

## Introduction

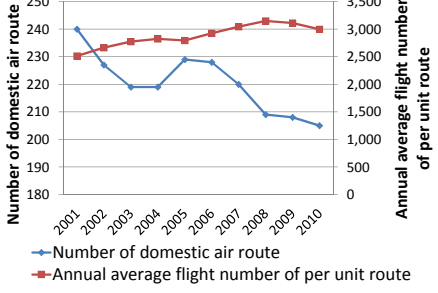
### The impact of deregulation for aviation market

In Japan, the number of abandoned domestic air routes has been increased after the deregulation of airfare and new entry to air routes

The central government is considering the new support scheme for sustainable regional air networks

The criteria to subsidize for the regional air routes is not clear

### The number of domestic air route and average frequency/route



### Support schemes

Foreign country	Support schemes
EU : PSO	Central government and local government support to the necessary air routes
US : EAS, SCASDAP	Central government support to communities which is self-help efforts
Japan	Support schemes
	Load-factor-guarantee (Noto – Haneda etc.)
	The Contest in the Landing Slot Allocation Scheme at Haneda (Iwami, Tottori, Yamagata)
	Central government support to subsidy for Island routes
	The central government is considering the new support scheme for regional air networks

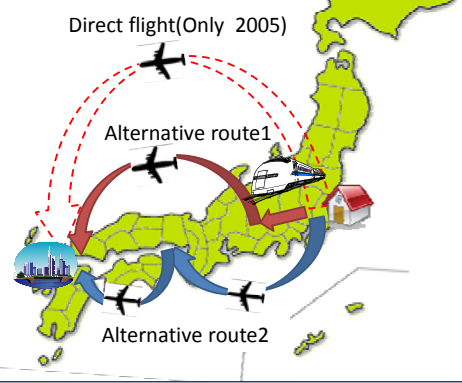
### Purpose

- To analyze the actual change in intercity passenger volume and route choice behaviors after abandoning the direct domestic regional air route in Japan
- To quantify the effect of maintaining the direct air route by the generalized travel cost from the route choice model in small demand market

## Data

### Classification of the targeted air routes

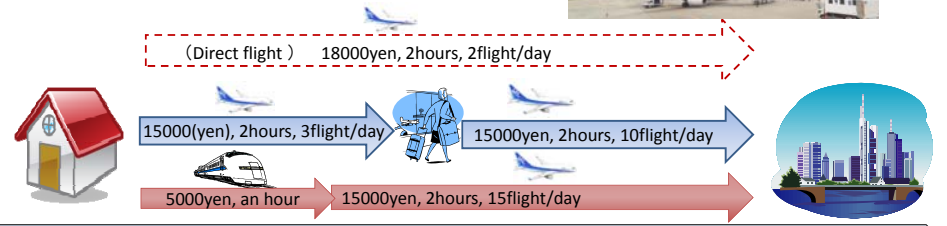
Targeted abandoned air route are 24 between 2005 and 2010



### Extracting the major OD for abandoning air route and source of travel data

- Extracting the ODs which used the targeted abandoned air routes (the ODs with small demand or long access time to the airport are excluded)
- Inter-regional passenger travel data >> Inter-regional Travel Survey in Japan (2005-2010)
- LOS data >> JTB timetable, Route choice informed website, The Minister of Land, Infrastructure, Transport and Tourism (MLIT)

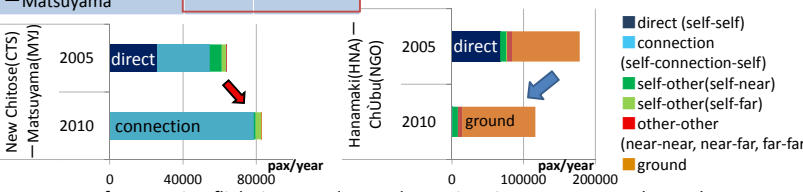
### Examples of LOS data for each routes



## Results and Discussions

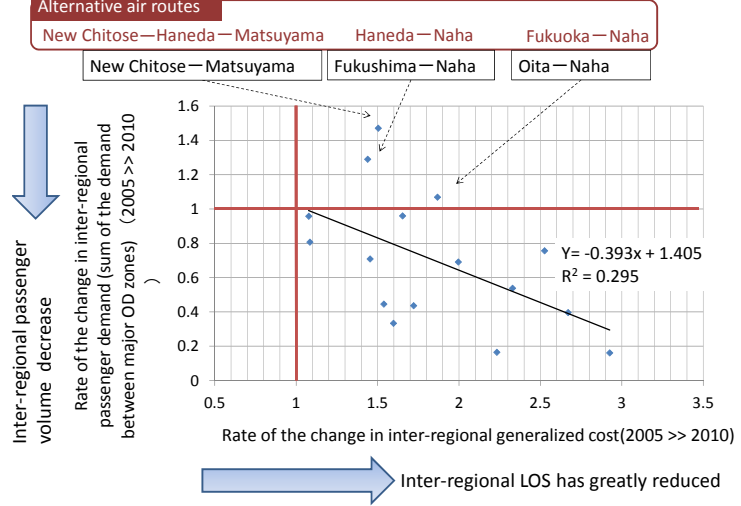
### The changes inter-regional passengers flow(example)

Air routes between major OD zones	Changes of flight frequency (flight/day)		Air routes between major OD zones	Changes of flight frequency (flight/day)	
	2005	2010		2005	2010
New Chitose – Matsuyama	1	Abolition	Hanamaki – Chūbu	3	Abolition
New Chitose – Haneda – Matsuyama	7	9	Sendai – Chūbu	5	5



Frequency of connection flight increased ⇒ passenger volume maintain  
Alternative air route was not changed ⇒ passenger volume greatly reduced

### Generalized cost and flow volume inter-region



### Estimation of the route choice model and calculation of generalized cost of inter-regional travel

$$P_i = \frac{\exp(V_i)}{\sum_{j=1}^K \exp(V_j)} \Rightarrow \ln\left(\frac{P_i}{P_1}\right) = V_i - V_1 = \sum_{k=1}^K \beta_k (X_{ik} - X_{1k})$$

$V_i$ : utility function of route i (utility)  
 $\beta_k$ : The parameters for the variable k  
 $X_{ik}$ : Explanatory variable k of route i

The parameters of the aggregate logit model

Explanatory variable $X_k$	$\beta_i$	t-value	P-value
Total travel time (minute)	-0.0054	-1.84	0.0733
Total cost (yen)	-4.89E-05	-1.80	0.0792
Ln (effective frequency) (flight/day)	0.274	1.67	0.102
Dummy of direct flight (direct flight=1)	1.11	2.15	0.0375

N=47 Adjusted R<sup>2</sup> = 0.29

The inter-regional generalized travel cost are calculated by Logsum variables derived from the estimated the route choice model

$$C_{ij} = \{\ln \sum_k \exp(V_{ijk})\} / b$$

$C_{ij}$ : Generalized cost between zone i and j(yen)  
 $V_{ijk}$ : utility of route k between zone i and zone j  
 $b$ : cost parameters in route choice model

### Conclusion

- We estimated the factor which affects passenger choice behavior in small demand market.
- This study estimated the effect of maintain a direct air route and the criteria for the subsidy base on calculating the generalized cost
- Transport LOS in the alternative routes has an impact on the passenger travel volume, especially High-speed railway development or higher LOS of alternative connection flights after abandoning direct air route