

|| Contents

Preface

1	Introduction	1
1.1	Motivation	1
1.2	Product differentiation and discrete choice theory	2
1.2.1	Product differentiation	3
1.2.2	The discrete choice model and (air) transport demand analysis	4
1.3	Developments in the aviation industry	5
1.3.1	Low-cost carriers	7
1.3.2	Intermodal transport	7
1.4	Research objectives and outline	9
2	Vertical product differentiation in a multi-product monopoly using a random utility framework	13
2.1	Introduction	13
2.2	Background	14
2.3	Heterogeneous demand in observed attributes	17
2.4	Heterogeneous demand in observed and unobserved attributes	23
2.4.1	Nested logit model	23
2.4.2	Unobserved inter- and intra-product heterogeneity	25
2.4.3	Numerical results	29
2.4.4	Welfare comparison	32
2.5	Conclusion	33
	Appendix 2A: First order conditions and implicit analytical solution	35
	Appendix 2B: Patterns of product differentiation in the social optimum	37
3	Vertical product differentiation in multi-product duopolistic aviation markets	39
3.1	Introduction	39
3.2	Model	41
3.2.1	Background	41
3.2.2	Market coverage	42
3.2.3	Number of variants-then-quality-then-price game	43
3.3	Consumer behaviour	44
3.4	Market configurations: Low-cost carrier versus legacy carrier	47
3.5	Numerical results	49

3.5.1	Patterns of product differentiation	49
3.5.2	Multi-product strategies and profitability	51
3.6	Conclusion	55
	Appendix 3A: Numerical method	58
	Appendix 3B: High level of unobserved heterogeneity and symmetry	59
4	Loyalty programs and consumer behaviour: The impact of FFPs on consumer surplus	61
4.1	Introduction	61
4.2	Frequent flier programs	63
4.2.1	Basic mechanism	63
4.2.2	Airline X's FFP	65
4.3	Modelling purchase frequency and transaction size	65
4.4	Data and empirical specification	68
4.4.1	Data	68
4.4.2	Modelling transaction size	70
4.4.3	Modelling purchase frequency	72
4.4.4	Consumer surplus analysis	74
4.5	Results	74
4.5.1	Transaction size model	74
4.5.2	Effect of fare and goal distance in points on transaction size	77
4.5.3	Purchase frequency model	79
4.5.4	Effects on consumer surplus	81
4.6	Conclusion	82
	Appendix 4A: Definition and construction of variables	84
	Appendix 4B: Derivation of compensating variation	86
	Appendix 4C: Elasticities of market share with respect to fare	87
	Appendix 4D: Combined fixed and random effects (hybrid) model	88
	Appendix 4E: Unconditional fixed effects negative binomial model	89
5	Capacity choice under uncertainty with product differentiation	93
5.1	Introduction	93
5.2	The model	95
5.2.1	Basic set-up	95
5.2.2	Demand uncertainty	96
5.3	Existence of pure strategy equilibria	97
5.4	Mainly vertical product differentiation	99
5.4.1	Contested monopoly region	99
5.4.2	Residual monopoly region	100
5.4.3	Bertrand-Edgeworth duopoly region	101
5.4.4	Capacity stage	101
5.5	Results	103
5.5.1	Profit maximising capacities	104
5.5.2	Welfare maximising capacities	106
5.5.3	Efficiency	107
5.5.4	Price dispersion	108

5.6 Conclusion	109
Appendix 5A: Degree of vertical product differentiation and the low-quality firm	111
Appendix 5B: Contested or residual monopoly	112
Appendix 5C: Pure or contested monopoly	113
Appendix 5D: First-best solution	114
6 Intermodal competition in the London-Paris passenger market: High-speed rail and air transport	115
6.1 Introduction	115
6.2 Empirical analysis	116
6.2.1 Data	116
6.2.2 Model	123
6.2.3 Results	125
6.3 Elasticities of market share and market developments	129
6.4 Conclusion	133
Appendix 6A: Definition and construction of the variables	135
Appendix 6B: Cross-elasticities of market share	136
Appendix 6C: Exit and the elasticity of market share with respect to frequency	138
7 Conclusions and discussion	139
7.1 Results	139
7.2 Implications and directions for further research	142
References	145
Samenvatting (Summary in Dutch)	155