Michael Becker-Peth

Behavioral Supply Chain Contracting

Decision Biases in Behavioral Operations Management



Edition KWV

Die "Edition KWV" beinhaltet hochwertige Werke aus dem Bereich der Wirtschaftswissenschaften. Alle Werke in der Reihe erschienen ursprünglich im Kölner Wissenschaftsverlag, dessen Programm Springer Gabler 2018 übernommen hat.

Weitere Bände in der Reihe http://www.springer.com/series/16033

Michael Becker-Peth

Behavioral Supply Chain Contracting

Decision Biases in Behavioral Operations Management



Michael Becker-Peth Wiesbaden, Germany

Bis 2018 erschien der Titel im Kölner Wissenschaftsverlag, Köln Dissertation Universität zu Köln, 2012

Edition KWV ISBN 978-3-658-23884-1 ISBN 978-3-658-23885-8 (eBook) https://doi.org/10.1007/978-3-658-23885-8

Library of Congress Control Number: 2018968334

Springer Gabler

© Springer Fachmedien Wiesbaden GmbH, part of Springer Nature 2012, Reprint 2019 Originally published by Kölner Wissenschaftsverlag, Köln, 2012

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer Gabler imprint is published by the registered company Springer Fachmedien Wiesbaden GmbH part of Springer Nature

The registered company address is: Abraham-Lincoln-Str. 46, 65189 Wiesbaden, Germany

Acknowledgements

It started five and a half years ago and was more like a vision. It started to be reality and grew over the time and looking at the results makes me somehow proud. This it not only true for my thesis, but also to my beloved children, Luis and Marie. Writing his PhD thesis is a special time, becoming father twice during that time makes it even more special.

First of all I would like to thank my supervisor Professor Ulrich Thonemann. He first introduced me to the field of Behavioral Operations Management and I really learned a lot during the countless hours of discussion of how to finalize the papers. I am honestly grateful for the time as a research assistant at his department. I also thank Professor Dirk Sliwka for kindly co-supervising the thesis and Professor Ludwig Kuntz for heading the thesis defense.

I also want to thank Professor Elena Katok for her feedback and suggestions as a coauthor of my first paper. The third chapter of this thesis would not have been possible without Anna-Lena Beutel and Professor Stefan Minner, and I want to thank you, for charing your data, knowledge, time and inspirations with me.

During my time at the University of Cologne I was accompanied by many people. I want to thank my colleagues, Marc Albers, Andreas Brinkhoff, Michael Decker, Nicola Decking, Marcus Dettenbach, Hannah Egbringhoff, André Fuetterer, Torsten Gully, Tanja Haeger, Moritz Heininger, Dominik Heinz, Katja Henne, Kai Hoberg, Simon Höller, Nadine Holtvogt, Christina Jakobs, Sebastian Jucken, Silke Jütte, Kerstin Kubik, Anna Küpper, Philipp Laufenberg, Katharina Nachtsheim, Philipp Naujoks, Ulf Merschmann, Karin Möllering, Signe Oepen, Henning Olbert, Raik Özsen, Felix Papier, Vladislav Richter, Kathrin Rieger, Johanna Rosenbusch, Lisa Scheele, Stefanie Schiefer, Frank Schneider, Monika Scholz, Jeanette Seifert, Marcel Sieke, Analena Stern, Carina von Weyhe, Alexander Weyers, and Jingnan Zhu for being my colleagues and friends.

Especially, I would like to thank Alexander Weyers, Torsten Gully and Lisa Scheele for sharing the office with me and the numerous discussions we had together.

I also want to thank my brother Andreas Becker for proofreading my thesis and my parents Ute and Manfred Becker for raising my interest in business and research topics and for enabling me to do my (PhD-) studies.

At last, I am deeply grateful to my family: Frauke, Luis and Marie. During this special time you were always there when I needed you. You supported me whenever I needed it and with everything you could do. Luis and Marie: Thank you for being the most important thing in my life. And Frauke, this thesis would not be possible without you, thank you for your endless hours of patience and babysitting when I sat at my computer writing this thesis and for motivating me when I did not want to sit down:

Thank you Frauke!

Cologne, 2012 Michael Becker-Peth

Contents

LIS	st or	Figure	5	х
Lis	st of	Tables		хi
Lis	st of	Abbrev	viations	xii
Lis	st of	Symbo	ols	xiii
1.	Intro	oductio	on	1
	1.1.	Motiva	ation	1
	1.2.	Behav	ioral Decision Making	4
	1.3.	Outlin	e	7
	1.4.	Contri	butions	8
2.	Des	igning	Contracts for Irrational but Predictable Newsvendor	10
	2.1.	Introd	$ uction \dots $	10
	2.2.	Analy	tical Background	12
	2.3.	Develo	opment of Behavioral Model	13
		2.3.1.	Effect of Contract Parameters on Orders	14
		2.3.2.	Mental Accounting	16
		2.3.3.	Behavioral Model	18
	2.4.	Design	of the Main Experiment	19
	2.5.	Analys	sis of Behavioral Models	22
		2.5.1.	Aggregate Behavioral Model	23
		2.5.2.	Individual Behavioral Model	26
	2.6.	Valida	tion Experiments	30
		2.6.1.	Individual Behavioral Contracts	31
		2.6.2.	Aggregate vs. Individual Behavioral Contracts	37

Contents

		2.6.3.	Training vs. Individual Behavioral Contracts	38
	2.7.	Structu	ıral Insights	40
	2.8.	Implica	tion for Theory and Practice	41
	2.9.	Conclus	sion	42
	2.10.	Proofs		44
	2.11.	Additio	onal Data	47
3.	Con	tract S _l	pecific Reference Points in Supply Contracts	53
	3.1.	Introdu	action	53
	3.2.	Analyti	ical and Behavioral Background	54
		3.2.1.	Analytical Model of Supply Contracts	54
		3.2.2.	Behavioral Aspects of Supply Contracts	55
	3.3.	Referen	nce Dependent Utility	57
		3.3.1.	Initial Experimental Analysis of Revenue Sharing Contract	58
		3.3.2.	Reference Dependent Valuation	61
		3.3.3.	Reference Points and the Effect on Supply Contracts	62
	3.4.	Revenu	e Sharing Experiment	66
		3.4.1.	Experimental Design and Laboratory Protocol	66
		3.4.2.	Experimental Results	67
		3.4.3.	Estimation of Reference Points	69
	3.5.	Structu	ral Insights and Implications for Contract Design	71
	3.6.	Conclusion and Outlook		
	3.7.	Proofs		73
	3.8.	Additio	onal Data	79
4.	Emp	oirical N	lewsvendor Decision Biases under a Service Level Contract	80
	4.1.	Introdu	action	80
	4.2.	Theore	tical and Behavioral Decision Making in the Newsvendor Setting	81
		4.2.1.	Analytical Model for Service Level Contract	81
		4.2.2.	Behavioral Operations and the Pull-to-Center Effect	83
	4.3.	The En	npirical Newsvendor	85
		4.3.1.	The Setting	85
		4.3.2.	Adaptation of Theories and Derivation of Hypotheses	86

Contents

	4.4.	Empir	ical Analysis	. 88	
		4.4.1.	Expected Profit Maximization	. 88	
		4.4.2.	Service Level Differentiation	. 90	
		4.4.3.	Demand Chasing	. 93	
	4.5.	Conclu	ısion	. 94	
5.	Con	clusion		97	
Α.	Арр	endix		100	
	A.1.	Briefin	ng Documents of Buyback Experiment	101	
	A.2.	Traini	ng Documents for Validation Experiment	105	
	A.3.	Briefin	ng Document for Reduced Revenue Sharing Experiment	110	
	A.4.	Briefin	ng Document for Expectation Experiment	. 114	
	A.5.	Briefin	ng Documents for Revenue Sharing Experiment	117	
Bil	Bibliography 121				

List of Figures

1.1.	Supply contracting setting	2
1.2.	Order quantities in the newsvendor setting	5
1.3.	Order quantities for managers and students in the newsvendor setting $. $.	6
2.1.	Actual mean orders vs. newsvendor orders of laboratory experiment	23
2.2.	Histogram of order quantities for 28 treatments	24
2.3.	Actual and predicted mean orders of aggregate behavioral model	26
2.4.	Predicted vs. actual orders of subject 26	29
2.5.	Actual mean orders vs. newsvendor orders in the validation experiment .	32
2.6.	Mean order quantities with behavioral contracts in the validation experi-	
	ment	35
2.7.	Effects of preferences on contract parameters for first-best order quantities	41
3.1.	Mean order quantities for reduced contracts	60
3.2.	Results of Experiment 3.2	65
3.3.	Results of revenue sharing experiment	68
3.4.	Individual order quantities	69
4.1.	Comparison of newsvendor model and actual decision maker $\ \ldots \ \ldots$	91
4.2.	Comparison of newsvendor model and actual decision maker (continued)	92
4.3.	Service level per product	93

List of Tables

2.1.	Newsvendor orders and actual mean orders of laboratory experiment	22
2.2.	Likelihoods and AICs for different aggregate behavioral models	25
2.3.	Estimated individual preferences	28
2.4.	Newsvendor orders and actual mean orders in Phase $1 \dots \dots \dots$.	32
2.5.	Individual behavioral parameters of subjects in the validation experiment	33
2.6.	Expected profits in validation experiments	37
3.1.	Mean order quantities in the revenue sharing experiment $\dots \dots \dots$	67
3.2.	Estimation results of parameters	70
4.1.	Auto-correlation coefficient of demand	86
4.2.	Estimation results for demand chasing effects	95

List of Abbreviations

BB Buyback

e.g. Exempli gratia

FB First best

i.e. Id est

NV Newsvendor

RS Revenue sharing

SL Service level

WP Wholesale price

List of Symbols

Anchor factor α α^A Aggregated anchor factor Anchor factor for subject n α_n bBuyback price Loss aversion factor β β^A Aggregated loss aversion factor Loss aversion factor for subject n β_n Production costs cOverage costs c_o Underage costs c_u Parameter CR^{Ret} Critical ratio of retailer CR^{SC} Critical ratio of supply chain Error term ϵ EUExpected utility $F(\cdot)$ Cumulative distribution function

$F^{-1}(\cdot)$	Inverse cumulative distribution function
γ γ^A γ_n	Source dependent valuation factor $ \mbox{Aggregated source dependent valuation factor} \\ \mbox{Source dependent valuation factor for subject } n $
i	Index variable
j	Index variable
μ	Mean demand
n_p n_s	Number of products Number of stores
p	Product
Π^{Man}	Expected manufacturer profit
Π^{Ref}	Reference profit
q	Order quantity
r	Unit revenue
RP	Reference point
σ	Standard deviation of error term
SL_{α}	α service level