

Intercontinental network in a non-hub scenario



- SkyTeam frequency maintained
- Direct AMS service cancelled
- Destination served by other airlines
- SkyTeam frequency decreases

Decrease in the number of directly served routes and frequencies

Routes		Type of route	Number of weekly flights						Number of destinations					
			Absolute number			% change			Absolute number			% change		
			Hubcarrier and partners	Other carriers	Total	Hub carrier and partners	Other carriers	Total	Hub carrier and partners	Other carriers	Total	Hub carrier and partners	Other carriers	Total
Routes served by hub carrier & partners		Europe	315	1 051	1 366	-84%	90%	-46%	11	55	62	-85%	67%	-13%
		Intercontinental	100	222	323	-80%	75%	-48%	15	32	44	-80%	52%	-42%
		Subtotal	415	1 273	1 688	-83%	87%	-47%	26	87	106	-82%	61%	-28%
Other routes		Europe		485	485		0%	0%		69	69		0%	0%
		Intercontinental		162	162		0%	0%		46	46		0%	0%
		Subtotal		647	647		0%	0%		115	115		0%	0%
Total routes AMS		**Europe**	**315**	**1 536**	**1 851**	**-84%**	**48%**	**-39%**	**11**	**124**	**131**	**-85%**	**22%**	**-6%**
		Intercontinental	**100**	**384**	**484**	**-80%**	**33%**	**-38%**	**15**	**78**	**90**	**-80%**	**16%**	**-26%**
		Total	**415**	**1 920**	**2 336**	**-83%**	**45%**	**-39%**	**26**	**202**	**221**	**-82%**	**20%**	**-16%**

Consumer welfare impacts in a non-hub scenenario (x mln year) in comparison to the 2013 situation

		Scenario	
		Non-hub	Partial dehubbing
Effects for Dutch users of air transport services	Fare/ competition	-66	-20
	Connectivity	-154	-46
	Landside access costs	-370	-78
	Total	-590	-145

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Conclusions

- ***First order*** **consumer welfare impacts in air transport can be assessed using the usual transport model formulations**
- **However, airline seat capacity is lumpy**
  - Airlines cannot adjust capacity continuously to changing demand
- **Lumpiness can leverage initial elasticities**
- **Rationalization of airline hubs can eventually result in a 'domino effect', although hubs are quite robust up to a certain level**
- **The HNR-model allows to estimate (part of) the second order impacts**

Policy recommendations

- **Policy makers and regulators should take into account risk of potential *second order* supply impacts**
- **Applications of the presented approach are numerous:**
  - **(De)regulation of aviation markets**
  - **Impact of greater airline competition**
  - **Introduction of air travel taxes**
  - **Changes in airport charges, ATC costs, security costs**