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Air Cargo Revenue Management

Combined Allotment and Spot Market Allocation Model

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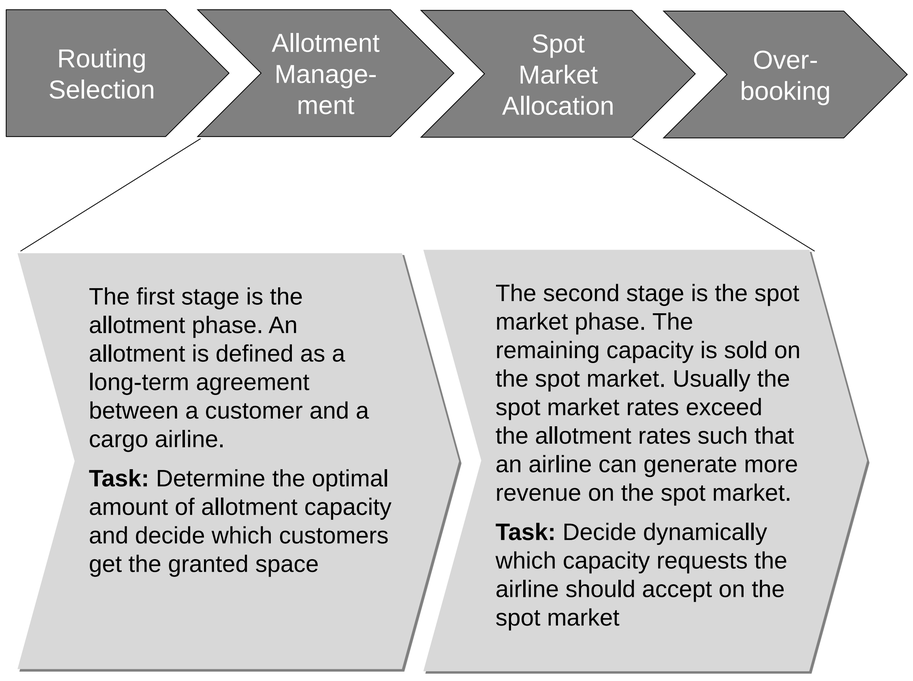
Problem Definition

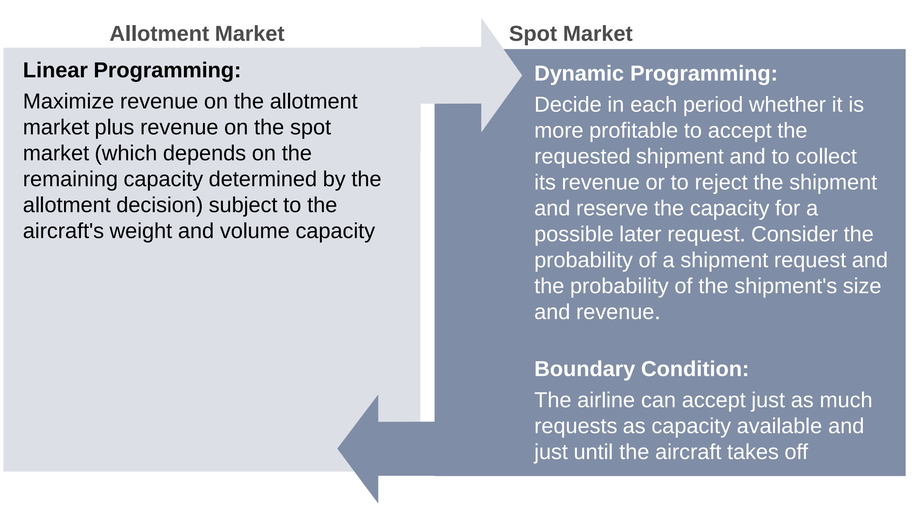
The air cargo industry is often referred to as a prime candidate for applying revenue management techniques. Nevertheless, air cargo revenue management is still underdeveloped compared to the prevailing systems in the air passenger industry. This is due to a relatively high complexity driven by, for instance, multidimensional capacity (volume, weight), uncertainty of available capacity, and a short booking period.
In this thesis we propose a model which integrates two decision problems of cargo revenue management: the spot market allocation problem and the allotment management task. The innovative idea of this integrated approach is that it determines a holistic solution for both planning steps which are traditionally solved in a sequential process.

Air Cargo Revenue Management

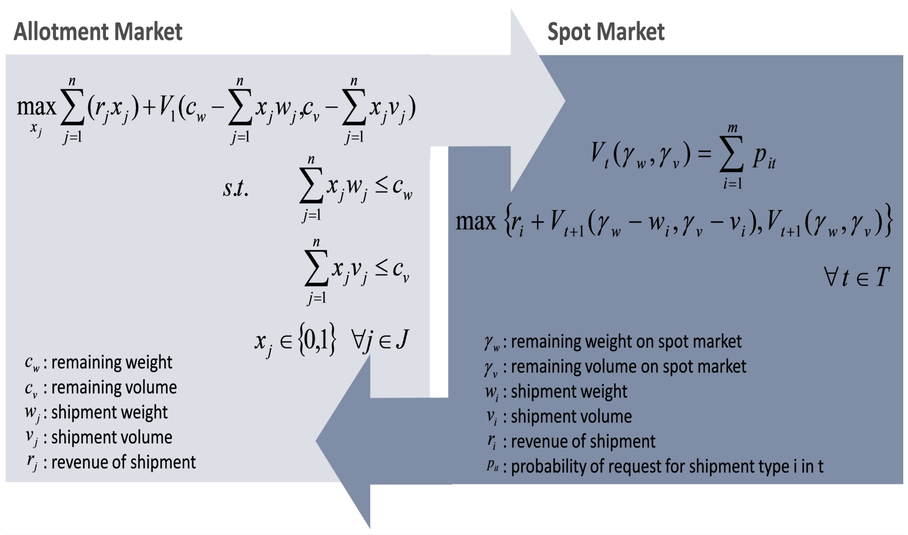
In the first stage of air cargo revenue management, routing selection, a shipment is assigned to a flight leg at a particular time. After the aircraft's capacity has been assigned (allotment management & spot market allocation), a degree of overbooking is determined, and a decision on which shipments will be unloaded in case of an oversold situation is made.



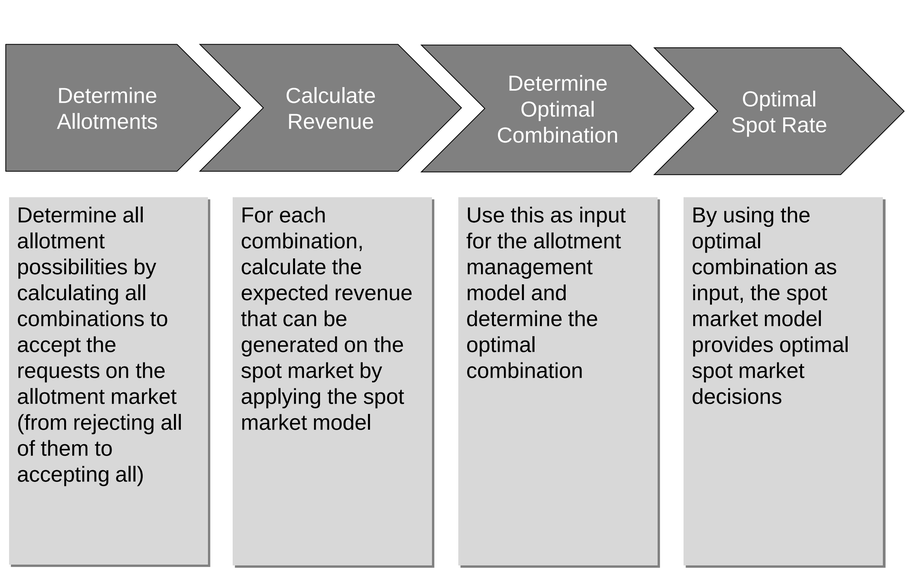
Combining Allotment Management and Spot Market Allocation



The Decision Model



The Solution Procedure



Results

An example case tested the performance of the model by using a Middle East airline's data. The model generated a revenue increase of 29.64% to 243.13% compared to a first-come, first-served policy on four adequate routes. The combined optimization is particularly adapted for the air cargo industry since both optimization problems depend on each other. Therefore, an integrated optimization assures a maximum overall revenue improvement. As expected, it is noticeable that the model generates the highest revenue increase on routes with sparse capacity compared to a high amount of booking requests

Flight	a/c weight	a/c volume	# Ship-ments	FCFS	Combined model	Revenue improve-ment
A	4845 kg	12.64 m^3	72	$ 2,693	$ 9,241	243.13 %
B	555 kg	3.17 m^3	4	$ 375	$ 700	86.56 %
C	11,935 kg	31.05 m^3	12	$ 11,153	$ 14,459	29.64 %

This thesis was written in co-operation with Lufthansa Consulting